International Union of Soil Sciences

# Publish or Perish (5) – Soil science for business

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*Money is like muck, not good except it be spread*
Francis Bacon (1561-1626)

## 1. Introduction

There are many trends in the world of science and unravelling these trends and quantifying their effects on society is difficult, but a challenging activity. Science has delivered extraordinary goods and services for the benefit of mankind. Indirectly, or directly, science has brought wealth and an enormous improvement in living standards for many people on this earth. Of course there are people who have not benefited from scientific progress and there are also others who have only experienced the disadvantages of scientific progress. The net effect is, undoubtedly, that science has provided welfare to mankind. Soil science has contributed to this by delivering a major input to the increase in agricultural and food production, but soil science has also made significant contributions to the environmental, earth, and biological sciences.

A striking trend that occurred in the past decades is that soil science and money have become entwined as the commercialisation of society has unquestionably become an integral part of science. I am not fully sure where and when it started in Western Europe, but it is likely that the economic recession in the 1980s and the privatisation of governmental institutes and services that followed, have been instrumental in tightening the link between soil science and business. There are two aspects in the commercialisation of soil science, which deserve special attention and that is the external funding of research and the publishing of scientific results. These are related and are discussed here, but because this article focuses on "Publishing in Soil Science" I will specifically discus about the publishing aspects. As with previous articles it is meant to stimulate and provoke discussion, and thus far that has not been a roaring success. I should mention that the views expressed are entirely my own and they do not necessarily reflect the views of ISRIC.

## 2. External funding of soil research

An increasing amount of research in soil science is externally funded through industry, private companies but also semi-privatised governmental organisations as well. The pros and cons of this trend have been discussed elsewhere (Bouma, 1997; Mermut and Eswaran, 1997; Ruellan et al., 1997; Tinker, 1985), and here it suffices to mention that the discussion has scientific, financial, political, and emotional aspects. If 10 soil scientists would be asked to give their opinion about this trend, it would be relatively easy to collect an equal number of opinions. If we strictly look at the scientific relationship between soil science and money one could argue in two distinctly different ways.

*Total freedom and competition*

Some people advocate that the best soil science is conducted in total freedom, when the researcher has almost unrestricted grants and research personnel. Only in such environments scientific breakthroughs are created, since the scientist does not have to bother about bi-monthly reports to the funding organisation or the writing of research grants which is time-consuming and often fruitless. The overall idea is to let soil scientists do what they are best at (investigate the soil) and let others arrange such conditions so that the scientists can do the job. How nice this would be, but I am afraid it is an utopia. Although many soil scientists would know well how to handle a bag of money and research personnel, other might be terribly wasting it by unceasingly moving into dead research allies. This is likely the case since so many people have entered the world of soil science for whom soil science is merely a profession and not a way of life (Phillip, 1991). For many soil scientists it is "soil science for money/salary" and not so much "soil science for pleasure or society" or soil science as a way of life, as the late John Phillip viewed it.

On the other end, there is the arena of total competition where money is distributed following applications and where grants have severe restrictions. This is where "soil science for business" rules. Only the best will have little difficulties to reach their goals and take care of the interests of their clients. By its very nature, that interest is practical and the soil science applied. It may yield some new insights, models or applications, but sooner or later progress will get jammed and no more advancements are being made. In quite some countries soil science has moved in this direction and it is amazing how little has been written on the quality and quantity impact of this movement on the society. A problem with externally funded research is that it restricts freedom of the researcher to make unrelated side investigations and it can also cause problems when it comes to publishing and accessibility to the research data. There are many examples in other branches of science where these problems are cropping up.

*Conclusions?*

Being conclusive on this matter is impossible for there are success and failure stories from both ends of the spectrum. I personally do believe that restrictions are good. The evidence comes, for example, from the works of Johan Sebastian Bach (1685-1750) who had to compose with restrictions. Like most Baroque composers Bach was extremely productive (in the 1720s he wrote one cantata per week) but more importantly his work is amongst the most beautiful that mankind has ever made (or as someone once said: "Bach almost persuades me to be a Christian"). So Bach proves to me that restrictions do not necessarily mean that nothing brilliant is being produced. In his case one could probably argue that if those restrictions had not existed we might not have so many cantatas, passions etc.

**Fig. 1** Johan Sebastian Bach (1685-1750). Not quite known for his soil science contributions but one of the most admirable composers who produced much of his work under severe restrictions with brilliant results that will last for as long as man will exist.

Besides restrictions, external funding also means competition and I probably can best quote Bertrand Russell (1872-1970) who stated: "..I do not think that ordinary human beings can be happy without competition, for competition has been, ever since the origin of Man, the spur to most activities." (Russell, 1949). He thought man should not attempt to abolish competition but only make sure that it takes forms which are not too injurious. There is no doubt that external funding encourages competition but then one could ask whether recognition and appreciation are equally good in getting the most out of people. For a brilliant scientist restrictions nor competition are necessary but for the average it may be most useful and even essential.

If we now return to soil science and the trend of external funding, the question arises how soil science makes the greatest advancements and at the same time significant contributions to society: total freedom or funding with severe restrictions. The best situation is somewhere in between where there is an adequate funding for research without direct gain or application, and sufficient competition for more applied work, provided that the fundamental and applied research are properly linked. We can start pondering about what is sufficient, what is applied and what is a good ratio between applied and fundamental research. This has to be clearly indicated by soil science community and not by those who sit on the money. Funding in soil science involves the soil scientists, the funding agency (government, industry), and the clients or users of the soil science (farmers, industry, government etc.). Soil scientists should clearly indicate who needs what for which activity, and for a start they need to indicate more clearly what the impact of their activities will be. We produce thousands of soil science publications per year but virtually none of them attempts to quantify our impact. When quantification is established we are in a better position to rigidly oppose or support the externally funding trend. Until that time we will have to "take the money - call the tune" (Satchell, 1992).

Whatever system will evolve in the future, a prerequisite is a certain degree of freedom for individuals to explore new pathways, or as Russell stated: "..a community needs, if it is to prosper, a certain number of individuals who do not wholly conform to the general type. Practically all progress, artistic, moral, and intellectual, has depended upon such individuals." (Russell, 1949). No doubt this also applies to the soil science community.

## 3. Our journals

*Restriction and competition*

Although research restrictions and competition have become an important part in the way soil science is conducted , the largest restriction and competition is found when it comes to publishing of research results. All journals have detailed instructions on how a paper should look like and what it should contain. For research papers, guidelines are generally fixed: introduction, materials and methods, results and discussion, but review papers are usually prepared in a less controlled format. No doubt that the mode of presentation has advantages and it has been very successful in the disseminating of soil science knowledge. The advantages outweigh the disadvantage of being robotic and giving little freedom to an author to express original but perhaps not directly necessary thoughts.

I may be wrong but there may be too little space in soil science to express idiosyncratic ideas inside the immediate arena of primary research journals whereas such ideas may be important for the advancement of our discipline. In addition, I cannot think of a soil science journal that would publish this article (that's fair enough), whereas opinion and news articles have a role to play in soil science. There are many soil science newsletters but these have no

influence and are barely cited. In summary, there are severe restrictions in the publishing of soil science ideas and research and I think it would be good for soil science if there are journals that occasionally lift those restrictions. Perhaps electronic publishing may bring a change in the rigid formats of scientific publishing. Competition is another important factor in publishing and that exists between journals. An important measure for competition is the impact factor – the annual returning sacred figure for journal editors and publishers.

*Commercial and National society journals*

Scientific publishing was started by scientific societies and universities. From the 1950s onwards an increasing amount of scientific publishing is being done by commercial publishers, partly because societies and universities handed over their activities to the commercial publishers, and because commercial publishers set-up new journals in response to the rapidly growing number of scientific papers. Fig. 2 shows the increase in soil science and agronomy journals from national societies and commercial publishers in the past century.

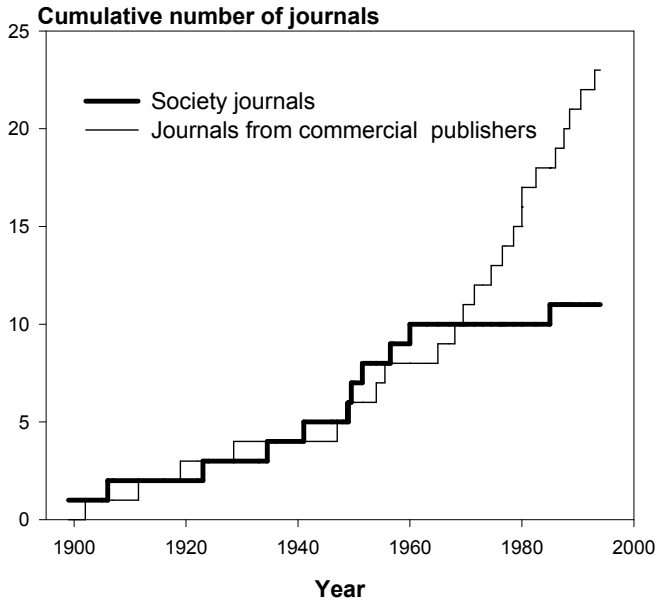


**Fig. 2.** Cumulative number of soil science and agronomy journals from national soil science societies and commercial publishers. Data from Hartemink (2000) – Table 1.

The firm distinction between soil science journals published by a national soil science society or a commercial publisher is fading. A number of society journals are published by commercial or not-for-profit publishers, such as the European Journal of Soil Science by Blackwell (commercial publisher), and the Australian Journal of Soil Research by CSIRO (not-for-profit).

The main society journals and their impact factors for 2000 and averaged over the years 1991 to 1999 are listed in Table 1. Interannual variation in impact factors can be large so the nine-years average gives a fair indication of the impact of the journals. It does not take into

account trends and a recent analysis of the annual impact factors of some of the leading soil science journals has shown that they all increase but that the impact of some journals increases more than others (Hartemink et al., 2001).

**Table 1.** Major international soil science journals published by national societies, and the mean annual impact factor over 1991 to 1999 and the impact factor for 2000.

| Journal | Published by | Impact factor | |
|---|---|---|---|
| | | Mean 1991-1999 | 2000 |
| Soil Science Society of America Journal | National society | 1.328 | 1.401 |
| Journal of Soil and Water Conservation | National society | 0.577 | 0.755 |
| Canadian Journal of Soil Science | National society | 0.703 | 0.597 |
| Australian Journal of Soil Research | National society/not-for-profit publisher | 0.914 | 1.078 |
| Soil Use and Management | National society/not-for-profit publisher | 0.607 | 1.598 |
| (European) Journal of Soil Science | National society/commercial publisher | 1.336 | 1.386 |

The main soil science journals published by commercial publishers are listed in Table 2, including the impact factors. Kluwer and Elsevier are in command of the major soil science journals, whereas Springer, Dekker and John Wiley are only minor players in the field of soil science. With few exceptions it appears that society journals have slightly higher impact factors than journals by the commercial publishers. This probably has a historical cause as the main society journals are much older and the impact of a journal generally increases with its age.

**Table 2.** Major international soil science journals published by commercial publishers and the mean annual impact factor over 1991 to 1999, and the impact factor for 2000.

| Journal | Published by | Impact factor | |
|---|---|---|---|
| | | Mean 1991-1999 | 2000 |
| Soil Science and Plant Nutrition | Dekker | 0.600 | 0.522 |
| Communication in Soil Science and Plant Analysis | Dekker | 0.416 | 0.363 |
| Soil Biology and Biochemistry | Elsevier | 1.313 | 1.747 |
| Geoderma | Elsevier | 0.836 | 1.068 |
| Soil and Tillage Research | Elsevier | 0.566 | 0.735 |
| Catena | Elsevier | 0.700 | 1.082 |
| Land Degradation and Rehabilitation/Development | John Wiley | 0.320 | 0.449 |
| Plant and Soil | Kluwer | 1.052 | 1.218 |
| Soil Science | Kluwer | 0.945 | 0.923 |
| Fertilizer Research/Nut. cycling in Agroecosystems | Kluwer | 0.399 | 0.753 |
| Biology and Fertility of Soils | Springer | 1.017 | 1.307 |

The overall trend for 2000 is that soil biology and biochemistry journals have shown a considerable increase in their impact factors. Soil biology is not only in the lift but it seems to become a primary subdiscipline in soil science. For the first time Soil Use and Management

has done better than its much older and bigger science brother: European Journal of Soil Science. As mentioned variation is large in impact factors so it may be the other way around again next year. Over the years 1991-2000, the impact factor of Soil Use and Management has a cv of 63% versus a cv of 17% for the European journal of Soil Science. It is conform the general trend that variation in the impact of journals decreases with the age of the journal – see Fig. 3.

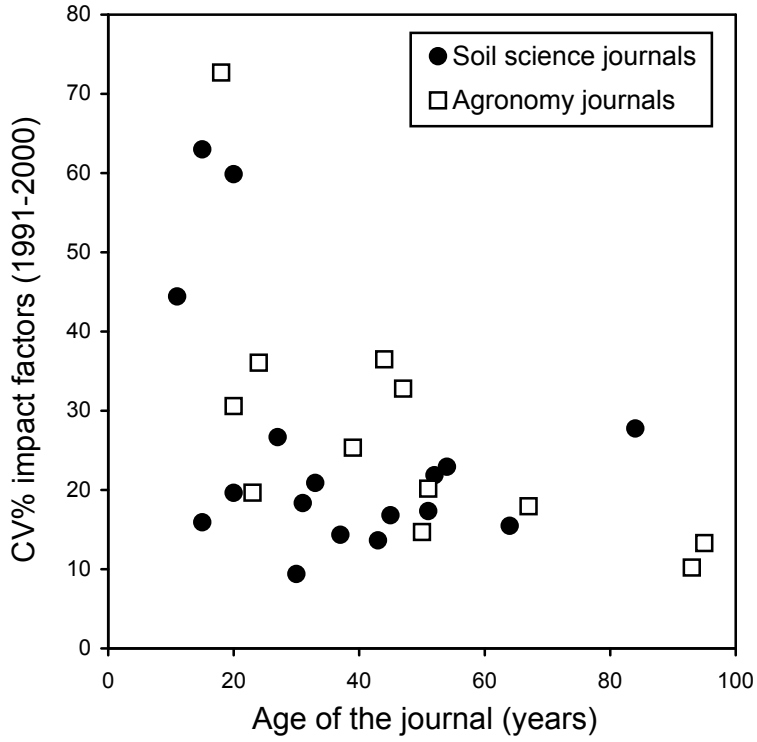


**Fig. 3.** Relation between age of the journal and CV% of their impact factors over the period 1991-2000. Based on data from 29 soil science and agronomy journals

*The pricing of journals*

Scientific publishing is big business. The total market is worth some $10 billion and hugely profitable: margins in the scientific and medical business at Reed-Elsevier are around 35%, compared with and average of 20% for all its publishing interests (The Economist, 10th May, 2001). In a previous article (Hartemink, 1999a), I have shown the difference in price of journals from commercial publishers and national soil science societies. In the past years, largest price increases generally occurred in the journals from national soil science societies. For example, the institutional subscription price for Soil Use and Management increased by 19% between 1996 and 1998 whereas the price of Plant and Soil (Kluwer) hardly changed over the same period – see Table 5 in Hartemink (1999b). Nonetheless, journals from commercial publishers are, on average, much more expensive - both absolutely and per page published than soil science society journals.

The basic problem with the pricing of journals from commercial publishers is that fewer and fewer people have a subscription to the journal leaving the remaining customers to fund the whole system. According to Derk Haank, the chief of Elsevier science section, they

first lost all the student subscriptions, then those of the faculty staff followed by the marginally interested libraries, and they are now down to the hard core of big libraries but there are only few of those in every field who have to fund the cost of the whole system and that leads to subscription prices of thousands of dollars per year.

I am not an accountant nor economist, but if I am not mistaken, the price of soil science journal is determined by the number of subscriptions and the price of a journal (=income), the production costs (printing, marketing, distribution, personnel) and the profit margin (=difference). Publishers can work a bit on a reduction in costs but have most effect on the profit margin through the price of a journal. National soil science societies may put the profit margin at zero whereas commercial publishers may put it to 35%. The dilemma in the pricing of a soil science journals is well-known: A low subscription price may require page charges in order to break-even. The low price has the advantage of wide circulation and readership in the soil science community and the chance for a high impact. If there are page charges it may imply that authors from small institutes or from developing countries may not be able to publish in the journal thus creating inequity. Such authors may be able to read the journal but cannot contribute to it, and as far as I know only Soil Science (by Kluwer) has currently page charges. Despite these page charges Soil Science keeps increasing its annual subscription rates.

The second option is no page charges with a low distribution, which may influence the impact factor of a journal. The disadvantage is of course that the price of the journal has to be high to compensate for the low number of subscriptions, whereas costs and profit margins may be high. The main advantage is that authors from developing countries can contribute and this applies to most of the journals of commercial publishers.

The discussion on page charge vs no-page charge is essentially a discussion on availability of a journal vs possibility to contribute to a journal. I think a system of no-page-charge is a better system for the possibility to contribute is blocked with a system of page charge. The electronification of scientific publishing, see Hartemink (2000), puts this discussion in another light. Suddenly it is not only subscription which influences availability of scientific information but it is also the infrastructure (computers, telephone lines, fibre cables etc), which determines access to it. Although changes are under way it still takes ages to download half a megabyte in Los Baños, Bujumbura or Barbados when compared to a download in Brisbane, Bruxelles or Baltimore.

In the end, the electronification of publishing will result in lower costs. Thus a lower price means wider circulation and better access. That is good for soil science and scientific communities. That electronic publishing indeed means wider access and distribution is demonstrated by the results of Elsevier: in 1999 they had about 500,000 subscriptions and the number went down by a few percent each year as libraries had to cancel. Currently with new contracts combining electronic and paper delivery there are more than 700,000 subscribers (Haank, 2001).

*Pricing of electronic journals*

The question remains what sort of pay model will be made for electronic publishing, and two different models can be envisaged. In the first model the customer, that is the library or institute of the scientist, pays for each download and somewhere in the system a counter is required registering Mbytes or articles traffic. At periodic intervals the university library or institute receives an invoice from the publisher for the number of downloads its staff has made. The second pay model in electronic publishing is a system whereby a fixed amount is paid to the publishers and scientists have unlimited access and abilities to search and download articles.

The first system sounds probably more fair but it may require more administration - hence extra costs although it would be easy to handle the system electronically - and some libraries may put restrictions on the number of downloads, should the periodic invoices become sky-high. In other words, it is more uncertain for both the publishers and librarians whether the user pay system is cost-effective. A fixed payment system therefore seems preferable and is also the way that some of the major commercial publishers are thinking. Another possibility is the author-pay electronic publishing system (Velterop, 2001) and that is discussed below.

**4. Criticism on commercial publishers**

Recently some renewed but fierce agitation was noticed against the Anglo-Dutch firm Reed-Elsevier following the go-ahead of the American antitrust officials to buy Harcourt General for $4.5 billion. Yes billion. Reed-Elsevier will control some 20% of the science-journal market, and add a further 500 journals to its 1200-strong stable (The Economist, 10th May, 2001). It also means that the Elsevier-Harcourt merger will give one company control over journals representing 42% of a typical university's spending in that area (The Guardian, 26th May, 2001). That leaves the impression that scientific publishing is increasingly controlled by a single publisher. Overall, it should be borne in mind that most universities spend about 1% of their total budget on all literature (books and journals) whereas university libraries spend only a quarter of their budget on literature – the rest is infrastructure.

The Economist, certainly not known for its critical attitude towards business, recently summarised the main criticism on the commercial publishers: (i) the fact that that online versions of journals and their archives are closed to non-subscribers denying scientists an even wider audience, (ii) the complain about the time it takes for a scientist to see his latest through in print, and most importantly (iii) the price increases of the scientific journals.

*Some recent initiatives*

In response to this criticism on the commercial publishers several initiatives have been taken by the scientific community. For example, in the past years websites have been set-up with free access to journal articles. The most well known is probably PubMed Central which is a digital archive of life sciences journal literature managed by the National Center for Biotechnology Information (NCBI) at the U.S. National Library of Medicine (NLM) – see http://www.pubmedcentral.nih.gov/. It is not a journal publisher and access to PubMed Central (PMC) is free and unrestricted. To date more than 20 journals have contributed material to PubMed Central and it is hoped that many more publishers will be encouraged to contribute to the archive so it can realize its full potential – in ways still to be discovered (Sequeira et al., 2001).

Some argue that with the advancement of electronic technology costs of publishing can be much lower and the balance of payments can be addressed by asking who arguably benefit most – the author – to pay their share in the submission charges (Velterop, 2001). This would be equivalent to the page-charge system in the "traditional journal publishing" with the same drawback: poorly funded scientists can do research but may not be able to publish their result internationally. Nevertheless, there is an increasing interest in the author-pay electronic publishing system (Velterop, 2001; Walker, 2001) with the argument that free online availability increases a paper's impact (Lawrence, 2001).

Another more radical initiative has been that some scientists have argued to stop buying, publishing in or reviewing for any journal of the commercial publishers. I can imagine scientists do not submit their papers to journals from commercial publishers but refusing to review papers from colleagues who have submitted papers to such journals would be hurtful

to those colleagues and our discipline in the long-term. Others propose much more rigid changes in which publishers turn into providers of a peer-reviewing service rather than producers of journals (Harnad, 2001). For those who are interested in a more lengthy discussion on science journals publishing (free or fee), it is suggested to check Nature's website: http://www.nature.com/nature/debates/e-access

In soil science we have to face the reality that commercial publishers own many of our respected journals. Any aspiring scientist can put a research paper on his website, but few within the discipline will pay it any attention unless it has undergone the vetting and peer review of a respected journal (The Economist, 10th May, 2001). This situation is not likely to change in the future so we will have to work together with the soil science journals from the commercial publishers. I personally think the right approach is not to run away or block the commercial publishers but to constructively put pressure on the pricing mechanisms they endorse. It can be successful. For example, the American Association of Physical Anthropologists (AAPA) negotiated with Wiley-Liss, the publisher of The American Journal of Physical Anthropology, to reduce the subscription price. Wiley-Liss agreed to cut the journal's annual subscription rate from $2085 to $1390.

According to one of the AAPA members: "The era of very high charges is going to end either with cuts in prices like ours, or with many competing journals owned by associations themselves" (Anon., 2000). So this triumph story shows that dialogue and negotiations should be preferred above boycott. I am not sure whether the dialogue with the commercial publishers has been sufficiently explored by the soil science community and only if it yields nothing tangible tougher measure may be considered to force a better deal for scientists. But there is some good news, which takes some wind out of the sails of those who vividly oppose the commercial publishers.

## 5. The good news

In the previous section major criticism on the commercial publishers was discussed including how part of the scientific community has reacted to emerging trends. Possibly in response to that reaction, the main commercial scientific publishers have recently made a very good deal for developing countries. In July 2001, six of the world's leading medical publishers pledged to allow free access to their scientific journals to those in the poorest countries who could otherwise not afford them. The six publishers, which own about 50% of the medical journals are Elsevier, Blackwell, Harcourt (also Elsevier soon), Kluwer, Springer and John Wiley (The Guardian, 10th July 2001). The scheme will involve nearly 1000 journals and commence in January 2002 and will last for at least three years. Until now, the subscription prices have been uniform across the world regardless of the ability of some countries to pay for them.

The deal of the medical journals was initiated by the UN-Secretary General Kofi Annan and was brokered by the current WHO director, Gro Harlem Brundtland (from the "sustainability" report). She considers the deal as "..perhaps the biggest step taken towards reducing the health information gap between rich and poor countries" (The Guardian, 10th July 2001). The journals will be available through a protected internet portal at the World Health Organization (WHO) and training will be provided for institutions in developing countries how to access the medical information. Good news!

## 6. And now soil science?

Following the excellent deal for the medical journals would it be possible to do something similar for the soil science, agricultural and ecological journals? The arguments are straightforward and simple: much of the information is not available in developing countries where agriculture and soil science are of such great importance and where there is such a great need for adequate soil information and literature.

I see two separate ways for a follow up on this initiative: Firstly, free access to the society journals, which are all available on the web. As an example to the commercial publishers, national soil science societies should make their journals freely available to soil scientists in developing countries. It possibly requires some moving and shaking within the national societies and some amendments in the arrangements with the not-for-profit publishers. The national society needs to make a strong plea for this but we do have far more control on the society journals than on those published by commercial publishers.

The second group of journals is those of the commercial publishers and they should be approached in an concerted action. I firmly believe that the IUSS as our global organisation of soil scientists should take this up. Although the IUSS is perhaps not as powerful as the WHO, through the contacts with the International Council for Science (ICSU), of which the IUSS is a full member, this should be endeavoured. Free or reduced price access of the soil science literature would be good for people in developing countries and good for soil science. This is particular the case for Africa which came out from the green revolution empty handed (Keese, 2001). If soil scientists take over Brundtland's initiative on the medical journals as readily as they have taken her ideas and report on sustainability, I foresee a bright future for soil science information in the developing countries.

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