

Towards a dirtier Australia: Facing the future soil management challenges

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Abstract.

Land degradation is a complex technical, socio-economic and political issue without simple answers (Sumner and Wilding 2000) and this is also true of soil degradation and improved soil and landscape management. The management of soil has been overshadowed by issues perceived to be more important and urgent such as water resources and climate change (Campbell 2008). While this has shifted focus from soils as a societal issue, the importance of soil management and science is recognised within these other broader environmental problems. This has created an opportunity and Hartemink and McBratney (2008) have discussed the approaching soil science renaissance, where novel approaches are needed in multidisciplinary framework to address societal environmental problems associated with the ground that we walk on. However, the disconnection between policy, soil science, industry, and consultant sectors is the root cause for the failure of sustainable soil management. This paper will explore the pressing present and future environmental soil challenges and possible solutions to the conundrum of soil management and disconnection in the Australian context.

Introduction

In the past, soil degradation was recognised in Australia as a matter of national significance (Bradsen 2000). Things have changed. A review of the Australian Commonwealth Government's policy on soil management by Campbell (2008) was damning. Over the last decade state and federal policy lacked focus and tended to be overshadowed by other important environmental issues. These include global climate change, the long term drought in Australia's south-east and biodiversity conservation. Soil science experts and practitioners within state and federal agencies have become isolated and their important work lacks the recognition it thoroughly deserves. A focus of the 6 o'clock news and the morning television of recent dust storm in Australia's south-east (October 2009), a result of the long-term drought, was not the soil degradation that was occurring but how the urban population was going to cope with the clean-up. This goes to the heart of Campbell's thesis, that Australian society is largely disconnected from the sustainable use of soil resources. Obviously there are exceptions, such farmers, composters, permaculturalist and other regenerative farming movements and keen gardeners. It also appears that the linkage between the broader environmental issues, such as climate change, and soil management is not fully appreciated by the public and government. This societal attitude shift may be a result of the economic shift from the dominance of agriculture to mining and tertiary industries. This has lead to political inaction, an ad-hoc short term funding model, and a decline in commitment, knowledge and capacity (Campbell 2008). Campbell (2008) states that to reverse this there needs to be significant reinvestment in data infrastructure, information and professional capacity, a rebuilding of soils literacy and a renewed energy and rekindling of enthusiasm in soils. The challenge has been set and as soil and environmental scientists we should tackle it.

What are the future soil challenges?

Before one can attempt to answer Campbell's (2008) challenge, a first question needs to be addressed, is there an actual need to reinvigorate Australia's soil management and soil science? There are many soil issues that the world will face in the near future. The world's growing population, which is predicted to be 9.1 billion in 2050, will need to be fed from a fixed land area. In 2000 there was an estimated 1.5 billion ha of cultivation land in the world and assuming that this area stays constant, then in 2050 there will be only 0.15 ha/person available for food production. This is 25% of the amount of land (0.44 ha/person) available in 1960. It is predicted that the demand for food will also double and diversify as incomes increase and consumers are able to spend more on high end foods (Core 2009). Human society will need produce food much more efficiently to meet the growing demand without placing strain on the existing soil resources and our ability to sustainably manage land. Compounding the issue of population growth and demand is the increased cost of fertilisers. The world fertiliser index (US\$) is closely linked to the oil price and with the approach of peak oil and the rising demand, fertiliser price should increase in the future. There are also indications that phosphate supplies will begin to be exhausted in the next 50-100 years (Cordell *et al.* 2009). Thus there are two

significant nutrient issues that face the world's farming systems and society. Two growing areas of research are soil microbiology and interconnections between the different disciplines for the improved soil nutrient management and productivity. It is also apparent that soil carbon will be an issue of rising importance as the world grapples with climate change, but in the face of a significant knowledge deficit.

In south-eastern Australian catchments yields have declined more than expected due to reduced rainfall (Timbal and Jones 2008). It has been hypothesised that this has been caused by a shifted in the seasonality of the rainfall, ground and surface water extraction and significant soil moisture deficits. In areas where climate change will increase rainfall variability and temperatures agriculture production systems will need to be modified, especially downstream irrigation areas in the Murray-Darling Basin. Some management practices include the installation of leaky weirs in incised gullies to slow run-off and increase soil moisture and practices that increase infiltration. The effects of such practices on soil nutrient cycling and catchment productivity still need to be investigated.

In Australia many other parts of the world fertile and productive soils are being converted from agricultural to urban land uses. Many landholders are cash poor, but capital rich and are planning to sell their land and use the profits to self-fund their superannuation. This issue is particularly acute in the expanding peri-urban zones around major cities. This is a policy question that needs to be resolved for the maintenance of food production. Finally, one of Australia's priority research areas is overcoming soil loss, salinity and acidity. "A multidisciplinary effort is required to develop sustainable land management practices that are appropriate for Australian conditions and mitigate major land degradation processes and increase biodiversity" (ARC 2009). This is by no means an exhaustive list but it is clear that to achieve sustainable soil management and Australia's soil research priority there is a need for reinvestment in soil science by the public and private sectors.

Facing the present and future soil challenges: the way forward

Policy and Research

The way forward is develop a research, teaching, development and policy model that will invigorate soil science and the blue print is the Government's response to surface and ground water management. There is a need to manage soils at a Commonwealth level, allowing a co-ordinated approach for the database construction and maintenance, policy development, and extension. A dedicated unit within the Department of Agriculture, Fisheries and Forests is long overdue and its funding should be long term and sustainable. As well as policy guidance and specific programs, such a unit would be positioned to advise research funding organisations on priorities. This policy unit would be part of a structure that involved a National Soil Research and Training Centre or program, CSIRO, Industry, Australian Soil Science Society Inc., relevant university groups and extension organisations charged with research and developing of sustainable soil management. This will reconnect the policy, soil science, industry, and consultant sectors, thus correcting the root cause for the present failure of sustainable soil management.

Interdisciplinary education and training

Soil science faculties and teaching units in many undergraduate universities in Australia and around the world have been amalgamated with other disciplines (eg Biology, Geology) to form environmental science mega-schools. Many have declined in size over time. We should not lament the decline of isolated soil science teaching but greet the teaching challenge proactively because to solve future soil science challenges will need graduates with a broader interdisciplinary outlook (Hansen *et al.* 2007). Indeed novel approaches are needed in multidisciplinary framework to address societal environmental problems associated with soil (Hartemink and McBratney 2008). Our graduates have these skills, but there is still room for improvement. The teaching of soil science should occur at the postgraduate level but many universities have lost capacity in this discipline. To overcome this problem we believe that the establishment of Australian Soil Research and Training Centre (ASRTC) or some other form of coordinated program is needed to co-ordinate multi-universities and industry develop and deliver postgraduate research and course. This model has been established and tested by National Centre for Ground Water Research and Training, and collaborative graduate programs across key universities have been established in other areas (eg. the National Forestry Masters Program). However it is proposed that, as well as universities, CSIRO play a central role in ASRTC development and operation in keeping with its key role in soils research. Within the proposed centre a range of continuing education options should be developed for soil and environment science professionals to keep up to date with the latest techniques, methods and theories, and to combine courses from more than one

institution. The Australian ground water school and the other professional organisations successfully run such programs and it would be a great boost for soil and environment science professionals. It may also be possible to integrate with the International Union of Soil Sciences and develop connections to international teaching and research training.

The role of Australian Society of Soil Science Incorporated (ASSSI)

ASSSI core objectives are to promote the field of soil science, further expertise, provide a forum for discussion, increase government and community awareness, encourage research and extension and development the wise management of soil resources and as a the professional body it would a key player in reinvigorating the discipline. We believe however that the ASSSI executive should produce a policy document from its biennial conference, broaden the conference to include industry groups, alternative practitioners and natural resource managers and possibly host a “soils festival” with the conference. This will immediately help lift the profile of soils within Australia government and society. It must be remembered that most undergraduate students in soil science classes now graduate with an environmental science degree and thus the conference should be broadened to include the multidisciplinary nature of the graduates. Also most Australian’s do not have a direct connection with soils, unless it is on their boots, and a soils festival, which includes produce, art and good fun, is a way of attracting and increasing the awareness of the general public.

Soils in the real world

To address the problem and to make the globe a dirt friendly place “we need people talking about soil in the real world” (McBratney 2009). This may seem difficult, but to raise the interest of soil science out side the profession, we need to remove the jargon and explain the issues clearly. There are some examples of this occurring,

1. The US Soil Science Society has established a policy office which is supported directly by soil scientists and official working groups to inform congress about soils, and
2. Gardening and composting television programs and literature.

Typically scientists are generally absent from the general media and other information services. This needs to be reversed and we, the soil and environmental science professionals, need to explain the issues to the media and general public. The most obvious recent example is soil carbon and it’s role in carbon sequestration. Most people would not know about this issue in a general sense and this is at a time when their governments are debating whether soil carbon and sequestration should be included in trading scheme. So it is really up to us to report our research findings and expertise in a meaningful way to the scientific literature and to translate and publicise these findings into information that a lay person can understand and use in there day-to-day lives. If soil issues are in the mainstream media then three things will occur, more people will join the profession, soil management, research and development will improve and society will be able to face and manage the future challenges.

Conclusions

Campbell (2008) has thrown down the gauntlet and it is up to the soil and environmental science community to meet the challenge to make Australia dirtier. It is clear that there is a need to reinvigorate soil science research, teaching and policy for sustainable management. A federal driven framework is required, that includes ASSSI, CSIRO, Universities, industries, state agencies and well funded Government department or unit. The overarching aim would be to provide the information base, skills and policy settings to enable the sustainable management and use of soil resources for the long term. The integration of soil science into broader undergraduate environmental science is an advantage because the graduates will have multidisciplinary skills to solve society’s complex environmental problems. We believe that soil science should be taught at the graduate level and research and training coordinated by an over arching research and training centre or program. To achieve some quick runs the ASSSI executive should develop a policy document from the biennial conference. This conference should also be broadened and not focused only on soil taxonomic discussion. In the end it is up to us the soil science professions to reconnect with the general public and explain the importance soil science issues and the relevance to society.

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