The need for soil science amateurs

Tony Koppi[A] ,Damien Field[B] , Alex McBratney[C] and Alfred Hartemink[D]

[A]Faculty of Agriculture, Food and Natural Resources, University of Sydney, NSW 2006, Australia, Email tkoppi@gmail.com
[B]Faculty of Agriculture, Food and Natural Resources, University of Sydney, NSW 2006, Australia, Email d.field@usyd.edu.au
[C]Faculty of Agriculture, Food and Natural Resources, University of Sydney, NSW 2006, Australia, Email A.McBratney@usyd.edu.au
[D] ISRIC - World Soil Information PO Box 353 6700 AJ Wageningen The Netherlands, Email Alfred.Hartemink@wur.nl

Abstract
Attracting more people to soil science is a concern shared by many practicing soil scientists and education institutions. Many disciplines have amateur societies whose members engage with the discipline out of sheer passion and personal interest. These amateur enthusiasts are members of the general community that have perceived something of value and interest in the discipline to which they may contribute knowledge and advancement of the discipline in its own right. Some examples of amateur societies are: botany, paleology and astronomy. Soil science has no recognised amateur society. The professional training may mostly focus on knowledge at the expense of development or fostering amateur qualities to which members of the public could relate. Soil science and the general community have much to gain by fostering amateur qualities and the creation of a Society of Amateur Soil Scientists.

Key Words
Amateur qualities, soil education, amateur societies.

Introduction
This paper is concerned with public awareness of soil science, the role and qualifications of soil science professionals, the changing role of soil scientists, soil science education, and the possible contribution of soil science amateurs in creating greater public interest and growth of the discipline. People who have not been formally educated in a discipline yet have a strong interest and passion for it, and engage with it in a practical way, are called amateurs. There are many amateur scientists, and Mims (1999) notes: "The term amateur can have a pejorative ring. But in science it retains the meaning of its French root *amour*, love, for amateurs do science because it's what they love to do. Without remuneration or reward, enthusiastic amateurs survey birds, tag butterflies, measure sunlight, and study transient solar eclipse phenomena. Others count sunspots, discover comets, monitor variable stars, and invent instruments." Mims (1999) reports that these amateurs invest huge amounts of time in their scientific endeavours and data collection which they provide for scientific organisations and publish in prestigious journals. Perhaps the most famous amateur scientist was Thomas Edison (1847–1931) who held more than 1,000 US patents in his name (Wikipedia 2009a) and who began the journal *Science* in 1880 (Mims 1999). The Society for Amateur Scientists (SAS 2009) has a weekly publication (The Citizen Scientist), youth education, and community programs. The SAS was founded in 1994 by Shawn Carlson, a physicist from the University of California (Wikipedia 2009b). Amateur astronomers are probably the best-known group of amateur scientists that engage in research and invention of instruments (e.g., clocks, telescopes) and have made many significant scientific discoveries such as comets (e.g., Hale-Bopp in 1995), variable stars, and supernovae (Wikipedia 2009c), and they have an amateur astronomy magazine for the community (AAM 2009).

The perception or image of soil science, as portrayed by soil scientists, needs to be examined. As practicing soil scientists we need to ask ourselves what impressions are we giving the general community and what are the reasons for lack of interest amongst people who have not been educated in soil science? The systematic study of soils started more or less in the first half of the nineteenth century. Important contributions were made by the German F.A. Fallou (1794-1877) who had studied jurisprudence at the University of Leipzig (Germany) and was interested in mineralogy. Fallou was never married and his love of nature turned his attention to soils - he studied soils as a hobby. He worked as a land tax assessor (Asio 2005) and published Pedologie oder allgemeine und besondere Bodenkunde (Fallou 1862). Just like Senft (Senft 1857) he attempted to treat the study of soils as an independent science, and soil as a separate formation – ideas that are mostly attributed to V.V. Dokuchaev. Fallou distinguished between soils formed in-situ and "washed-in" or alluvial soils. He discussed the effect of relief on soil depth, and introduced new terms like pedology and soil quality (both mean different things to different people).

We are not aware of soil science amateurs and hobbyism throughout much of the twentieth century but in 1988 the famous soil scientist, Francis D. Hole commented: " The 1980s would be a logical decade in which to organise a Society of Amateur Soil Observers." There does not appear to have been any substantial follow-up to his suggestion, begging the question, where are the amateur soil scientists and what are we doing that prevents there being an amateur soil science society? In contrast, in a closely related discipline, there are apparently many amateur geologists ("rockhounds") for whom there is a ready source of information and equipment (e.g., Amateur Geologist, 2009) including books and guides specifically for the amateur geologist, e.g., Cvancara (1995). It seems that general community interest in soil is limited to its utility (farmers, gardeners) rather than being appreciated for its own sake in a broader and deeper context as proposed by Hole.

Qualities of amateurs and professionals

Perry (1904) was concerned with identifying the amateur spirit in comparison to that of professionals and his distinctions are summarised in Table 1. Perry did not produce such a table of opposites; this pairing is an interpretation of his writing by the authors of this paper.

Table 1. Summary of amateur and professional qualities as described by Perry (1904).

Amateur	Professional
Broad approach to life	One-sided narrow view
Breadth of interest	Specialised training, skilful, expert
Imaginative and idealistic	Lack of imagination
Works for the sheer love of working	Works for personal gain
No self interest	Self-sacrificing for the profession
Chivalrous, winning is not the aim	Strong desire to win
Generous spirit	Lack of sympathy
Individual initiative	Clannish narrow loyalty to the group
Versatile, spontaneous and adventurous	Machine-like
Human curiosity and eagerness	Dominated by exact methods and approved knowledge
Personal enthusiasm and boundless zest	Uninteresting

While it is most unlikely that we would agree with the full distinctions Perry perceived, we can recognise qualities of the professional that apply to ourselves, as indeed we would claim to have some of the amateur qualities too. Perry himself noted (p 31): "Many of us are fortunate enough to recognise in some friend this combination of qualities, this union of strict professional training with the free outlook upon life, that human curiosity and eagerness, which are the best endowment of the amateur." A balance of these qualities is clearly desirable in the soil science professional today.

Preparation of balanced professional soil scientists

If we agree that a balance of the amateur and professional qualities given in Table 1 is desirable, we may find it surprising that the performance objectives of the Soil Science Society of America's Council of Soil Science Examiners (SSSA 2007) are almost entirely concerned with technical skills and knowledge (24 pages) and 5 lines concerned with ethics in relation to a client. This approach is selecting for and encouraging the development of the one-sided, cold and hard qualities of the professional as perceived by Perry over 100 years ago. This would not endear the profession to the public at large and encourage more engagement with soil science.

Universities generally have a broader approach to the development of a balanced professional and these days; Perry's list of amateur and professional qualities would be described in terms of discipline knowledge and generic skills or attributes. The discipline knowledge would include specialised training in methods and thinking like a soil scientist. The generic attributes include other qualities of graduates that are claimed by most universities, such as research and inquiry, information literacy, personal and intellectual autonomy, ethical, social and professional understanding, and communication (The University of Sydney, 2004). One would expect graduates in soil science to have an appropriate balance of discipline knowledge and generic attributes, analogous to a mixture of the amateur and professional qualities given by Perry, for their professional life that would include interactions with employers and the general community.

Employers require a range of skills from their graduate recruits. Singh *et al*. (2004) surveyed employers (51 firms) for a wide range of skills (40 in total), knowledge and attributes desired of recent agriculture

graduates. They found that the top six requirements were: self motivation; the ability to write clear reports; having strong presentation skills and use of graphics; the ability to speak clearly and concisely; the ability to express technical concepts clearly and in a non-technical manner; and teamwork abilities. These results showed that employers placed less emphasis on discipline knowledge and more on the personal attributes that approximate more closely to the amateur qualities of Perry than the professional ones. Thus skills required by professionals are people skills with the ability to interact with colleagues, clients and the community. Members of the community are unlikely to be impressed with representatives of the profession, or indeed the profession, without those people skills. Advocating soil science to the community and attracting more interest requires qualities of the amateur more than these of the professional.

A role for the amateur soil scientist?

The role of the soil scientist in response to society's needs has changed over the years. As mentioned over 150 years ago there were non-professionals (amateurs in that sense) concerned with the rational use and management of the soil (Table 2, column 1). Gradually the discipline of soil science formed and was concerned with discovering the nature of soil, the development of methods of analysis, and soil behaviour whilst being associated with production and use of soil (Table 2, column 2). More recently, there has been recognition that soil science has a much broader holistic role to play in society's needs and that soil scientists need to be more involved with other discipline scientists, stakeholders, policy makers and other users of soil information (Warkentin 1994; Bouma, 2001; Wessolek 2006), as shown in Table 2, column 3. Soil science is now recognised as an important part of ecological processes and has an essential scientific and economic part in contributing to the solution of the world's problems, including those of food, fuel, water scarcity and climate change (Hartemink and McBratney 2008). It seems that other disciplines are also more interested in soil science, including the social sciences and liberal arts which are contributing to the broader holistic nature if soil science knowledge (Warkentin 1999). Wessolek (2006) and Hartemink (2009) suggest that the public awareness and image of soil may be changed through aesthetics and art.

This development from left to right in Table 2 may lead to the next step (column 4) where amateurs co-exist with today's professionals and become involved with soil science. This amateur engagement with the discipline would parallel that of other scientific amateurs (astronomy, geology) who study and practice in the discipline out of sheer love and interest and develop expertise without necessarily having an academic qualification. Is that the definition of a community of practice, do we need that in soil science? Perhaps the only component missing at this point in time is that of the network (society) which is the mechanism through which amateurs in various disciplines engage.

Table 2. The progression of soil science from left to right and the possible co-existence of soil science amateurs

Amateurs (non-professionals)	Early professionals	Recent professionals	Amateurs
The study of soil for utilitarian and survival purposes (over 150 years ago)	The study of soil in its own right; development of methods and analytical procedures; linked to agricultural production	Linking soil science with other disciplines and engaging with other scientists, politicians and stakeholders to provide information and solutions to complex environmental issues and problems	Members of the public who engage with soil science out of personal interest and enthusiasm for the discipline and its practices.

Perhaps these soil amateurs already exist and practice within organisations such as landcare groups which are made up of people with diverse backgrounds and expertise who are interested in contributing to the solution of local problems (Landcare 2007). As such members of landcare groups may be amateurs in the true sense of the word, as well as professionals in some discipline, and would straddle the boundary between columns 3 and 4 of Table 2.

Conclusions

Unlike astronomy, geology, and other sciences, soil science has no amateur society. The appreciation and study of a discipline for its own sake, as practiced by amateurs in the general community, is apparently lacking for soil science. Amateurs have many qualities that enrich a discipline by their presence and activities as well as making possibly substantial contributions to the knowledge of that discipline as has occurred in science and astronomy for example.

Soil scientists are changing in response to society's recognition of the essential role of soil science in the well-being of the planet, and are interacting with other disciplines and many stakeholders. The one-sided development of soil science professionals that lack people skills and the ability to interact with and enthuse the general pubic about the discipline would work against this trend as well as detract from encouraging amateur interest. An important change that we can make to improve the public perception of soil science, thereby possibly attracting more students, is to change soil science teaching and/or academia engaging with the general public through student community projects. In short – getting out there and demonstrating how soil science can enrich local communities and also revealing that there is more to soil than its mere utilisation. For such a task, the professional would need to display amateur qualities. The residual impact of these activities may spark interest and enthusiasm which could then be channelled into a Society of Amateur Soil Scientists that is yet to be created.

References

AAM (2009) Amateur Astronomy Magazine. http://www.amateurastronomy.com/ [Viewed 27 October 2009]

Amateur Geologist (2009) http://www.amateurgeologist.com/ [Viewed 27 October 2009]

Asio VB (2005) Comments on "Historical development of soil and weathering profile concepts from Europe to the United States of America". *Soil Science Society of America Journal* **69**, 571-572.

Bouma J (2001) The new role of soil science in a network society. *Soil Science* **166**, 874–879.

Cvancara AM (1995) A field manual for the amateur geologist: tools and activities for exploring our planet. (John Wiley & Sons Inc., USA).

Fallou FA (1862) 'Pedologie oder Allgemeine und Besondere Bodenkunde.' (Schönfeld Buchhandlung: Dresden).

Hartemink AE (2009) The depiction of soil profiles since the late 1700s. *Catena* **79**, 113-127.

Hartemink AE, McBratney A (2008) A soil science renaissance. *Geoderma* **148**, 123–129.

Hole FD (1988) The Pleasures of Soil Watching. Orion Nature Quarterly, Spring 1988, pp 6. http://www.soils.wisc.edu/~barak/fdh/The_Pleasures_of_Soil_Watching.pdf [Viewed 27 October 2009]

Landcare (2007) What is landcare? http://www.landcare.com.au/Landcare/landcare.html [Viewed 30 October 2009]

Mims FM (1999) Amateur Science--Strong Tradition, Bright Future. Essays on Science and Society, Science, 2 April pp. 55–56. http://www.sciencemag.org/cgi/content/full/284/5411/55 [Viewed 26 October 2009]

Perry B (1904) The Amateur Spirit. Reprinted by Laing Press (June 30, 2008), 184 pages.

SAS (2009) The Society for Amateur Scientists. http://www.sas.org/ [Viewed 26 October 2009]

Senft F (1857) 'Lehrbuch der forstlichen Geognosie, Bodenkunde und Chemie.' (Manke: Jena).

Singh SP, Ekanem E, Tegegne F, Muhammad S, Comer S (2004) An Evaluation of Skills and Attribute of Agriculture/Agribusiness Graduates for Biobased Industry and Economy. Paper Prepared for Presentation at the IAMA World Food and Agribusiness Symposium, Montreaux, Switzerland, June 12-15, 2004. http://www.ifama.org/conferences/2004Conference/Papers/Singh1096.pdf

SSSA (2007) Soil Science Professional Practice Exam Performance Objectives. Soil Science Society of America's Council of Soil Science Examiners. https://www.soils.org/files/certifications/practice-exam-objectives.pdf [Viewed 21 October 2009]

The University of Sydney (2004) Generic Attributes of Graduates of the University of Sydney. http://www.itl.usyd.edu.au/graduateAttributes/policy_framework.pdf

Warkentin BP (1994) The discipline of soil science: how should it me organized? *Soil Science Society of America Journal* **58**, 267–268.

Warkentin BP (1999) The return of the "other" soil scientists. *Canadian Journal of Soil Science* **79**, 1–4.

Wessolek G (2006) Some reflections on the future of soil science. In 'The Future of Soil Science'. (ed E H Alfred) pp. 150–152. (IUSS, Wageningen, The Netherlands).

Wikipedia (2009a) Thomas Edison. http://en.wikipedia.org/wiki/Thomas_Edison [Viewed 26 October 2009].

Wikipedia (2009b) Society for Amateur Scientists, http://en.wikipedia.org/wiki/Society_for_Amateur_Scientists [Viewed 25 October 2009]

Wikipedia (2009c) Amateur Astronomy. http://en.wikipedia.org/wiki/Amateur_astronomy [Viewed 27 October 2009]