



Discussion paper

The challenge of soil science meeting society's demands in a “post-truth”, “fact free” world



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ABSTRACT

Assuming that “post-truth” and “fact-free” attitudes are only symptoms of deeper misgivings about “elite” behavior of scientists and lack of understanding of the scientific method, approaches to overcome problems should focus on improved interaction processes and on ways to better illustrate the goals of science. Regarding interaction processes, soil science has a rich history cooperating and interacting with land users that can be continued by closely involving stakeholders when defining goals and research procedures, creating joint learning and ownership, negating possible “elite” impressions. This takes a lot of time that is not available in current scientific regimes, that will have to change. Clear goals of land-related science can be derived from the UN-Sustainable Development Goals (SDG's) with a broad societal focus offering excellent opportunities for soil science to show its crucial role in reaching several of the land-related SDG's. This will require active cooperation with other sciences going beyond delivering basic data. Use of soil-water-plant-climate simulation models can facilitate interdisciplinary cooperation. Internally, the soil science community can form Communities of Scientific Practice where basic and applied scientists work in a team with knowledge brokers and educators. Soil science has a bright future because it has a central position when considering SDG's and a comprehensive systems analysis of the soil-water-plant-climate system, aiming at several SDG's at the same time, presents a promising direction for future research.

1. Introduction

Like all scientific disciplines, the soil science community is being challenged by societal developments, fed and inspired by universal use of the internet and social media and characterized by widely discussed “post-truth” and “fact-free” attitudes in societal and political arena's. (e.g. Bouma, 2015; Munafo et al., 2017). Does science only present: “just another opinion”? The science community is, in my opinion, still struggling to articulate an effective reaction to these developments, which can hardly be avoided because “the truth” and “facts” are the lifeblood of science. This discussion paper is intended as a “call to awareness”, starting a discussion within the soil science community as to the relevance of “post-truth” and “fact-free” phenomena for the profession and to explore possible future actions that can alleviate existing limitations in showing the full potential of applying soil expertise to solve current and future environmental problems. Of course, relations between science and society have widely been studied during the last decades and results of such studies have to be considered when analysing current problems, the more so since the explosive development of internet accessibility and social media has fundamentally changed these relations during the last decade. The objectives of this

discussion paper are therefore to discuss: (i) the nature of “fact-free” and “post-truth” phenomena; (ii) research analysing changing relations between science and society; (iii) future directions for the soil science discipline.

2. The nature of “fact-free” and “post-truth” phenomena

In fact, “post-truth” is an ambiguous concept. “The truth” certainly does exist in many instances when, for example, stating that the world is round, that soil has a sandy loam texture or that Darcy's flow equation produces “true” results when applied to homogeneous sands. But results of experiments, trying to show “significant” differences between treatments are expressed in terms of statistical probabilities: a 95% probability of occurrence still implies significantly different results in 5% of the cases: no absolute truth! Focusing attention to land-related research in the context of the UN Sustainable Development Goals, to be discussed later, problems are “wicked”, there is no “true” form of land use nor of land management. Depending on a particular vision, certain forms of land use may come close to a personal “truth” corresponding with that particular vision but other visions are bound to conflict, often quite strongly. Ultimately established forms of land use are all too often

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a hard-fought compromise between conflicting visions. Each vision is supported by framed “facts”, derived from existing data or from new research. Facts that don’t support a particular vision are omitted or vehemently denied.

“Fact-free” does, therefore, not exist either. There always will be facts, be it that they are often selectively “framed”. This also applies to: “fact-free” politics. Politicians have a vision on current societal conditions and, particularly (one may hope), on desired future conditions. The latter vision is ideologically coloured: socialists, neoliberals and nationalists all quote selected “facts” to support their future visions but, again, these are “framed facts”. Only facts that fit in their discourses are used, the rest that do not fit are either ignored, simply denied or vehemently contested with the effective weapons of the modern communication industry.

So, in fact, when the expressions: “post-truth” and “fact-free” are used what does this really mean? The popular discourses will argue that “truth” and “facts” are defined by the “elite”, serving their own purposes in their own bubble, ignoring the attitudes and opinions of the population at large. Scientists are seen as part of the “elite”. This may be the key to the problem: large groups of increasingly well-educated citizens and stakeholders, now with access to much information on the internet and active on social media, don’t understand activities of the scientific community and have the feeling that their own opinions are not taken seriously. The “truth” and “facts” of past soil research have not always been applied by farmers and other land users. Many convincing examples have been presented of successful studies combatting various forms of soil degradation (e.g. [Schwilch et al., 2012](#)) but still 25% of agricultural land is severely degraded and areas tend to increase rather than decrease ([FAO-ITPS, 2015](#)). Of course, traditional attitudes and social peer pressures played a major role in non-adaptation. But widespread use of internet and social media and use of mobile phones tends to strongly intensify these processes. Both well-educated land users or uneducated and disadvantaged ones, the latter receptive to apocalyptic nonsense on internet, don’t see themselves as passive recipients of advice from “elite” self-appointed experts but as equal partners in pursuing innovative forms of sustainable soil management. The term: “citizen science” has the same implications.

Establishing or restoring a trustful and effective relation with a majority of stakeholders may therefore be the key challenge for the future. But relations between science and society have been studied for many years, particularly in the social and political sciences. A brief review should therefore put the problem in a broader context.

3. Changing relations between science and society

A classical paper by [Gibbons et al. \(1994\)](#) describes the emergence of a research system that is highly interactive and “socially distributed”. While knowledge production used to be located primarily in scientific institutions and structured by scientific disciplines (mode 1 knowledge), its locations, practices and principles are now (or should be) much more heterogeneous. Mode 2 knowledge is produced in the context of transdisciplinary collaborations, where stakeholders work together with scientists. Scientists are more reflexive and they operate according to different quality criteria when compared with mode 1. Mode 1 knowledge production is thus characterized by academic content, disciplinarity, homogeneity, autonomy and traditional quality control (by peer review). Mode 2, in contrast focuses on an application context, is transdisciplinary, heterogeneous, reflexive on social accountability and subject to novel forms of quality control. The authors don’t intend to replace mode 1 with mode 2, but see a need to combine the two. In a follow-up publication, [Nowotny et al. \(2001\)](#) reflect on developments in sociological literature, describing a Risk Society next to a Knowledge Society, expanding mode-2 beyond the science arena. In particular they introduce the concept of “contextualized science” which basically means that society now “speaks back” to science. Another classical paper by [Funtowicz and Ravetz \(1993\)](#) introduces the term

“post-normal” science, acknowledging the limitations of rational decision making. Given the complexity of current issues in environmental policy, a reassessment of the role of scientific research is needed. In environmental debates, “facts” are uncertain, values in dispute, stakes high and decisions urgent. “Normal” science assumes that problems can be divided in subproblems to be handled without questioning or acknowledging the broader context or paradigm. The authors suggest a need for a “post-normal” scientific practice that can cope with uncertainty, value plurality and consider interests of the various stakeholders of the problem at hand. The most striking characteristic of “post-normal” science is public participation.

Considering the current “post-truth” and “fact-free” debate, the introduction of the mode 2 and post-normal concepts twenty-five years ago were visionary. Still, implementation of these concepts in practice has been very slow. The debate has remained academic and restricted to an exclusive intellectual “bubble”. However, the introduction of widely accessible internet and social media during the last decade has strongly intensified the societal debate urgently requiring adjustments to mode-1 and “normal” approaches of knowledge generation. This may perhaps be less relevant for theoretical sciences such as particle physics, genetics and astronomy, but it is, in my opinion, highly relevant for soil science.

Introducing mode 2 and “post-normal” principles requires a basic understanding of the manner in which stakeholders react to attempts at being engaged. This aspect is not covered by the authors of the “mode-2” and “post-normal” concepts. A recent report of the Scientific Council for Government Policy in the Netherlands ([WRR, 2017](#)) emphasizes the importance of non-cognitive rather than cognitive aspects when interacting with stakeholders. Earlier, [Alroe and Kristen \(2002\)](#) presented an analysis also emphasizing non-cognitive issues. “Knowing and doing” do not necessarily go together and they often don’t. Most interesting, the WRR surveys show that this not only applies to low-income, poorly educated people as is often all too easily assumed but also to others with high incomes and education levels. The Five Factor Model of [McCrea and Costa \(1999\)](#) is most commonly used to express personal non-cognitive character characteristics that are important in this context: (i) *extraversion* (e.g. positive emotions, activity and excitement seeking, warmth, gregariousness, assertiveness); (ii) *neuroticism* (e.g. anxiety, depression, angry hostility, self-consciousness, impulsiveness, vulnerability); (iii) *conscientiousness* (e.g. competence, order, dutifulness, self-discipline, deliberation, achievement striving); (iv) *agreeableness* (e.g. trust, altruism, straightforwardness, compliance, modesty, tender-mindedness), and (v) *openness to experience* (e.g. fantasy, esthetics, feelings, actions, ideas, values). Further discussion of these characteristics is beyond the scope of this text but the key message is clear: it is easy to speak in general terms about the need for inter- and transdisciplinarity in a mode 2 and “post-normal” context, but realizing such forms of interaction can only be successful when the approach taken by the scientists connects with non-cognitive behavior of a particular group of stakeholders involved. The Five Factor Model shows that different types of stakeholder groups, or, more realistically, their representatives, will require different approaches and the fact that the mode 2 and “post-normal” concepts have remained rather theoretical in the past 25 years may partly be due to the fact that scientists have failed to articulate the right approaches. Experiences in a major research program on sustainable agriculture in the Netherlands (2004–2010) can illustrate these phenomena ([Bouma et al., 2011](#)). Twenty programs were started and in the end only ten produced significant results. Conflicting requirements of local and national regulations, actions of non-governmental organisations and different stakeholder groups produced complicated interaction processes that often took more than ten years before results were obtained. These interaction processes were visualised by [Bouma et al. \(2011\)](#) for four programs. Successes were based on persistent entrepreneurs and “knowledge brokers” from the science community, injecting the right knowledge at the right time and the right place. They also had an important function in keeping

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