



PAHENT

JOHAN BOUMA, EMERITUS PROFESSOR OF SOIL SCIENCE:

‘Our knowledge is not applied enough’

The various soil science institutes around the world operate too independently of each other, with too little focus on the application of the knowledge, says emeritus soil professor Johan Bouma. 'I think it's one of the big questions in soil science: why is our knowledge still not applied enough?'

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One third of the soils on earth are eroded, salinized, compacted or have lost their organic matter to a dramatic degree. In most cases we actually know perfectly well what we should do about that. Ten years ago, for instance, at the initiative of Wageningen researchers, an overview was made with 150 case studies describing the successful approach to various forms of soil degradation. We should talk more with stakeholders about that and get people involved. I think it's one of the big questions in soil science: why is our knowledge still not applied enough?

Science for Impact, the motto of Wageningen University & Research, perfectly suits emeritus professor of Soil Inventorization and Land Evaluation Johan Bouma. 'Science is wonderful, but in my opinion the results should serve to solve problems,' he says. 'Applied research sometimes has the image of not being the real thing. And that is reflected in the way it is remunerated. In my view, there is no real difference between applied and fundamental research: you analyse a problem, you formulate a hypothesis and research it with good methods that lead to a reproducible result, independent of the financier. That applies universally. If the result is good, it will be used or applied. If that doesn't happen, you should ask yourself why not. Maybe because it had nothing at all to do with a real problem?' Life hasn't got all that much less busy for Johan Bouma, who is 78 but doesn't let

that stop him cycling in from Rhenen for the interview. This week he has already given a talk to Master's students and attended a discussion about scientific ethics at the Royal Netherlands Academy of Arts and Sciences (KNAW). And he still has an enviable H index of 74. This measure of scientific impact counts the number of published articles and how often researchers cite them. 'I now mainly work with universities in Naples, Sydney and Dresden,' he says. 'Once you've left your own university, you must avoid getting under people's feet there. My wife sometimes asks, "What does retirement mean, actually?"'

NO INTEREST IN COWS

He grew up on a dairy farm in the province of Friesland. 'I would have been the fifth generation of the Bouma family on the farm but I have absolutely no interest in cows. Luckily, my parents were relaxed about that. From a career choice test I got the advice to study politics and social sciences in

Amsterdam. I think they got that right. Later I did go into the policy side of things, including being on the Scientific Council for Government Policy. But at that time I didn't think I would be at home in the big, hectic city.' So in 1959, Johan Bouma came to Wageningen.

'Why did I pick soil science? I don't have a particularly clear story about that, actually. There wasn't nearly as much choice in Wageningen then as there is now; cows were out of the question, I knew nothing about crop farming, so it ended up being soil science. No, I don't regret it. I still find it incredibly fascinating that soil, which is practically invisible, is so crucial in land use. Erik Smaling discovered in a recent research project that 80 per cent of the differences in harvests in Ethiopian agriculture are down to soil characteristics. Each soil has a story to tell, and it is our task as soil researchers to translate that story into human language.' And Bouma did this with so much passion and conviction that in the past few years >

'For mitigating climate change there's no getting around the soil'



he has been showered with honours (see inset), including major prizes for distinguished careers. But Bouma himself is not at all prone to harking back to the past. He would much rather talk about his mission for the future: ‘We soil scientists must focus on the UN’s Sustainable Development Goals,’ he believes. ‘About 190 governments have signed the agreement on them, committing themselves to results by 2030. Of course, those are nice words and nothing will come of it, but those sustainability goals do provide us with a sense of direction, a target on the horizon. And they are also generating renewed interest in our field. For an adequate food supply, clean water, biodiversity and to mitigate climate change, there’s no getting around the soil.’ And this is increasingly being recognized, Bouma notices. But if his discipline is to

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play a role in realizing the sustainability goals, something’s got to change, he thinks. ‘We must collaborate more, both with each other and with other disciplines. When I came to Wageningen, you had applied soil science at Duivendaal and the specialists in soil physics, soil chemistry and fertilization at De Dreijen. They were different worlds with a certain degree of rivalry. Those sub-disciplines still have their own

chair-holding professors, which is unique in the world, but fortunately collaboration is now high on the agenda,’ says Bouma. ‘From an international perspective I think the different soil science disciplines still operate too independently of each other.’ They all ‘charge ahead’, in his words, separately accumulating new knowledge, with too little focus on its potential application.

100 YEARS OF SOIL RESEARCH IN WAGENINGEN

1930s



SOIL MAPS

In the 1930s, **Willem Oosting** was the first person to make soil maps of the area around Wageningen, for farmers and other land users. His work was continued by **Kees Edelman**, who laid the foundations of the soil mapping of the Netherlands, working during the Second World War with students who had gone into hiding from the Nazis on soil maps for the Bommelerwaard area in the Rhine delta. This work continued in the decades following the war. In the 1950s, Edelman also pioneered the use of aerial photography for soil mapping. Nowadays, soil characteristics and therefore the value in use of the land are mapped from the air.



CAT POO

At the boundary between peaty and clay soils, and influenced by groundwater, extremely acid soils are formed in which not much grows. Dutch farmers call this soil cat poo, but that was too crude for soil scientists, who adopted the term cat clay. In the mid-1970s, **Nico van Breemen** succeeded in decoding the chemistry underlying this phenomenon. Applying Wageningen knowledge, cat clay was dealt with at various wet locations around the world, including the Mekong delta, where **Tini van Mensvoort** worked on it. This led to a big rise in agricultural production.

1980s



SOIL UNDER PRESSURE

In the early 1980s, **Frans de Haan** advised people on problems of toxicity, such as the Lekkerkerk housing estate scandal. He also successfully campaigned against the use of sewer sludge – full of heavy metals – as a fertilizer in agriculture. It became clear that even animal fertilizer has a big impact on the soil. From the 1970s, **Willem van Riemsdijk** developed models for phosphate saturation of soil, which are still a cornerstone of the phosphate policy in the Netherlands. In a publication in *Nature*, also in the 1970s, **Nico van Breeman** clarified how ammonia from manure acidifies the soil. A relevant theme again today.

He sees digital soil mapping as a good example. ‘An awful lot has already been published about how it could be even better. But should we devote our scarce material and human resources to it? Let’s take the example of the legally required data collection about nutrients in the livestock sector. Why don’t we make efforts to ensure that all the farmers get this kind of modern soil map? In combination with models for simulating the water and nutrient dynamics, the farmer would then be able to respond to his crop’s needs in good time. He wouldn’t have to wait until the plants go all limp, but would know in time that the nutrients are running out. Plus, he can avoid over-fertilizing and therefore polluting groundwater and surface water. This would be a significant soil science contribution to precision agriculture, and to circular

agriculture. And what is more, we would be making an immediate, real contribution to the development goals.’ Is the reflex to go on doing more and more research necessary, Bouma wonders. ‘Of course you need new specialized research because our current understanding sometimes falls short. The web of life is unbelievably complex. But let’s do it more in consultation with other disciplines which study that closely interwoven system of soil, water, plants and climate. And before we start researching yet another new topic, let’s first see what we can achieve using our current knowledge. To have an impact, we must listen to stakeholders as well, to avoid isolating ourselves and becoming ivory tower scientists.’

LOADS OF TIME

‘Working in a more interdisciplinary way takes up loads of time, I do realize that, and time is in short supply in the research world. PhD students have to publish four articles in four years. In that situation it’s hard to avoid keeping your work monodisciplinary. That can produce perfectly good science but it won’t help you reach the UN’s sustainability goals. ‘The linear model – hypothesis, study, result – doesn’t work for the SDGs. There are no simple, straightforward solutions to the world food supply question, for example. There are a lot of conflicting interests at stake, and possible courses of action eventually emerge from a compromise between those interests. Science can provide independent data to support that process. ‘The time is past when scientists could dream up such compromises themselves at their computers. We must involve stakeholders more in our work, take them seriously, listen, and take them along in a shared quest. That is our challenge for the 21st century, in which, sadly, alternative facts that ignore the truth are gaining more and more influence.’ ■

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PRIZES

In 2018, Johan Bouma was honoured in a special way. The scientific journal *Geoderma* will soon publish a special edition in which 18 of his PhD graduates, now spread around the world, contribute articles in honour of their former mentor. The emeritus professor has had numerous honours bestowed on him in recent years. In 2014, he received the Soil Society of America’s President’s Award. Last year he received the Alexander von Humboldt medal from the European Geosciences Union, for his research in developing countries. And the icing on the cake was the prestigious Dokuchaev award, granted every four years by the International Union of Soil Sciences, which he received this year for his research and teaching in soil science.

1980s



NOW

LIVING SOIL

In the 1980s, **Lijbert Brussaard** started experimenting with a new form of soil management in the North-east Polder in the northern Netherlands. Less manure, less ploughing and more organic matter stimulate soil life, which then contributes more to the nutrition of plants and the structure of the soil. Several farmers adopted this approach. In the new Agroecology and Technology Test Location in Lelystad, work continues on the supporting role of soil biology. In the Paris Agreement on climate, boosting the proportion of organic matter in the soil is listed as one of the key measure for slowing CO₂ emissions.