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Mr. Rowan Ramsey, MP  
Chairman  
House of Representatives Standing Committee on Agriculture and Industry  
PO Box 6021  
Parliament House  
Canberra ACT 2600

25 September 2015

Dear Mr. Ramsey and other Committee members,

In this submission to the Parliamentary Committee Inquiry into Agricultural Innovation, I raise three issues and make three recommendations. These are:

**1. Broadband and Telecommunications/Upload Capacity in Rural Areas**

**RECOMMENDATION ONE:** Form an industry-government taskforce to determine the roadmap to rapid implementation of sufficient rural telecommunications and broadband infrastructure, to enable innovation in agriculture around IoT and big data analysis technology.

**2. Recognition of soil as a key asset in agricultural policy, for productivity, profitability and resilience**

**RECOMMENDATION TWO:** That the Federal Government, and in particular the Minister for Agriculture and the Department of Agriculture, establishes a new strategic priority for research and development for soil management and the development of digital soil mapping for increased agricultural productivity, profitability and resilience. Soil management should be on an equal footing with water management as an area of policy focus for agriculture.

**3. Integrated National Soil Moisture Monitoring for Increased Drought Resilience and more effective Drought Management Policy**

**RECOMMENDATION THREE:** That the Federal Government consider the establishment of a coordinated research effort to establish a National Soil Moisture Monitoring Network, leading to daily soil moisture reports by location from the Bureau of Meteorology, for the purpose of increased resilience to drought and improved drought management policy by the Government and Industry.

Agriculture will be transformed over the coming decade as 21<sup>st</sup> century digital technology becomes embedded into every aspect of production and farm enterprise management. This transition is already well underway. The combination of telemetry, sensing and computing technologies (sometimes referred to as the Internet of Things, IoT), cloud computing and the cheap costs of processing and analyzing huge amounts of data to provide decision support and prescription agriculture, is changing farm practice and the entire agricultural supply chain.

Through my unique position of understanding and developing relationships between Australia and the US on issues of soil policy and agriculture, I have seen that the US is somewhat ahead of Australia in public dialogue on the topic of big data and the IoT in agriculture, and the issues and impacts that this rapidly emerging technology will have on agriculture and its supply chains. This is despite the fact that Australian agriculture is well advanced in the uptake and use of technology. Our precision agriculture research and commercial sector is world class, and is already using big data and IoT technologies. Bringing awareness of these trends to the policy sector in Australia is critical, and I welcome this Parliamentary Committee Inquiry.

On June 25 of this year, I directed and convened on behalf of the United States Studies Centre at the University of Sydney, the *'Soil, Big Data and the Future of Agriculture'* Conference in Canberra. Minister Barnaby Joyce and the Member for Hume, Angus Taylor both presented, along with six senior experts in the field from the USDA, the American Farm Bureau, John Deere, Monsanto, and Kansas State University and a line up of Australian speakers from across all agriculture, research and technology sectors. The presentations and videos of speeches are available at [www.soilbigdata.org](http://www.soilbigdata.org).

This was the first major conference in Australia to address the impacts of big data and the IoT on agriculture, and the first conference in the world to address how these technologies will greatly enhance soil management for agricultural productivity and resilience. I am delighted that Minister Joyce has called for this Parliamentary Committee Inquiry into Agricultural Innovation, and hope that in some way the USSC's investment in the June conference had some influence in his decision.

I have three key issues to highlight, leading to three recommendations for this Inquiry:

## **1. Broadband and Telecommunications/Upload Capacity in Rural Areas**

The biggest barrier to the adoption of emerging technology in agriculture, will be broadband and telecommunications capacity across rural Australia, and in particular, upload capacity. Telemetry and sensing systems on farm generate huge amounts of data, which must be uploaded to the cloud for processing. This data is then processed and the user downloads the analysis and decision support information, which is far less data intensive.

The single biggest point of failure for Government to facilitate the adoption of agricultural innovation would be failure to ensure sufficient broadband and telecommunications upload capacity in rural areas. If this infrastructure is provided, the market will innovate around emerging IoT and big data technology. If it is not, innovation adoption will stall.

**RECOMMENDATION ONE:** Form an industry-government taskforce to determine the roadmap to rapid implementation of sufficient rural telecommunications and broadband infrastructure, to enable innovation in agriculture around IoT and big data analysis technology.

**2. Recognition of soil as a key asset in agricultural policy, for productivity, profitability and resilience**

The second issue is more esoteric, but just as impactful. It relates to emerging technology relevant to the agricultural sector in the area of soil management.

Improved soil management provides the biggest single opportunity to dramatically increase agricultural productivity, farm profitability and landscape resilience in Australia, than in any other arena in agricultural research and development. Over recent decades, efforts to increase agricultural productivity have focused largely on chemistry and genetics (plant and animal). Soil management has had relatively little focus, despite the fact that soil is the farmer's main production asset.

Why has this happened? Why is soil the forgotten resource in agricultural productivity research and development? It is because soil has been disconnected from agriculture policy. At Federal and State Government levels, soil has become a Natural Resource Management (NRM) issue, and is not considered to be a critical platform for agricultural productivity. This disconnect has flowed through into funding priorities for soil research, leading to a situation where soil research and development is mostly only couched in terms of natural resource management outcomes. Long established soil constraints including soil carbon loss, acidification and salinity receive some attention, but a positive view of soil as the engine room for productivity is rarely considered.

The terms of this Parliamentary Inquiry reflect this disconnect – soil and soil management is not mentioned, and yet as I will outline below, innovation in digital soil mapping has the biggest potential to boost agricultural productivity in Australia.

Soil should be equal to water in agricultural policy. These two resources provide the foundations of any agricultural enterprise. Even hydroponics rely on inputs that derive from soil. And yet whilst water now has its own Agriculture ministerial focus, soil has almost no policy focus.

This disconnect has not occurred at the practice level. There is a new and growing interest in the agriculture sector on soil management. Farmers are increasingly recognising their soil system as the engine room for production and are building their farming system around it. One example is grain producer Brad Jones from Tammin in WA, who spoke at the Soil, Big Data and the Future of Agriculture conference. <https://www.youtube.com/watch?v=zmk6B2ejMdY>. He has dramatically improved ROI and profitability through detailed understanding, mapping and management of his soil systems.

The time to address this fundamental disconnect is now, as digital soil mapping, telemetry and sensing technology will enable farmers to optimize the performance of their soil systems. The vision, as articulated at the conference, is that farmers and

graziers will have at their fingertips, on their mobile devices, farm equipment and computers, four dimensional digital maps of the soil in their paddocks, detailed down the profile, and along with it, an understanding of the chemical, biological and physical processes and functions that are occurring in the soil, which they can then manage in order to optimize the growth of the plants they are growing – crops, pasture or horticulture. This vision is perhaps 10 – 15 years away, and will rely on Government recognition of soil as a strategic production asset for agriculture, and not just as an NRM issue.

The basic building blocks of this vision are already in use on farms, including electromagnetic (EM) soil mapping and soil moisture monitoring. The Australian Land and Soil Grid developed by CSIRO and the University of Sydney provides a platform for integrated use of public soil data, however the value of this at paddock level is still to be demonstrated. The privately owned soil data resource, which is collected and used by farmers, agronomists, consultants and fertilizer companies is far more up to date and detailed. If used correctly, this data leads to changes in practice that greatly enhance the productivity, profitability and resilience of the farm.

Australia is well placed to take advantage of a renewed focus on soil management though the development and integration of digital soil mapping technology with precision agriculture. The University of Sydney is an internationally recognized centre for soil informatics (pedometrics) and digital soil mapping. Along with CSIRO, The University of Sydney has led the International Union of Soil Science initiated Global Soil Map project, which sets international standards for conversion of analogue soil data to digital soil maps. Combined with its long-standing leadership in precision agriculture research, the University of Sydney brings together the knowledge in soil science and informatics with practical application at farm level through precision agriculture.

**RECOMMENDATION TWO:** That the Federal Government, and in particular the Minister for Agriculture and the Department of Agriculture, establishes a new strategic priority for research and development for soil management and the development of digital soil mapping for increased agricultural productivity, profitability and resilience. Soil should be on an equal footing with water as an area of policy focus for agriculture.

### **3. Integrated National Soil Moisture Monitoring for Increased Drought Resilience and more effective Drought Management Policy**

The third issue is really a subset of the second, but deserves special attention. As mentioned above, soil moisture monitoring probes are now increasingly used across cropping systems, and are routinely used in irrigated systems.

In addition to direct sensing technologies, great advances are also being made in remote sensing of soil moisture. Earlier this year, NASA launched the Soil Moisture Active Passive (SMAP) satellite, which measures soil moisture in the top 5cm of soil over all of the earth, every 2 – 3 days. This has triggered an explosion of research around the world in the collation, processing and use of soil moisture data at broad scales.

In Australia there are a number of disconnected research projects focused on soil moisture monitoring, including the project and its associated funding that was

announced by Minister Joyce at the *Soil, Big Data and the Future of Agriculture* conference. It appears to me that there is little strategic coordination of these various efforts.

Again, due to the disconnect between soil and agriculture at the policy level, soil moisture monitoring would not receive the level of Ministerial attention that it should. But the reality is that technology in this area is such, that the Minister could ask for, and expect to see at some point in the not too distant future, a daily soil moisture report by location, generated by the Bureau of Meteorology for use by the agriculture sector, governments, banks, insurance companies and so forth. This would require a well-coordinated and cooperative research and technology development effort – it could be the focus for a Cooperative Research Centre.

This information could transform how Australian land managers respond to dry conditions, and how Governments formulate drought policy. Soil moisture levels could provide an early warning system to prioritise drought relief. Land managers who carefully managed their soil moisture through vegetation and grazing management in response to dry conditions, and as measured by the soil moisture monitoring system could be prioritized for economic relief packages during droughts. Rather than putting in a crop after a string of dry years and hoping for the best, farmers could be rewarded for keeping remaining soil moisture in reserve until sufficient rain fall to wet down the profile.

Banks and insurance companies would also find this information highly useful in providing financial assistance in drought conditions. By better monitoring and managing soil moisture through the use of this technology, Australian agriculture would become far more resilient to drought.

This approach is already being considered in the US. The USSC hosted Dr. Mike Strobel, Director of the USDA-NRCS National Water and Climate Change Center to speak at the *Soil, Big Data and the Future of Agriculture* Conference in June. Dr Strobel is leading a pilot project to establish a US National Soil Moisture Monitoring Network. <http://soilbigdata.org/speakers/mike-strobel>. This is something that should be considered for Australia.

**RECOMMENDATION THREE:** That the Federal Government consider the establishment of a coordinated research effort to establish a National Soil Moisture Monitoring Network, leading to daily soil moisture reports by location from the Bureau of Meteorology, for the purpose of increased resilience to drought and improved drought management policy by the Government and Industry.

Thank you for the opportunity to submit on this very important topic.

Sincerely,

**Andrea Koch**