Please find my submission for Drought Resilience Funding Plan 2020 – 2024.

The focus of my submission relates to research. I attended the Moree Community Consultation.

I am Chair of the National Water Use in Agriculture Research and Development and Extension Committee https://www.agriculture.gov.au/ag-farm-food/innovation/national-primary-industries which is made up of DPIs from all States, CSIRO, Universities and the NFF.

Attached is a paper I wrote for The Australian Farm Institute Journal in 2019. It highlights, several areas that would improve the water use of agriculture and hence drought resilience. Your plan offers the long term strategic approach that is missing in the current R&D structures. You could look to some of the longer term challenges that will provide transformational opportunities.

Research will deliver public benefits with wide ranging spill overs.

Here are a couple of examples, but table 1 on pages 26 offers many others. These examples are very focused at the farm scale, but research could also be applied to catchment (NRM) and regional communities (social sciences). Any research program could have a Farm, Landscapes and Communities structure.

The Commonwealth could establish a National Network as a joint venture between the Australian Government and key research providers. This would have several regional hubs in key areas around Australia. Maybe even structured into a "CRC" type entity without the commercial focus and IP focus of that program.

The Minister could appoint a small drought research oversight implementation committee and host a technical science forum to get the ball rolling and flesh out the details. This could be done via the Government's National Water use in Agriculture RD&E committee or some other appropriate structure.

About Dr Guy Roth, Narrabri, NSW
Dr Guy Roth lives at Narrabri, NSW and is currently the Director of Northern Agriculture for The University of Sydney's regional facilities and lives on their 2500ha farm. Guy has worked for 25 years as a scientist, research manager and educator in agriculture. He is Chair of the Australian Government's National Primary Industries Water Use in Agriculture, Research and Development & Extension strategy.

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Evaporation mitigation

Vast amounts of water are stored in dams in Australia which is a function of our arid and highly variable climate. These dams range from large public storages, on farm irrigation dams, and stock and domestic farm dams. Depending where you live, evaporation levels can be around 2000 mm or 2 metres per year. On farm dams are losing around 30-40% of the water stored due to evaporation. Evaporation losses from farm dams and water storages is a major loss pathway for any farm water balance. It is an international problem and we need to find a solution to make some savings to improve our resilience. Even a partial solution for one - two summer months of the year or during a period of shortage such as drought would be significant on any farm. This is a problem with massive public benefits and requires more than one small project to solve this grand challenge.

Polymers

Perhaps the "number one" water use in agriculture innovation is poly pipe which was invented in the 1950-60s. A transformational product. As stated in the famous movie of that era "The Graduate" starring Dustin Hoffman; *"There is a great future in plastics"* and there certainly was. There would not be a farm in Australia that doesn't use poly or PVC pipe for its stock and domestic water supply, drip irrigation in vineyards and orchards or even its surface irrigation system. Polymers continue to evolve and most recently there is increasing interest in biodegradable polymer films in broadacre crops where they enable better water conservation. Livestock producers also use polymers for bailing twine, fodder wraps, cattle tags, and fence posts.

Geo Spatial Soil Moisture Monitoring

How much water is stored in your soil? As simple as it may sound, measuring the soil water content has proven scientifically challenging. All of the commonly used soil moisture sensors are point based systems and are only measuring a sphere of soil between the size of a tennis ball and basketball size to represent an entire paddock. Therefore, another holy grail and grand challenge is a geo spatial soil moisture sensor that can measure the entire paddock at several depths to at least 60 - 80cm down the soil profile in a cost effective and timely manner. Therefore, a soil moisture profile measurement tool is another grand challenge.

New Sources of Water

While the debate will always roll on about water sharing from our river and groundwater systems is it time to explore if we can get more water from other sources which have historically been too costly or inefficient. Cheaper and more energy efficient desalination processes would be desirable and are becoming possible. These could be small scale systems supplying a niche communities alongside the coastline or in the inland. Likewise, atmospheric water capture is gaining renewed technical interest, especially in dry low humidity climates where drought conditions often prevail such as a solar chimney or solar cyclone. Another 5 years of physics and chemistry would certainly advance this water resilience challenge for those people in the remote areas.

Plant breeding

Cropping and horticultural industries will continue to invest in plant breeding programs. However, for drought heat tolerance one such example, is at The University of Sydney at Narrabri where genetic variation of wheat and chickpea genotypes is being studied and promising results of genotypes being identified. A subset of genotypes deemed to have superior tolerance to heat were evaluated within field-based artificial heat chambers where a heat shock 4°C above ambient temperature This means there are genetic possibilities and greater investment is this sort of research will provide greater resilience to the sorts of heat waves and drought currently being experienced and enable these traits to come to use quicker with more local and regional testing.