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Determining the Scale of the Opportunity for Agricultural and Water Resource Development in Northern Australia

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Abstract
The Australian Government, jurisdictional governments and many local communities are actively encouraging the agricultural intensification of northern Australia. Indeed the Australian Government has released the “Our North, Our Future: White Paper on Developing Northern Australia” and the “Agricultural Competitiveness White Paper”, both of which highlighted the opportunity for northern Australia’s land and water resources to enable regional development.

Over the last decade CSIRO has led a suite of projects which can be best summarised as helping to determine the scale of the opportunity for irrigated and dryland agriculture, intensified beef production and other opportunities such as inland and coastal aquaculture.

These projects have provided regional summaries of: the surface and groundwater resources in terms of the amount of water that could be extracted for consumptive use; opportunities for mosaic style irrigation; opportunities for surface water capture; land suitability; crop and forage potential; supply chain and transport logistics issues; potential impacts on fisheries; considerations of land tenure and a review of the history of some of the major agricultural developments in the north. In addition to examining opportunities and constraints, these studies have identified factors that need to be considered to reduce risks in production, natural resource management, and socio-economics.

The presentation will consider these in summary but focus on the results of a large study examining the opportunities for development in the Gulf country of Queensland and discussion of an even larger study underway in the Mitchell catchment (Qld), the Fitzroy catchment (WA) and four catchments around Darwin. Both these studies encompassed a wide range of factors relating to development including soil and water resources, farming systems and market opportunities, potential ecological impacts, aquatic biodiversity and Indigenous rights, interests and values.

Introduction
The push for agricultural intensification in northern Australia is not new, it has been on the national agenda for over 100 years. Indeed slow progress was apparently one of the reasons behind the Federal takeover of the Northern Territory from South Australia in 1911 (Cook, 2009). The Northern Australian Land and Water Task Force (2009) recognised that the notion of northern Australia becoming a “food bowl” was not supported by evidence however it recognised that increases in the area of irrigated agriculture were likely, much of this in support of the northern cattle industry. It further noted that there were insufficient data at suitable scale to estimate the quantity and quality of available land and water resources for irrigated agriculture. This lack of good quality data at sufficiently fine scale has meant that only broad estimates can be made for most of the north. For example, soils maps exist for only parts of northern Australia. In many cases the most current mapping is of land systems at 1:1,000,000 scale from surveys post World War Two up to the end of the 1960s.

At least four definitions have been used over the last 10 years to define “northern Australia”. While these make it difficult to directly compare statistics from different sources they do not materially affect the general conclusions of this paper.

Determining the scale of the opportunity in the north
The northern cattle industry (as defined by the Northern Australian Beef Research Council and includes all of Queensland and the NT) already has a GVAP of approx. $5b at 2009/10 figures (Gleeson *et al*., 2012). Northern Australia has about 150,000 ha of existing irrigation, about 119,000 of

which is in the Mareeba-Dimbulah and the Burdekin irrigation areas. The Northern Territory has a total of about 5,000 ha (Ash *et al.* 2017). There are about 25,000 ha in Western Australia, mostly in the Ord River Irrigation area. Outside of these areas there are a few, small, irrigation developments totalling in the thousands of hectares.

Intensification of the cattle industry is likely to occur but so too will there be an increase in irrigated agriculture. This means that some of the rangelands will be turned over to crop (food and fibre) or forage, although the total area involved in intensification will always be a small percentage of the total area used for grazing.

Petheram *et al*. (2014) estimated that sufficient divertible surface water might be available to increase the total irrigated area in northern Australia, to about 1.4 million ha. This represents 0.5% of the area of northern Australia and would be an increase of around 50% in the area under irrigation in all of Australia. If the prospects for increased irrigation in the eastward flowing catchments are not considered (because these areas are not regarded as rangelands) the total reduces to about 1.2 million ha. Additional areas of 100,000 to 150,000 of irrigated land might be supported by groundwater (Petheram *et al*. 2014).

There is sufficient arable soil in northern Australia to support such an area. Estimates of soil suitable for irrigated production are at least 16 million ha (Wilson *et al.* 2009) recognising that soil or land suitability maps at fine scale are depauperate across the north.

Rainfall variability is high and this variability is magnified when converted to streamflow. Therefore estimates of dam yield need to be considered in terms of the year by year reliability of water availability. Therefore yields tend to be low in comparison to storage capacity to account for this. Evaporation rates are very high. For example, one of the more prospective dam sites in the Gulf country of Queensland would lose 1.2 GL of water to evaporation for every 1.0 GL of water released from the dam (Petheram *et al*. 2013). Transmission losses from the dam to the farm gate were estimated conservatively at another 0.325 GL and there would be further losses from the farm gate to the crop. Arable soils, while abundant at the regional scale, might not be found in areas sufficiently close to either surface water storage or groundwater to be economically viable. Even where soil and water might be coincident, sparse infrastructure often makes it difficult and expensive for transport of farm inputs and crop outputs, especially during the wet season, and remote locations make it difficult to attract skilled labour. In areas where Native Title is not extinguished, which is most of northern Australia, any significant change in land use will be considered a future act and will trigger the provisions of the Native Title Act 1993.

These constraints apply particularly to large scale irrigation development. The prospects are much better for small scale distributed (mosaic) irrigation to support beef enterprises (Grice *et al*. 2013). In this case, either groundwater or on-farm (i.e. off-stream) storages could be used to grow forages for cattle. Approval to undertake this kind of diversification is possible under the tenure provisions of all three northern jurisdictions although in many cases the approval process for water and land development can be daunting.

The economic analyses undertaken as part of the Flinders and Gilbert Agricultural Resource Assessment (FGARA) suggested that break-even gross margins required to meet standard investment returns were most sensitive to the capital costs of water storages and associated infrastructure. The economic analyses highlighted that the challenges in establishing irrigated agriculture go far beyond biophysical factors and so an integrated approach is needed in determining the scale of opportunity.

More precisely determining the scale of the opportunity

Improved estimates of the potential for irrigated agriculture can be made where data sources are more detailed and at finer scale.

Such higher resolution data was made possible in the Flinders and Gilbert catchments of the Gulf of Carpentaria through the FGARA project (Petheram *et al.* 2013a; 2013b). FGARA found water harvesting into off-stream storages to be the most promising method of water capture in the Flinders. By contrast, large in-stream dams were more likely in the Gilbert. There was more than 8 million ha of soil moderately suited for irrigated agriculture in the Flinders and more than 2 million ha in the Gilbert. Given a water reliability of between 70% and 85%, about 10,000 to 20,000 ha in the Flinders and 20,000 to 30,000 ha in the Gilbert were potentially available for irrigation. Distributed, small scale irrigation as part of beef enterprises was more likely in the Flinders while there was potential for

scheme scale development in the Gilbert. The ecological risks were also different between the two catchments. For example, the dry-season pools were naturally persistently turbid in the Flinders while clear in the Gilbert. This means that moderate inflows of turbid water from agriculture would have limited impact on the pools of the Flinders but the pools of the Gilbert would be highly sensitive to such disturbance.

A similar project, the Northern Australia Water Resource Assessment (NAWRA) is underway in prospective catchments in each of the three northern jurisdictions, and will report by June 30, 2018. NAWRA includes activities which consider: climate; freshwater and marine ecology; groundwater and surface water hydrology; water capture and storage; indigenous aspirations and water values; farm and region scale socio-economics; land suitability; and agriculture and aquaculture viability.

What is the future likely to look like?

Small scale irrigated agriculture is likely to increase as an adjunct to existing beef enterprises. This will occur in many places across the north using groundwater or off-stream storages. Such development may become more likely if cattle prices warrant the investment and if investors such as private equity funds, corporates and high net worth individuals are prepared to invest with capital that is somewhat patient. Some of these ventures will move beyond forages to growing commodities and/or high value crops. The number of new, large schemes in northern Australia will be low. These will be constrained by the high cost of water capture and storage infrastructure and the lack of cropping systems which can provide sufficiently high returns to service these capital costs.

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