



THE GILBERT'S SOIL A cautionary tale

RESEARCH BY **ANDREW BROOKS** AND **JOHN SPENCER** IS CONTRIBUTING KNOWLEDGE TO THE RISKS AND CHALLENGES FACED BY NEW IRRIGATED AGRICULTURAL DEVELOPMENTS IN NORTHERN AUSTRALIA.



There has been much talk of the great promise for irrigated agriculture in northern Australia, and the Gilbert River catchment within the Gulf Country has been at the forefront of plans to turn this promise into reality. While it is anticipated that this sort of development has sweeping benefits, it doesn't come without its challenges, especially within a landscape highly susceptible to erosion.

Dr Andrew Brooks, senior research fellow with the Australian Rivers Institute at Griffith University, has been investigating the soils and geomorphology of catchments in the Gulf, and his research findings can be used to guide new irrigation developments away from areas which are highly likely to experience major erosion. Funded under the Australian Government's National Environmental Research Program (NERP), the project considered the challenges confronting these types of developments due to the extreme variability of rainfall and the particular characteristics of the landscape with its ancient, weathered and infertile soils.

"Any proposal which would see land developed in the Gulf Country needs to look at the underlying soils and topography of the catchments. While some floodplain areas may offer relatively suitable, flat land with fertile soils, other areas have relatively steep, nutrient poor and highly erosive ancient soils," said Andrew.

Case in point

Using a major proposal in the Gilbert River catchment as a case study, Andrew and colleague John Spencer examined the risks associated with transforming the land use from the current low-density grazing land to high-intensity irrigated agriculture. The proposal is to create a 65,000 hectare integrated farm and processing precinct producing mainly sugar and guar beans (*Cyamopsis tetragonoloba*) for the Asian market.

Above: Exposed tree roots within an alluvial gully in the Gilbert catchment, highlighting the susceptibility of this landscape to erosion. Photo Andrew Brooks.

Traditionally, new irrigated agricultural projects are developed for areas with good quality soils that are suitable for intensive development, and then water storage and infrastructure are designed around these good soils. This new proposal is, however, using an approach called fertigation, where fertiliser is dissolved and distributed within the water of the irrigation system, in a process akin to large-scale hydroponics. Andrew says this approach changes the emphasis for site selection to locations suitable for water infrastructure development, while soil quality is a secondary consideration.

The approach has been typically used on smaller-scale projects where the water and nutrients are delivered via sub-surface drip irrigation. In a proposal of this scale, however, there are major logistical issues to be overcome in setting up sub-surface drip irrigation in the poorly-drained sodic soils that characterise this landscape.

The development includes plans for two off-stream dams, that will take 40 per cent of mean annual flows from the Einasleigh and Lower Etheridge Rivers, equating to 550,000 megalitres per year. Andrew says this will significantly reduce the frequency of large scouring flows in the river. These flows are important to scour deeper pools in the wide sand river bed. The flow diversion

only takes the water, leaving all of the sand in the river and preventing the deep pools from being formed. These deep pools last into the dry season, acting as critical refugia for many aquatic animals, including endangered sawfish. To date, the necessary research has not been done to fully evaluate the impact of such a scenario on these refugial habitats.

In comparison to other northern Australian developments, this is proposed to be 80 per cent of the size of the existing Burdekin Irrigation area, and around four times the size of the Ord irrigation scheme.

These existing agricultural areas are sited on flat floodplains with relatively young and fertile soils. This new development, however, is planned for a geological unit known as the Holroyd Plain, which is the oldest part of an ancient fluvial megafan. The megafan has a well-developed network of drainage channels, considerable topography, with very little suitable flat land, and soils that have been weathering since they were deposited two to 10 million years ago. These soils are potentially highly susceptible to erosion if disturbed.

While there is a thin (5–10 centimetres) veneer of stable soil on top, it is the subsoil beneath that Andrew says is problematic. The laser levelling that will be needed to set up the paddocks for trickle-tape irrigation will require the mixing of the shallow stable ‘A’ horizon soils with the sub-surface soils, which are generally sodic, highly dispersable, and on an average gradient three times that of the Burdekin irrigation area, further increasing the erosion risk, particularly in the development phase.

“While it is true that the sodicity can be neutralised with the addition of gypsum (at considerable cost), this will not change the deep drainage problems, and it will not reduce the potential for accelerating gully erosion, which is a major risk in this landscape, particularly where rainfall-runoff ratios are altered by land-use intensification.

In other areas with similar soils and topography, we have documented gully erosion stripping metres of soil off the landscape due to catchment changes that are relatively subtle compared to development for irrigated agriculture.”

Andrew Brooks inspecting soils within the proposed development site. Photo John Spencer.



The proposal also requires an extremely dense network of farm tracks, and it is well known that vehicle tracks are a major initiation point for gully erosion in these landscapes. Great care would be required to design and build the track network so that it doesn't initiate gully erosion.

Andrew says the Gilbert River case study highlights development constraints associated with topography and soil structure, and emphasises the need for wider research to underpin land use planning for development in northern Australia.

"Although technology has the capacity to overcome the very poor fertility of the soil in this region, it can't ensure that soils won't wash away. For irrigated agriculture to succeed in the north it needs to take soil and topography into account as a first order priority."

"The assessment of soil erosion susceptibility must be ranked as one of the highest priorities for consideration in the planning process for any new agricultural development in northern Australia. Careful consideration needs to be given to accounting for soil structure and composition to ensure development opportunities are maximised for the short and long term, and that the built infrastructure does not become a stranded asset."

Future decisions

As northern Australia enters another period of renewed focus and interest, Regional Development Australia, Townsville and North West Queensland chair Paul Woodhouse says agriculture will continue to play a leading role. He says that there is a need for demand.

"Clear long-term policy agreement, certainty of tenure in areas where there are suitable soils, clearly defined but long-term water licencing arrangements, and access to good science and peer support. These factors alone will decrease the risk of lending by curious, but still conservative investors."

Paul believes that the construction of a sustainable agricultural and pastoral sector across northern Australia will also require removing impediments which have perhaps been convenient barriers in the past.

"Growth in areas of the region which have not been exposed to traditional agriculture may well begin as benignly as the individual growing of sorghum and other limited fodder crops, which offer more flexibility to beef operations outside of accepted seasonal marketing periods. Growth will also no doubt continue in areas of already intensive agriculture and cropping as producers move to spread their risk and maximise returns."



The major proposal in the Gilbert River catchment is 80 per cent of the size of the existing Burdekin irrigation area of 80,000 hectares (Burdekin region pictured). Source Burdekin Shire Council. Inset: Guar bean cluster. Photo Ton Rulkens.





An example of significant alluvial gully erosion in the Gilbert River catchment. Photo by Andrew Brooks with John Spencer circled.

“It won’t be perfect—leaders will continue to lead and sometimes overstep, many will follow good examples, some will follow bad, some will succeed, others not as well. But such is life in the growth stages of what could become a significant industry if well managed and supported. Such was life in the infancy of extensive experimental farming in Australia, such is life now. It will be an interesting journey for policy makers, producers, inventors and scientists together, we can only hope the language is a common one, and the direction is a shared one.”

While Andrew agrees that we have to proceed in a partnership between scientists, farmers and business entrepreneurs, he has a slightly different view about the need to make mistakes, as we have in the past.

“We have the capacity to do it much better today than in the past, when ‘trial and error’ was the only way to go, because we didn’t have the technologies at our disposal that we have today. The whole point of programs like the NERP is that through research we can learn from the mistakes of the past, and we can apply technologies such as high-resolution remote sensing, coupled with good old-fashioned field data collection, to map out areas that are appropriate for high-value agricultural investment.”

“Not only is this better for the environment, but it is better for business, because it will help us maximise the return on investment by reducing the waste associated with unproductive ventures.”

FOR FURTHER INFORMATION

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