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Opportunities and Conflict in Agriculture and Natural Resource Management in the Australian Tropics

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Northern Australia is endowed with an enormous natural resource base and a small human population. Spanning tropical Queensland, the Northern Territory and Western Australia, it encompasses 42-46% of the land mass, depending on whether or not adjacent subtropical regions are included, but less than 5% of the Australian population (< 1 m people). By way of contrast, the tiny island of Timor which shares many biophysical and climatic features with parts of our North, hosts three times as many people on 1% of the area. Ever since early European settlement, there have been many optimistic assessments of the North's food production potential. However, attempts to establish large-scale agricultural enterprise have met with varied success. The region's climate is hot and largely seasonally arid, with highly variable rainfall, both in amount and intensity, concentrated during the short summer monsoon of 3-5 months depending on the year. Rain fed crop and pasture production is possible where there is adequate rainfall and extensive-enough areas of arable soils with adequate water holding capacity, while irrigated cropping is potentially an option in both the wet and dry seasons in small arable areas where there are also renewable surface or ground water resources. Apart from areas of coastal Qld and nearby ranges, the main ecological region where agriculture might be contemplated is tropical savanna grassland / woodland, and the dominant rural industry is extensive beef production exploiting native grassland.

Most of the region's current agricultural production occurs in coastal Qld and adjacent tableland areas in Central Qld and the Atherton Tableland in the north. There are small areas of rain fed cropping scattered through northern and western Qld, the Katherine-Daly region of the NT and the Kimberley in WA. The main irrigated cropping areas based on surface water storages are located around Emerald in the central highlands, Bowen, the Burdekin Valley and the Atherton Tableland in Qld, and the Ord Irrigation Area in WA. Smaller areas of irrigated cropping based on water from streams and bores occur along the Qld coast and in the Douglas Daly region of the NT. The most successful industry is sugar, about a third of which is irrigated, the rest rain fed. A range of cereal, oilseed and pulse crops is grown in the rain fed cropping areas of the central highlands and the northern tablelands while legume crops are expanding into sugar areas. The east coast also supports significant areas of horticultural fruits and vegetables.

As Australia's population surged through post-World War II immigration, optimism about the potential for the North fed into several large public and private agricultural projects in locations remote from existing population centres in central Qld, the Kimberley, the NT, and lower Cape York. In most cases, these projects (e.g. the Ord, Douglas Daly, Lakeland Downs) did not match the vision of their architects and in some cases (e.g. Peak Downs in central Qld and Tipperary, Willeroo and Coastal Plains in the NT) failed completely. The reasons for their failure have been well-documented elsewhere, but generally related to economic pressures (high cost structure because of their location remote from populations centres and markets), unanticipated difficulties in scaling-up production operations (exacerbated by the extremely variable weather conditions, patchy, infertile and difficult soils and biotic challenges) and the general unsuitability in the tropics of what at least initially were essentially temperate crop production technologies from the South. Many of these issues are not dissimilar to problems faced in developing countries. The Ord is the largest and the most emblematic of these developments and the extent that it is seen as a failure depends on one's overall view of whether the North should support agricultural development or be reserved for other uses. Certainly, after promising starts, cotton and later sugar failed after about a decade, albeit for partly different reasons. On the other hand, the Ord today hosts c. 16,000 ha of successful horticulture and sandalwood production; there has been at least one positive overall benefit: cost assessment; and government has approved a stage 2 expansion to c. 28,000 ha. Likewise, while the initial enterprises foundered, rain fed cropping now occurs in Central Qld, the Douglas-Daly and on Lakeland Downs.

Over recent decades, the agricultural potential of the North's natural resource base has become contested, with some markedly more pessimistic assessments of the scope for development than in earlier times. In the 1970s, for example, the area of arable land in the NT potentially suited to rain fed cropping was estimated at 1 m ha, whereas by the mid 1990s, that figure had shrunk by four-fifths as more detailed mapping showed how patchy the potentially arable soils were. In terms of irrigated agriculture, whereas the Ord dam was built in 1971 to provide capacity for irrigating 72,000 ha, the 2009 Northern Australia Land and Water Science Review (NALWSR) put the total potential irrigable area in the Australian tropics (excluding already developed areas of Qld but including the Ord) at a mere 60,000-120,000 ha. In part, the re-assessment of northern agricultural potential reflects several confluent trends, including the mixed success of past developments, more detailed scientific assessment of the challenges in harnessing and managing the region's soil and water resources for agriculture – particularly the region's seasonal aridity, the usually uncertain weather

patterns, and the often infertile and fragile soils. According to the NALWSR, water rather than soil is the key primary NR constraint to future agricultural development across the North: "While there is potentially c. 17 million ha of soil suitable for annual crops, and as much as c. 32 million ha suitable for forestry … rainfall is not sufficient to support cropping in large tracts of northern Australia." The NALWSR makes clear that detailed assessment of the region's soils and water resources remains constrained by the lack of useful information at a suitably fine scale.

In addition, there is now greater awareness, in part based on southern Australian experience, of the vulnerability of natural ecosystems to agricultural activity, competing economic uses for NR and associated ecosystems, and importantly, changing perceptions of the value of natural environments in Australia's increasingly urban population. The NALWSR makes clear that its assessment is predicated firmly on the premise that current community values preclude future development of the North based on principles similar to those that guided the development of southern Australia. The North contains many unique, in some cases iconic ecosystems, ranging from the Great Barrier Reef and world heritage wet tropics rainforests along the NE coast to the rugged escarpments of Arnhem Land and the Kimberley. Like the region's soil and water resources, scientifically many of these remain poorly-understood. Experience in the NE has demonstrated the vulnerability of coastal wetlands and at least the inshore reefs to agricultural (and urban and fishing) activities. In Qld, those agricultural industries in the river catchments that flow into the Great Barrier Reef lagoon have faced increasing community, and most recently regulatory, pressure aimed at reducing adverse downstream effects. The natural biodiversity assets of northern Australia do not just include unique eco-systems and iconic species: tropical Australia is home to a wide range of potentially valuable plant germplasm, including wild relatives of a range of internationally important field and tree crop genera like Oryza, Sorghum, Vigna, Glycine, Cajanus, Nicotiana and Santalum. Even within these well-known agriculturally-important genera, new taxa are continually being located and described.

On the east coast, R&D largely proceeded apace with agricultural development and as a consequence was relatively effective. The sugar industry for example has actively supported and in turn been supported by its own production R&D since the start of the 20th century. In more remote areas, however, agricultural R&D, like the development experience itself, has a chequered and contested history. During the early post-war years, the broad emphasis in the NW was on land use assessment to identify potentially suitable agricultural areas and introduction and testing of potential crop plant species, followed later by empirical studies of selected species to identify best bet options for variety and basic agronomic management. As it became clear that practices that had worked in the south were often not suitable in the semi-arid tropics, adaptive, systems-focussed research worked to tailor practices from elsewhere in the tropics to local conditions. The build-up of local R&D capacity, which took time, did not peak until the late 1970s, by which time many projects had already folded. The R&D solutions often lagged the needs of specific developments, some of which were initiated before there was adequate scientific knowledge to support them. The development of the conservation tillage / ley farming system for dryland cropping in the NT, for example, came too late to save the NT's Agricultural Development & Marketing scheme, although the basic techniques developed in that two-decade systems-focussed program now underpin locally successful dryland cropping of sorghum using the introduced pasture species Centrosema pascuorum as the forage legume. Conversely, many if not most of the problems of irrigated wet season cropping in the semi-arid areas remain under-researched and unresolved.

Initially, the overwhelming emphasis of agricultural R&D across northern Australia was production-related, but over time broadened to include soil conservation and management, as on-farm degradation issues emerged. Since the mid-1970s, production-related R&D has contracted sharply, replaced by research heavily focussed on catchment-scale NRM and environmental research largely unrelated to food production. The question now needs to be asked whether we retain sufficient local agricultural R&D capacity in the North to effectively support development of even the limited potential identified by the NALWSR, within the two decade timeframe envisaged in that report. By way of example, the number of CSIRO crop and pasture scientists in the tropics has declined over the past 35 years from a peak of > 30 to just a few today - a much greater contraction than the revised assessments of the region's agricultural potential. It is instructive to contrast the Australian R&D experience in the tropical savannas with that in the Brazilian savanna region (the cerrado) . The cerrado has much more favourable rainfall distribution than Australia's North and being elevated, less extreme high temperatures, but otherwise shares other features, particularly remoteness and infertile soils. In the 1970s, the technological packages imported from the US did not work in the cerrado, and early large-scale agricultural developments there also failed. However, instead of retreating and accepting defeat, Brazil invested heavily in systems-focussed R&D with the result that mixed cropping-livestock enterprises in the cerrado now produce 70% of Brazil's agricultural output. Largely because of this massive increase in food production, Brazil is now the World's No. 1 food exporting nation and the only one where production is based in large-scale mechanised agriculture in the tropics.

To summarise, Australia's tropical North has vast natural resources although the scope for agricultural development is lower than previously believed. Even so, given the run-down in crop and pasture science capacity in the North over the past three decades, it is doubtful the region retains sufficient capacity to develop even that more limited potential.