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This is the fifth edition of the NTPS Professionals Newsletter. We hope to receive contributions from members working within the NTPS in the future.
To contribute articles or letters to this Newsletter, please see below.

Present state and future of the world's mangrove forests

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SUMMARY

Mangroves, the only woody halophytes living at the confluence of land and sea, have been heavily used traditionally for food, timber, fuel and medicine, and presently occupy about 181 000km2 of tropical and subtropical coastline. Over the past 50 years, approximately one-third of the world's mangrove forests have been lost, but most data show very variable loss rates and there is considerable margin of error in most estimates. Mangroves are a valuable ecological and economic resource, being important nursery grounds and breeding sites for birds, fish, crustaceans, shellfish, reptiles and mammals; a renewable source of wood; accumulation sites for sediment, contaminants, carbon and nutrients; and offer protection against coastal erosion. The destruction of mangroves is usually positively related to human population density. Major reasons for destruction are urban development, aquaculture, mining and overexploitation for timber, fish, crustaceans and shellfish. Over the next 25 years, unrestricted clear felling, aquaculture, and overexploitation of fisheries will be the greatest threats, with lesser problems being alteration of hydrology, pollution and global warming. Loss of biodiversity is, and will continue to be, a severe problem as even pristine mangroves are species-poor compared with other tropical ecosystems. The future is not entirely bleak. The number of rehabilitation and restoration projects is increasing worldwide with some countries showing increases in mangrove area. The intensity of coastal aquaculture appears to have levelled off in some parts of the world. Some commercial projects and economic models indicate that mangroves can be used as a sustainable resource, especially for wood. The brightest note is that the rate of population growth is projected to slow during the next 50 years, with a gradual decline thereafter to the end of the century. Mangrove forests will continue to be exploited at current rates to 2025, unless they are seen as a valuable resource to be managed on a sustainable basis. After 2025, the future of mangroves will depend on technological and ecological advances in multi-species silviculture, genetics, and forestry modelling, but the greatest hope for their future is for a reduction in human population growth. nutrient retention mechanisms, and the ability to cope with salt and to maintain water and carbon balance.

Northern Australia Land and Water Science Review *full report* October 2009

10 Irrigated agriculture: *development opportunities and implications for northern Australia*

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Maize crop, Katherine
Photo: Peter Thorburn CSIRO

Irrigated agriculture:

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Maize crop, Katherine
Photo: Peter Thorburn CSIRO

KEY POINTS

Northern Australia's soils have been highly weathered by millennia of monsoonal rain. They are typically low in organic carbon, have low water holding capacity and are highly erodible. These traits unite to provide soils that are susceptible to surface sealing and have low infiltration rates which, combined with the north's high rates of solar radiation and evaporation, confer on crops a low water use efficiency. In the north's severely water-limited environment, this poses a strict limitation on the expansion of irrigated agricultural development.

While there is potentially *ca* 17 million ha of soil suitable for annual crops, and as much as *ca* 32 million ha suitable for forestry, there is probably only water sufficient to exploit *ca* 60,000 – 120,000 ha, or <1.0% of this potential via irrigation. Rainfall is not sufficient to support crops in large tracts of northern Australia. Water, rather than soil, is the resource that limits irrigated agricultural development in northern Australia.

The available water resource may be sufficient to enable a two- to four-fold increase of northern Australia's existing irrigated cropping industry. Within 20 years a doubling of its size could increase gross regional product by $185 m (136%), create an additional 1,400 full-time equivalent jobs and increase regional population by 2,200 people.

Groundwater appears to be the source of water most likely to sustain new development of irrigated agriculture. Whereas surface water favours development of a small number of centralised irrigation schemes (such as the Ord River Irrigation Area), groundwater is best suited to supporting a larger number of small scale and widely dispersed irrigation developments; often called 'mosaic' irrigation.

The application of mosaic irrigation is logically attractive but largely untested. Its advantages over larger schemes include the potential to reduce salinity, erosion and runoff. Its small scale makes it within reach of private investors, which may induce capital and operating cost efficiencies that can escape larger public schemes. Its small scale also makes it well suited to the adaptive management that may be required in the north: the costs of 'learning by doing' are probably more bearable than in larger schemes.

The potential disadvantages of mosaic style irrigation development include the possibility that it reduces water use efficiency through enhanced advective losses. Its distributed nature may mean that it less able to provide for industry 'hubs' around which the soft and hard infrastructure that support new industries can develop. On the other hand, its distributed nature may help the already well-established beef industry to increase productivity and capital efficiency, by improving the amount, quality and timeliness of feed supply.

It is not clear whether biodiversity and conservation values are enhanced or reduced by the use of a smaller number of larger irrigation schemes or a larger number of distributed activities.

Humans have practised irrigation for 5,000 to 7,000 years. It has rarely been sustainable, though it has been variously acceptable, desirable and necessary. The problems of irrigation – including salinisation, local-scale waterlogging, nutrient depletion and the degradation of surrounding landscapes through water depletion – usually take a long time to become evident and, though examples of it are rare, even longer to ameliorate. It is possible that the 'problem' of irrigation is less that it is not sustainable than that we persistently pretend that it is. Positing irrigation design and management on the assumption that it is sustainable may lead us to conceive and operate it in ways that do not maximise its many benefits or minimise its various disadvantages.
Whether or not irrigated development proceeds, and whether or not it occurs via large schemes or irrigation mosaics, it is critical that it does not repeat *all* of the errors of previous irrigation developments. *Some* of the impacts of irrigation are unavoidable as they are inextricably linked with consumptive water use.

PROLOGUE

Australians have long dreamed of substantial agricultural development in the north of our

continent. In the historical public mind, its abundance of soil and water have been wasted and, 'if we don't use them, someone else will'. Surely northern Australia has the potential and, given the spectre of global food shortages, perhaps even the duty to be the Nation's new food bowl?

Public perceptions are not always well informed. The nature, extent and current uses of soil and water are dealt with elsewhere in this report and suggest that the northern landscape supports a multitude of uses and values (Indigenous livelihoods, tourism, fishing, mining, terrestrial and aquatic conservation, amongst others.). It is not being 'wasted'. Furthermore, the north already contributes significantly to the world's larder. If northern Australia were a country, it would be the world's seventh largest beef exporter [Calculated from (1).] The story of agricultural development of the north is therefore variously one of outstanding success, unrealised potential or over-reach, depending on one's point of view.

INTRODUCTION

This chapter describes cropping in northern Australia from a land and water perspective. It draws on a brief history of its irrigated agriculture before outlining its current status and potential development trajectories, based largely on opportunities and constraints as they are currently applied and understood[1].

It explores the positive and negative impacts of these possible trajectories, outlining methods by which benefits can be maximised and negative outcomes minimised. We conclude with a brief summary of critical knowledge gaps.

As in southern Australia, irrigated agriculture is economically and socially significant in many parts of northern Australia. In most other ways, however, northern Australia is fundamentally unlike Australia's traditional cropping areas. Profound differences exist in the climate, soils and history of the existing southern and potential northern cropping regions.

The south's comparatively moderate climate enables the majority of its crops to be grown profitably without irrigation. This has not proven feasible at any comparable scale in the temporally arid north, where the yield of dryland crops is typically 2 to 5 times lower than that of irrigated crops (2). The soils of the south, while not of uniformly high standard, tend to be newer, less weathered and therefore more nutritious than those of the north. Notwithstanding these stark biophysical distinctions, it is the different histories of the north and south that provide the most telling contrast.

Substantial development of the south occurred much earlier than in the north. Consequently, the north has had a shorter period in which to 'find its feet', and to build the hard and soft infrastructure required to support a significant non-grazing agricultural industry. More importantly, it means that the south was developed by and for a different society. That society was unashamedly and, some argue, necessarily pro-development. It was willing to promote wide-scale landscape transformation,

[1] We have not, for instance, taken into account a range of unforeseeable future technological developments that may enhance agricultural potential. We are similarly unable to estimate the costs and hence attractiveness or rationality of irrigating the landscape. The possibilities for both are excessively wide and subject to unpredictable change.

and to subsidise the inputs and infrastructure required to initiate it and the markets required to sustain it in its infancy (3).

Society has changed markedly since the years of widespread agricultural development in the south. In the 20th Century, agriculture's contribution to the Nation's gross domestic product (GDP) contracted ten-fold, from 30 to 3% (4). As a consequence, popular and political support has diminished and, where attention was once paid only to the 'upside' of agriculture, its negative consequences now command closer scrutiny. Experience with the widespread and irreversible degradation of the Murray-Darling's waters and surrounding landscape has made society wary of agricultural developments, particularly those based on irrigation. Changes in domestic political paradigms and international agreements have made direct and indirect subsidy of agriculture less attractive. Evidently, this present study of agricultural development in the north must swim against, rather than with, the tide that supported agricultural development of the south. So it is not possible to simply compare future development in the north with that which has occurred in southern Australia. Land that was suitable for agricultural development in 1900 would not be deemed suitable for agricultural development today; society would not support the financial, physical or social costs required to subdue it.

But if we were to go back in time, and consider a scenario where we developed the north before the south, in the 1800s rather than the 2000s, how would it differ? This analysis would not be concerned with impacts on the environment, sustainability or the potential impacts on (or perhaps even existence of) other people or industries. Tourism, so significant today (*ca* $2.8 billion p.a. in northern Australia), did not exist. Prior ownership by Indigenous people was not widely recognised. The fate of the colony would have hinged on the success of the agricultural enterprise, so technical obstacles and the means to overcome them would have been identified. Much of the north's vast water resources and tracts of land would be available for agricultural production, and society would seek to mobilise the economy and its full technical armoury to achieve it.

According to the figures presented elsewhere in this report by Wilson et al., up to 18 million hectares of northern Australia has soil that is potentially suitable for agricultural production. Realising that potential would require vast reserves of fertiliser and the storage, transmission and application of enormous volumes (*ca* 200,000 GL; 100% of that annually flowing down the north's waterways (5)) of irrigation water. Even if that were technically feasible, in today's society, it is unlikely to be cost-effective or acceptable on environmental or other grounds. Consequently, this chapter does not consider the unconstrained potential of the north.

Our analysis is necessarily incomplete. It does not explicitly explore the potential for expansion of rainfed or dryland agriculture, which currently comprises about half the cropping area in northern Australia. The potential for this has been explored in detail elsewhere (6) and the significant advances that continue to be made in dryland cropping (2), and which may support expansion of that industry, are beyond this report's terms of reference.

The authors know that it is not possible to foresee with any considerable accuracy the arcs of actual future development in the north. Entrepreneurs exist to prove so-called 'experts' wrong. The vastness and variability of northern Australia provide ample opportunity for the development of innovative methods for profitably undertaking irrigated agricultural enterprise, using methods not foreshadowed here.

requirement under the terms of a pastoral lease). There has been increasing interest from pastoralists to diversify their operations and this will inevitably lead to more agricultural development on these stations (26).

This article covers the follow areas of interest

AA BRIEF HISTORY OF AGRICULTURAL DEVELOPMENT IN NNORTHERN AUSTRALIA

A general history

The Ord River Irrigation Area

5. CURRENT STATUS OF IRRIGATED AGRICULTURE IN NORTHERN AUSTRALIA

Northern Australia, total

Ord River Irrigation Area

Other irrigation areas

6. CROPPING IN THE NORTHERN AUSTRALIAN ENVIRONMENT

Soils

Climate

Greenhouse gas emissions

7. IRRIGATED AGRICULTURAL ENTERPRISES THAT MAY BE SUITABLE FOR NORTHERN AUSTRALIA

Annual crops

Perennial crops

Forestry

Pastures and fodder crops

8. POSSIBLE DEVELOPMENT TRAJECTORIES FOR IRRIGATED AGRICULTURE IN NORTHERN AUSTRALIA

Narrowing the possibilities for irrigation potential

Focusing on the probabilities of irrigation potential

A whole of northern Australia, groundwater recharge area based approach to estimating irrigation potential

A regional, groundwater prospectivity based approach to estimating irrigation potential

A surface water based approach

IRRIGATION SCHEMES

Mosaic agriculture

Biophysical considerations

Socio-economic considerations

Sustainability considerations

1RREQUIREMENTS FOR AGRICULTURAL DEVELOPMENT

Infrastructure

Skills, labour

This article can be found at:

http://www.industry.gov.au/ONA/Reports-and-publications/Documents/Chapter_10-Irrigated_agriculture.pdf