

06 Historical perspectives on land use development in northern Australia: *with emphasis on the Northern Territory*

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Figure 1. Federal Parliamentary Enquiries into northern Australian agricultural development have a long history. Here the Federal Parliamentary Party visit the Government Demonstration Farm at Rum Jungle, Northern Territory during their tour in 1912 following the Federal takeover of the Territory from South Australia in 1911, which was driven in part by the slow progress of agricultural development. National Library of Australia picture: nla.pic-an24282428. Used with permission.

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1. KEY POINTS

1. Outside of eastern coastal Queensland, cropping has largely failed to establish in northern Australia despite many pioneering efforts and a long history of government subsidisation and agricultural research. Northern Australian history has many examples of failed agricultural developments that typically relied on profits from tax concessions and increasing land and share values rather than sale of agricultural products.
2. Arable soils have been scarce in northern Australia and have not occurred in extensive contiguous areas. The arable soils themselves are typically of low fertility, low water holding capacity, highly erodible and prone to surface crusting. The climate is harsh with fluctuations between the wet and dry seasons causing numerous agronomic difficulties.
3. Much of the motivation to develop agriculture in the north has been driven by pressures external to the region, and particularly by the defence imperative. For most of the past century, Indigenous interests, long term sustainability, economic viability, and environmental and ecological consequences of northern agricultural development have been ignored by researchers.
4. In the absence of successful pioneering efforts at agricultural development, agronomic science was relied upon to lead the way for farmers. Despite many decades of intensive effort, it largely failed to achieve its goals.
5. For northern Australia to meet the competing demands of society, food security, climate change and development pressure it will require research that is better able to integrate the agronomic, environmental and social sciences, with particular emphasis on economics and governance.

2. INTRODUCTION

In Australia, the recent drought and its impact on irrigation areas of southern Australia has brought a new focus on the potential for development of currently marginal cropping lands in Australia's monsoonal north. Northern Australia has long been targeted by proponents of agricultural development, but these efforts have an equally long history of failure. Land use is currently dominated by low-intensity grazing of beef cattle on extensive properties often more than 10 000 km² in area. Indigenous land holdings are also extensive. Although the direct impacts of climate change on rangeland enterprises in Australia have been canvassed (1, 2), the impact of changing external development pressures has not received the same attention.

Generations of politicians, scientists, agriculturalists and land developers have written their hopes and dreams on the seemingly blank slate of the vast expanses of northern Australia that lie to the west of coastal Queensland. In the perceptions of many this was an immense, empty but well-watered land that contrasted starkly with other tropical lands with similar landscapes and climates that are home to millions of people. To many, the land has promised so much but, with few exceptions, the great hopes for agricultural development have not been realised. To the drought-ravaged south of Australia, northern Australia is again offering hope for agricultural industries through its seasonally abundant water. There are new calls for "*governments, communities and industries [to] work together to develop clear principles that allow for the sustainable developments of water resources in northern Australia*" (3). Such principles must now account for not only food security, but also Indigenous land rights, biodiversity conservation, carbon footprints and the sustainable use of water and soil.

The history of land development visions in the monsoonal north of Australia indicates that changing scientific and social paradigms and external pressures are likely to have as great or even greater impact on this region than climate change itself. These changes have been driven by a wide range of political, social, environmental and security developments. It can be expected that paradigms will continue to alter in the future, and climate change will simply be an additional driver of such changes.

In this paper, I review some of the main changes in attitudes and paradigms that have influenced land use policy and research over the past 170 years in monsoonal north Australia.

3. DIVIDED OPINIONS FROM THE START

John Armstrong was the first European to establish a successful garden in what was to become the Northern Territory. Having been appointed by Kew Gardens as a plant collector and to establish a government garden at Victoria Settlement on Coburg Peninsula, he appears to have taken to his job with a passion. In March 1839, just a year after he began, he was able to enthusiastically show the French explorer, Jules Dumont d'Urville, around his garden. The Frenchman's record of this tour foreshadowed similar exchanges of the next one and a half centuries:

"We still had to visit the governor's garden where the colony's attempt at agriculture was to be found. ... I went away expressing my sincere good wishes for the success of these useful undertakings on which the fate of the colony so much depended. But I

confess that I did not entirely share the hopes of M. Armstrong, who seemed to see already in the appearance of his garden the realization of that wonderful vision of making fertile this great land which appeared so dry and lacking in production.” (4).

Dumont d’Urville’s observation about the infertility of the landscape is even more cutting given that the time of his visit was towards the end of the wet season, when the vegetation should have been at its greenest. The conflict between scepticism and wild enthusiasm for agriculture in the north has continued with little abatement ever since.

4. PRE-FEDERATION VISIONS: A WHITE AUSTRALIA?

In his book *“North of Capricorn”*, Henry Reynolds (5) documents the importance of non-Europeans as pioneer settlers and developers during the late 1800s in northern Australia. No reading about agricultural development of the north from this period can escape discussion of the issue of race. Asian market gardeners featured prominently in supplying fresh vegetables to newly established towns and *“Kanaka”* labour was being used to pioneer Queensland’s sugar industry. However, in southern Australia, concern was mounting about the immigration of non-Europeans to the continent. This was driving a push for federation of the Australian colonies so that a national approach could be adopted to stop Asian immigration. Alfred Deakin, the second Australian Prime Minister stated that:

“...certainly no motive power operated more powerfully in dissolving the technical and arbitrary political divisions which previously separated us than the desire that we should be one people, and remain one people, without the admixture of other races.”
(6)

In northern Australia, serious efforts at agricultural development started before modern mechanised farming but after the end of convict transportation that had provided pioneer farmers in southern Australia with a ready source of cheap British labour. New sources of cheap labour were being sought and, prior to federation, many European settlers in northern Australia advocated the use of *“coloured labour”*. In doing so, they were hoping to emulate the plantation style systems, which relied on imported cheap labour, in many other tropical colonies such as Natal, Mauritius and Fiji. This vision was described eloquently by Payne and Fletcher in their 1937 report to the Commonwealth on land use in the Northern Territory:

[Having time to enjoy the] *“usual compensations which tropical countries provide, such as hours of leisure, social intercourse and labour for domestic duties”*.

A more prosaic description was given by Territory identity and once Premier of South Australia Vaiben Solomon:

“The position in regard to the rich agricultural lands in Northern Australia was simply this – they must either be utilised by the aid of black labour of some kind, or remain unproductive...To let the land remain idle was mere waste and the true interest of our European population would be far better served by the employment of black labour”
(The Northern Territory Times and Gazette June 24 1892).

While agricultural research in northern Australia has been seen as starting with CSIRO’s efforts after World War II (7), or with the establishment of research farms in 1912 following the Campbell report

(8), the Darwin Botanic garden was a much earlier venture aimed primarily at agricultural experimentation. During the late 1800s, Maurice Holtze in Darwin, and F. M. Bailey in Brisbane were the leading agricultural researchers and thinkers in northern Australia, and both were heavily influenced by Baron Von Mueller from Melbourne. They traded seeds and other planting material and ideas about tropical agriculture throughout the world. Although Darwin (then Palmerston) in the 1800s was very much an outpost in a backwater of the British Empire, Holtze traded seeds with 23 botanic gardens across the world (9). Many of the potential crop species they introduced, such as the fibre plant *Sida retusa* (*Sida rhombifolia*) assumed an agricultural system with a ready source of cheap labour. Holtze argued that South Australia's Act 240 of 1882 - an "*Act to encourage the introduction of Indian Native Immigrants into the Northern Territory of the Province of South Australia*" which had not been given Royal Assent, should be put into operation because European farm labour could never compete with Asian labourers (10). However, where a system of cheap non-European farm labourers had established in coastal Queensland during the late 1800s it was often seen to be little short of slavery and was unsupported by the rest of Australia (6, 11).

With the passage of the Commonwealth Government's Immigration Restriction Act of 1901, most of the people who were actually succeeding at growing crops in northern Australia were deported. This was seen by many European advocates of agricultural development as being the death of any hope (12, 13). Nevertheless, in 1910, "*coloured labour*" for agricultural development in the Kimberley region of Western Australia was still being canvassed by Western Australia's Commissioner for Tropical Agriculture, Mr A Despeissis. He emphasised that it was of "*material advantage to permit only those races which by temperament and by natural disposition will be the least objectionable*" (14). He described a range of agricultural industries that could be developed in the tropics of Western Australia once the limiting factor of labour was overcome through the introduction of a suitable class of labour. Reviewing the deliberations of a conference of rubber planters in Mexico, he described the options:

- (1) *The Javanese are the most desirable. They are sober and industrious and generally very hard working...*
- (2) *The Tamils of Southern India ... are the best of the Indian coolies.*
- (3) *The Chinese, provided they come from the agricultural districts of Southern China (Canontese), and not from the big cities are very good plantation labourers.*
- (4) *The Kanakas have proved themselves to be efficient labourers on sugar plantations in Queensland.*
- (5) *The negro in the West Indies and in America has shown himself lazy, thriftless, unreliable, and overbearing in manners.*
- (6) *The Japanese do not take kindly to agricultural work..."*

Debate about the physiological ability of Europeans to live and work in the tropics continued for some years during the post-Federation era, but appeared to be settled by the meeting of the Australasian Medical Congress in 1920. There it was concluded that there were no physiological obstacles to a "*working white race*" in the Australian tropics (15, 16). By 1937, Payne and Fletcher, in their report to the Commonwealth on land use in the Northern Territory could claim that "*All the States, all political parties, and all sections of the people are united in an ardent desire to maintain*

racial purity. Cheap or coloured labour cannot be allowed to become permanently established in Australia.” Nevertheless, their need to make this statement suggested that support for their proposition wasn’t as universal as they claimed. Indeed, they went on to argue that the exclusion of “*cheap or coloured labour*” was making it difficult for European women to live and raise families in the north and thus the White Australia Policy was best supported by the indenture of a “*limited number of Chinese gardeners*” and a “*strictly limited number of eastern natives ... for domestic duties*”. The report’s recommendations were soon to be swept away by the events of World War II.



Figure 2. “Bananas, paw-paw and English vegetables at maturity together”. This is the original caption from the Federal Parliamentary Party visit to Pine Creek in 1912. English vegetables were emphasised to counter those who argued that only Asian market gardens were successful in the north. National Library of Australia picture nla.pic-an24313567. Used with permission.

5. POST-FEDERATION: AN INVISIBLE AUSTRALIA?

Although Indigenous people have inhabited northern Australia for tens of thousands of years, and comprise nearly 30% of Northern Territory’s population, they have been effectively invisible for most of the historical debate about land use. This invisibility arose for several reasons. Firstly, their traditional land tenure was not recognised in Australian law until the Aboriginal Land Rights (Northern Territory) Act of 1976 and the Mabo decision in 1992. Secondly, prior to World War II, there was a widely held belief in the demise of Indigenous Australians:

“Where ever the white or Asiatic races come into contact with the aboriginals the latter first becomes degenerate and ultimately die.” (17)

Disease, displacement and deliberate killing were taking their toll. Reporting to the South Australian government about his explorations through Arnhem's Land (Arnhem Land), David Lindsay, a surveyor wrote (18):

"There is splendid sugar lands on the Roper and Goyder Rivers. The banks of both of these rivers are somewhat higher than the surrounding country which would greatly lessen the cost of irrigation. The natives throughout all the coast country are very numerous and more or less hostile. Especially would I caution any future travellers against trusting in the slightest to the natives near the mouth of the Roper and in the locality of Woornunyan Woorie. Were I to go there again I would shoot the first black-fellow I saw."

Commenting on debate about the significance of notches on peoples' rifle butts, Alfred Giles (19), the founder of Springvale Homestead at Katherine wrote:

"One can scarcely imagine anybody shooting blacks and taking the trouble to record the fact, unless he were getting so much per head"

Advocates of British settlement to Australia contrasted it with Africa where *"the African races are not dying out as in America and at the antipodes ... short of a concerted general extermination by England, France and Germany, the African races are more prone to increase and multiply in the future than to disappear and make room for the European"* (20).

Nevertheless, not all agreed with encouraging massive white settlement of the north as the solution to the problem of the *"empty north"*. Gilbert White, the Anglican Lord Bishop of Carpentaria, in his address to the Victorian Geographical Society in 1907 advocated a recognition of and national support for Aboriginal land tenure in northern Australia. He commented:

"They [the Aborigines] have not been recognised as possessing any rights. The land which they have held from time immemorial has been taken without process of law, and without any compensation given. They have been told to move on, lest they should disturb the cattle, and moving on has too often meant death. When the land became settled tardy efforts were made to provide for the few that remained..."

Now few persons will, I suppose, be inclined to deny that the unpeopled and unknown condition of most of the far north is an acute danger to Australia.... Now I think it will be admitted that could we, without affecting the good lands suitable for cultivation, without affecting the question of white immigration and settlement, and without importing any aliens, add in a few years a population of 40 000 to 50 000 persons earning their own living by agriculture, combined with hunting and fishing, well disposed to the Government of the country because well treated by it, developing certain industries, which the ordinary white man will not touch, because they do not produce sufficient profit to justify high wages, scattered in half a dozen central and many other small groups over the more desolate and neglected regions, recognising that the territory on which they lived was their own, and that they would not be disturbed in it, regarding themselves as loyal members of the Commonwealth, and taught in school their place and office in it, well drilled, accustomed to ride and run immense distances, knowing every rock and water-hole, keen to detect the least sign of a strange foot, and capable of a very real trust in and affection for the white man who is worthy of their trust" (21).

Professor A.P. Elkin's comments in the official book celebrating 50 years of Federation indicated the thinking during the transition in Indigenous policies in the post-World War II period:

"The original policy was that the aborigines were to be treated as British subjects; but this broke down in the face of clashes on the frontiers of settlements. Later, a negative policy of 'protection' was forced on the governments as the tragedy of the depopulation and hopeless plight of tribal remnants became known. But the belief was that the aborigines would die out. From 1936 onwards, however, partly as a result of anthropological research and of missionary pressure, positive policies have been drawn up whereby the aborigines might be saved as a race and play a useful part in Australian general life.

The principal now accepted is that the aborigines need not pass. They are capable, intelligent, and essential for the development of the northern parts of Australia; they must become citizens of Australia, contributing to its well-being. Moreover this aim seems possible of attainment, if adequate measures are taken to deal with their diet, health, education, conditions of employment and opportunities for economic advancement." (22)

However, Gilbert White's views on Indigenous tenure were generally ignored at the time, and despite Elkin's claim that Aborigines were essential for northern development, Indigenous issues continued to be largely ignored in most of the post World War II considerations of land use in the northern Australia. Nugget Coombs (23), the Chairman of the post World War II North Australian Development Committee (NADC), expressed regret in hindsight that *"Aborigines, we almost took for granted, would have no significant role in [northern development] beyond the most menial tasks and as possible beneficiaries of the more generous welfare policy which development might make possible"*.

In leading the land resource surveys of northern Australia that were requested by the NADC, C.S. Christian (24) argued that *"The Australian aboriginal did not leave any traditional forms of land use for adoption or improvement by the European settlers, or which might assist them to develop a productive form of land use or means of livelihood in this new environment."* Consequently the histories written during the 1950s through to the 1980s to inform planning for land development and management in northern Australia usually did not mention the Indigenous inhabitants, or mentioned them only in a very negative light (e.g. 11, 25, 26, 27). Only more recently have resource survey reports included in their histories acknowledgement of Indigenous occupants (e.g. 28). The Ord River Irrigation Area Review of 1978 (29) was indicative of the emergence of recognition of the negative effect of the major developments on Indigenous well being and the need for land use plans to take account of Indigenous views and issues from the outset. More recently, arguments have been developed for investment in Indigenous natural resource management (30, 31) as part of a more diverse range of options future northern Australian development (32).

6. DEFENCE OF THE EMPTY NORTH

"Beware of keeping your north empty, and remember an unmanned nation invites disaster" Theodore Roosevelt's warning to Australia 1905 (33).

Throughout most of the 20th century the paradigm of Australia's "empty north" was the driving motivation behind pressure for agricultural development of the region. The human population density in the monsoonal north of Australia is about 0.3 km⁻², orders of magnitude below that of comparable climatic regions elsewhere in the world's tropics and well below that of Australia's more densely populated southern and eastern fringe (32).

The perception of the "empty north" created a great security concern to Australia from the early to mid 20th century. The early European settlements in what is now the Northern Territory arose out of concerns to make a territorial claim on the region in the face of competing European powers. With the defeat of the Russians by the Japanese in Manchuria in 1905, concern about the "empty north" escalated and culminated in the Australian government's takeover of the Northern Territory from South Australia in 1911, as described by former Prime Minister Stanley Melbourne Bruce (34).

"The empty north is of immense strategic importance, and self-preservation demands that we devise means for introducing population into that vacant area. Such a policy, also, is vital to the maintenance of the great and basic principle of a White Australia... The first white settlement there was at Port Dundas, on Melville Island, in 1824, and was then the result of apprehension that the north of Australia was in danger of annexation by one of the great nations of the earth... It was transferred from the State of South Australia to the Commonwealth in 1911, because it was realized that, in its then state, it was a menace to the defence of the Commonwealth, and the maintenance of the White Australia policy, both of which are primarily the concern of the National Government" (Australia, House of Representatives, Parliamentary Debates, 10 February 1926).

The experience of the South African Boer War (1899-1902) where an untrained citizen soldiery provided robust defence against the trained forces from the British Empire convinced many that the solution to Australian defence concerns was to populate north Australia with settler farmers (33).

One of the main perceived failures of the South Australian administration was its inability to establish agriculture and farming communities (35). South Australians would have had considerable difficulty reconciling the desires of many in the Northern Territory to base agricultural development on cheap "coloured" labour given that South Australians had long prided themselves on being untainted by cheap convict labour (36). With the Australian government takeover of the Northern Territory, experiment and demonstration farms were quickly established at Rum Jungle and Daly River. Enthusiasm, however, got ahead of the science and subdivision for settlers went ahead on the Daly before the farm was established (8). By the time of World War II, neither the pioneering efforts of farmers, nor any research effort had facilitated viable large-scale agricultural enterprises and communities (37).



Figure 3 “Market garden in the middle of the dry season when all English vegetables grow well and rapidly under irrigation, Pine Creek (original caption)”. This picture was taken by the Federal Parliamentary Party during their inspection of the Northern Territory in 1912. It aimed to indicate the potential for agriculture in the north and the success of English rather than Asian market gardening. National Library of Australia picture nla pic-an24313625-v. Used with permission

During the interwar period, a new understanding of the environmental limits to agriculture and settlement across the Australian continent was developing. During the 1920s, the geographer, Griffith Taylor argued that the margins to settlement had already been reached, that northern development was a “*white elephant*” and that the continent’s aridity meant that ambitions for human populations of 100 to 500 million were unattainable (e.g. 38, 39). He was mercilessly lampooned in the press, his publications were banned in Western Australia, and eventually he left Australia for a career in the USA (40). The opinions of the Victorian politician George Swinburne were typical of many and help put criticism of Taylor into context. In 1927, Swinburne travelled by car from Oodnadatta in South Australia to Barrow Creek in the Northern Territory through some of the most desolate and arid lands of the continent. Nevertheless, he “*was strangely affected by the great territory he saw; [and] ... was convinced of the destiny of Australia to be the home of many millions of people*” (41).



Figure 4. In 1927, Victorian politician George Swinburne travelled by car from Oodnadatta (pictured) to Barrow Creek and “was convinced of the destiny of Australia to be home to many millions of people”. Picture by the author, 2007.

Gilruth (42), a divisional chief within the main Australian government research organisation (CSIR, later CSIRO) was familiar with and supported Taylor’s work. In his report of 1934, he argued that most of northern Australia was marginal agricultural land with doubtful economic potential unless demand for agricultural production increased markedly and circumstances drastically altered the economic advantages of southern Australia. He saw no great prospects for irrigation despite the abundant water, due to the limited extent of irrigable soils and the difficulty in storing and distributing enough water. Arguing “*that unoccupied waterless country forms the best defence*”, he dismissed the case for civilian settlement as a defence measure. He foresaw the failure of cotton in the Ord River irrigation area 30 years later. Like Taylor, Gilruth’s views were also pilloried in the press at the time, but were then ignored for the next 50 years until rediscovered by Henzell (43), who was about to quietly bring to an end much of four decades of CSIRO’s agricultural research in the north (7).

7. THE GOLDEN AGE: 1940 - 1966

“...six [research] centres were established during the period 1940 – 1966, a period that was clearly the ‘Golden Age’ for rural research in northern Australia” (44).

The “Golden Age” for rural research commenced with pressure for northern development arising from World War II. It was launched with the commissioning of the North Australian Development Committee at the end of the war. It culminated in the Forster reports into agriculture in the Northern

Territory (45, 46), and drew to a close with debate and criticism of the rationale of northern development.

World War II brought new pressure for close settlement of the north through agricultural development for defence reasons (47). The articulation of Hitler's concept of "*living-space*", and Nazi Germany's claim that Nauru, which was critical to Australia's agricultural phosphate supply, was still their territory (48) would have added to this concern. The challenge was met with the commissioning by the North Australian Development Committee of a greatly enhanced agricultural research effort from 1946 to support close settlement (49-51).

Little was written during the Post-World War II period about the nature of the hoped-for society in the new farming communities. Powell (40, 52, 53) argued that it was being driven by Arcadian imagery. During the middle of the nineteenth century Australia was successfully evoked for British settlers "*as a veritable Arcady, in which the Golden Age of rural prosperity and individual dignity might be recaptured*" (53). Powell describes how the application of Arcadian imagery arose among some of England's academics as a reaction to the industrial revolution, and that it was implicit in Australia's post-World War I soldier settler schemes, and in the visions for agricultural settlement of northern Australia. The visions of British "*Yeoman*" farming communities was strongly counter to the late 1800s push in much of northern Australia for indentured Asian labour as a cheap agricultural workforce (6). As early as 1885 it was argued by the Queensland Premier, Sir Samuel Griffith, that the development of agricultural machinery would render the need for cheap agricultural labour redundant. By the time of the post-World War II push for agricultural development, the desire for attaining dense settlement by people of any race through modern mechanised agriculture was clearly an anachronism. Rural depopulation affected much of the southern Australian agricultural landscape in the post-war years. Henzell (43) documented how similar policies to develop remote regions had been pursued for geopolitical reasons in remote parts of former USSR, west Africa, Tanzania, Brazil, Ecuador and Venezuela. It was the era of Britain's monumental failure with the massive Tanganyika Groundnut Scheme (54). Long-time CSIRO researcher the late Andy Chapman saw northern development as akin to Indonesia's transmigration policies (pers. comm. 1995).

Land use research in northern Australia during this period was characterised by a strong belief in several key assumptions and paradigms:

1. Agricultural research could and should solve any technological problems;
2. Intensive agriculture and intensive animal husbandry was the logical end-point for the use of most land;
3. The lack of intensive agriculture in the north was simply a technological problem to be overcome;
4. Any additional problems could be solved by Government subsidisation.

The era was one of big plans for national development:

"We Australian have already set our hands to many huge tasks since the war. New dams are rearing their massive walls in the mountain watersheds. From new hydro-power stations comes a fresh surge of energy to drive the wheels of swiftly expanding industry. The magic of irrigation unlocks new larders to feed the growing population.

But many more and greater tasks lie ahead. We are advancing into an era of national development on a scale beyond anything even contemplated in the easier days of the past - a pioneering era demanding the bold vision, the courage and the energy of our pioneer forefathers (55)".

It was out of this era that plans for the Ord River development were made (56). This built on the pre-war Commonwealth focus of agricultural research in three broad categories (A) investigation of the principles underlying the practice of agriculture and the rearing and feeding of stock; (B) the production of new varieties of plants or breeds of animals; and (C) The investigation of the diseases of plants and animals with a view to control (57). Soil survey to support irrigation developments built upon the work of Prescott of the Waite Institute in the irrigation areas of the Murray and Murrumbidgee Rivers (58).

Northern Australia contrasted strongly with the Mediterranean landscapes of southern Australia, where European settlers adapted long-standing European crops and agricultural practices to the new environment during a pioneering phase made possible by convict labour, the existence of accessible markets and many personal sacrifices (59). By the 21st century, a highly mechanised, competitive and successful export industry had developed. In southern Australia, science thus played a role in supporting existing farmers and farming communities. For most of northern Australia by contrast, there has never been a continuing pioneering phase with any crop (60). Consequently, science was relied upon not to augment existing knowledge and practices, but to establish both agricultural industries and an entire agricultural society in the north. Research was seen by governments as a necessary prerequisite for agricultural development (35, 61), but it was rarely appreciated that it was not sufficient (43). After World War II, agricultural research stations were opened in Western Australia (Kununurra), Northern Territory (Katherine, Coastal Plains) and Queensland (Mareeba, Narayen, and Lawes near Gatton). During this "Golden Age", researchers were more often supporting farmers who existed only in the imagination of policy makers than the resident land managers of northern Australia. The limited intensive agricultural and pastoral industries meant that the trialling of a vast array of crop and pasture species in the north was usually fruitless (62).

The power of research to overcome technological problems was a strong driver of leading CSIRO agricultural researcher during the post-World War II era, C.S. Christian. He was a key developer of the science of land evaluation and was a strong advocate for intensive agriculture in the north. He envisaged that research should and would bring major changes to northern Australia:

"Agricultural science should not be satisfied until natural resources have been changed to a level approaching as close as possible to ... [the maximum] ... theoretical limits in terms of solar radiation, water availability and physiological efficiency of plants and animals." (63).

The outworking of this philosophy was demonstrated clearly in the visions of J.G. Davies, who led CSIRO's post World War II pasture research in northern Australia. He was a powerful advocate of improved pastures employing introduced pasture species and fertilisers. His vision was that 67 % of the wetter third of the Australian continent was "awaiting pasture improvement" (64). Efforts at introducing pasture species were equally vast in scope, with more than 22 % of the world's grass species, and 18 % of the world's legume species being imported during the 20th century as potential improved pasture species – more than twice the indigenous flora in those families, which are among the top four most species-rich plant families globally (65). Many of these introductions became

weeds of both agriculture and the natural environment, and were of little to no value to production (65, 66).

The firm belief in the ability of science to transform northern Australia was clear in papers around the time of the Forster review. Christian (24) described the *“Future revolution in agriculture in northern Australia”*. The Forster committee further spelt out the vision (45, 46). The then Federal Minister Paul Hasluck (67) claimed:

“... if only we could show the same sort of boldness, imagination and faith as was shown by the first men who walked cattle into central Australia from the south, we should be able to alter the whole face of northern and central Australia in a generation.”

The primacy of intensive agriculture as the logical endpoint of the development of most land was formalised by the United States Department of Agriculture in its scheme for land capability assessment. This scheme was influential in Australia and had eight classes, with classes I to IV being suitable for cultivation with increasing impediments, classes V to VII being productive for grazing but not suitable to cultivation, and class VIII being suitable *“only for wildlife reserves and watershed protection”* (68).

Mounting arguments against closer settlement and its economics brought the *“Golden Age”* to a close. The most famous opponent of this era’s approach to northern Australia was Davidson, through publication of his book *“The Northern Myth”* (69), but the argument that closer settlement and intensive agricultural in the north was not economically viable had been developed for several years by both Davidson and others (70-73).

The confidence that the economics would follow once the research was in place started to unravel as the defence imperative declined in national importance. Davidson, who had been employed by CSIRO as an economist, was one of the first to seriously question the economics of northern development and of publicly funded major irrigation schemes (69, 74), but his views built on an earlier assessment by MacCallum et al. (70):

“This report has shown that State-sponsored closer-settlement schemes which follow the ‘traditional’ pattern are likely to result in high-cost farming and to act as a brake on the development of the country”

Davidson’s conclusion that *“..intensive farming in tropical Australia is only possible if it is heavily subsidized by the Australian people”* (Davidson B. 1965) provoked considerable criticism (75-77). The Hon Paul Hasluck, M.P. Minister for the Territories said that *“What we are doing is that instead of allowing the economic test to work itself out, we are replacing the economic test with a judgement of our own”* (78).

Patterson (79) invoked government will to support the economics of the Ord Project

“On the other hand, an appraisal involving public funds, such as the Ord Project, is concerned with the real economic costs and benefits of the Project. Here the criterion of development is to provide the greatest possible net benefit to society.

For example, some may argue that the Ord Project is necessary for more balanced development, for various defence reasons, to provide a solid base for employment, assimilation and settlement of Aborigines, or to satisfy Australia’s moral international

obligations with respect to the millions of Asians living at subsistence levels on Australia's northern doorstep" (79)

"If [the Australian public's] reason for being satisfied [with subsidies] is for many no more sharply defined than 'we don't like an empty North-West', it is nevertheless still an accepted basis for policy" (80)

Davidson had been an economist with CSIRO. He demonstrated that crop yields on agricultural experiment stations were substantially greater than those on commercial farms and that intensive development of northern Australia was only possible if heavily subsidised and would not serve any credible role in defence of the nation (73, 81). He was stopped from publishing his articles within CSIRO and left the organisation in the mid-1960s (7). CSIRO had been formed in 1949 out of cold war politics and a fundamental belief by the last Chairman of CSIR, David Rivett (82) in the importance of free and open scientific debate. By the time of Davidson a decade and a half later, that attitude clearly did not extend to questioning the *raison d'être* of a large proportion of the organisation's efforts. At its most fundamental level, the dispute between the views of proponents of agricultural development and those of Davidson and MacCallum et al. were over the role and limitations of conventional agricultural science. By arguing that there were real environmental and economic constraints to intensive agriculture in northern Australia they were directly attacking the research philosophies of Christian and Davies. Davies dismissed Davidson as "*ignoring plant adaptability and becoming too obsessed with mathematical formulae based on considerations of climate and soil and the requirements of a limited range of crop plants*" (77) and went on to argue that the application of improved pastures would enable an "*ultimate tenfold increase in beef production*" across northern Australia. Criticisms by Nix (75) and by Mentz and Rogers (76) focused on the minutiae of Davidson's arguments, and dismissed his major conclusions. Mentz and Rogers believed that Davidson's arguments were anachronistic in the mid-1960s due to the progress of scientific research and by 1970 the success of agricultural development would "*leave little room for doubt that research expenditure on an increased scale [would] be justified...*" (76).

Davidson's legacy was that there was no longer an unquestioning acceptance of the ability of science to overcome environmental limitations, or of the legitimacy of subsidising northern agricultural development – a paradigm that had long held sway (15).

8. THE OTHER GREEN REVOLUTION: 1966 – 1985.

By the 1960s, the argument that closer settlement of the north would achieve any defence objective was rapidly losing credibility (24) and convincing arguments that farmer settlements would not improve security were put forward (69, 70). These arguments were a restatement of Gilruth's (42) views of 30 years before. Eyles and Cameron (83) claimed that much of the post-war northern development advocacy was simply political opportunism. But the rationale for northern development quickly shifted to concern about global food security. The Green Revolution had successfully overcome concerns about famine in Asia, and the rationale for closer settlement and agricultural development of northern Australia changed to "*Australia's moral international obligations with respect to the millions of Asians living at subsistence levels on Australia's northern doorstep*" (24, 79). Not developing land assumed to have "*vast agricultural potentialities*" was seen to be an international "*embarrassment*" (60).

Meanwhile many private developers hoping to take advantage of national sentiment and achieve quick profits suffered financial ruin. By the mid-1970s, a number of large-scale agricultural development projects had failed (84): Territory Rice ceased operations in 1963, rice and cotton on the Ord ceased in 1966 and 1974 respectively, sorghum on Tipperary Station ceased in 1971; sorghum and maize on Lakeland Downs ceased in 1974; and sorghum and Townsville stylo on Willeroo Station was in receivership by 1974. These failures appeared to vindicate the views of Davidson and McCallum et al., and not the confidence expressed by Christian, Davies, Mentz and others. Fisher et al. (84) concluded that *“future research must be made more relevant to the problems of broad scale agriculture, by devoting more attention to the problems that arise when crops are grown on a larger scale and for longer times.”*

Due to the potential for great capital gains through conversion of marginal lands into prime agricultural lands many developers chose to ignore even the understated cautions of agronomists. Within the British Empire by the time of World War I, Imperial bureaucrats had learned to be suspicious of grandiose rural development projects (40). But for over a century in northern Australia, speculative investors were attracted to the *“empty north”*. Throughout the 20th century, review after review investigated the failure of these speculative agricultural developments, and produced new visions and described the research needed to achieve them (35, 37, 39, 45, 47, 85-89). In Australia, most of the speculative private agricultural development schemes in the north had a tendency to disregard even the overly optimistic scientific assessments of the constraints to agricultural productivity because of pressure for rapid expansion and rapid returns on investment. Many failed because their business models were based on profits through tax concessions, share dealing and the realisation of increasing land values, rather than through sale of agricultural products (60, 90). They were selling hope rather than grain. Much of northern Australia was, in the words of Ernestine Hill (91), a land of *“an ever-shadowed past and an ever-shining future, of eternal promise that never comes true....”* The disappointment was *“as profound as had been the original hopes for their success”* (92).

The Agricultural Development and Marketing Authority (ADMA) scheme for family-sized farms in the Douglas Daly region of the Northern Territory commenced towards the end of this period. Cameron and Hooper (93) wrote of this scheme:

“It is not a question of whether the ADMA scheme will succeed. It cannot afford to fail.”

Nevertheless, the ADMA scheme did fail to achieve its grand visions. The impetus for it was political rather than commercial, and it demonstrated again the unreliability of crop establishment under conventional cultivation (88).

“The history of northern development is a lengthy chronicle of ambitious, failed agricultural projects” (94)

Although the older *“Golden Age”* paradigms of development of intensive agriculture as the logical endpoint remained current in much debate, this era was characterised by the emergence of many new paradigms:

- Multiple land use, and competing interests emerged as an important issue for policy makers and researchers;
- Serious attempts were made to learn from the failures;

- There was a growing awareness of the limitations of traditional agricultural science.

In a keynote paper in the journal *Tropical Grasslands*, which was an important journal for proponents of introduced pastures, Tothill (95) foresaw the emergence in Australia of what he called “*The period of agricultural consolidation*” in which agriculture would take its place along with secondary industry, services, tourism, recreation, wildlife preservation and aesthetic considerations. Compared with Davies’ restatement of his vision for the expansion of introduced pastures across northern Australia just 10 years before (77), this marked a major departure in thinking.

Serious attempts were made to include considerations of wildlife conservation, low intensity grazing and Indigenous aspirations in discussions about northern Australia (96). However the transition period still carried many Golden Age assumptions. A discussion paper on the “*Principles of a balanced land-use policy for Australia*” developed in the mid-1970s still ignored Indigenous land (97). The science required to ensure the conservation of wildlife was in its infancy, and the conclusions of the discussion paper regarding the integration of wildlife reserves into the national land-use policy seem grossly inadequate. The authors concluded that “*it seems likely that it will be necessary to have wildlife reserves of not less than 200 ha each at several localities in each of the major vegetation associations of the high rainfall areas*” (97). This contrasts starkly with the conclusion of Woinarski et al. (98) that even a reserve the size of Kakadu National Park (20 000 km²) may be inadequate to conserve not only an iconic mobile species such as the Magpie Goose, and but also more sedentary species of limited range such as the northern Quoll (99).

The great faith in the ability of traditional agricultural science to fulfil Paul Hasluck’s call to transform the whole face of the northern half of the continent was evaporating. Pasture agronomists started to see some role for research and management of native pastures as existing landowners questioned the relevance of the improved pasture research (100). The failures of private agricultural development schemes came under close scrutiny by researchers and the historic role of science was examined (43, 62, 92, 101). Henzell bemoaned the fact that Australian agricultural experts were being sought for their help in the tropics overseas, but their opinions were not being used to inform agricultural developments in the Australian tropics (62). Part of the issue was that requests for assistance from the overseas tropics were from existing agricultural production systems whereas, in northern Australia, science had been called on to pioneer the industry.

In 1983, a review by CSIRO and the Commonwealth Bureau of Agricultural Economics concluded that:

“Although well-watered, the tropical north suffers from many other disabilities – a seasonally humid/arid climate, rugged terrain and poor soils. Erosion is a major hazard and high humidity and temperature encourage pests and pathogens. These factors, combined with remoteness and lack of infrastructure have precluded successful intensive development in the past. Extensive pastoral activity, sugar and areas of localised vegetable production are likely to remain the dominant forms of agriculture in the foreseeable future.” (102)

This review came just four years after the Australian Institute of Agricultural Science produced a comprehensive and extensive research agenda for agricultural development in northern Australia (89). This pointed to the emergence of strongly dichotomous views about the potential for northern agriculture. While Basinski et al. (44) in 1985 described the establishment of research stations across northern Australia as marking the “*Golden Age*”, Henzell, who brought to an end CSIRO’s research at

those stations during the late 1980s, believed the whole premise for many of those research stations in northern Australia was flawed from the beginning, coming from strategic considerations during the Second World War (7).

The era came to a close with the publication of two major documents reviewing mainly the post World-War II research into crops and pastures in northern Australia (44, 83), and an important conference proceedings which included a somewhat more critical analysis of where agricultural science should head in the future (87). Proponents of agricultural development responded to the criticism marking the beginning of this era by playing on Davidson's language in the title of his best-known work (*"The Northern Myth"*) to publish *"The Northern Challenge"* (44) and *"Australia's North West Challenge"* (103) again pointing to strong dichotomies in views.

9. SUSTAINABILITY AND COMPETING INTERESTS: 1985 - 2005

Agricultural research continued through this era and culminated in the last major review of the outcomes of decades of research into farming systems for northern Australia (104). This concluded that a mixed agriculture system with ley pastures and minimum or no-tillage cropping was the best way for dryland farming areas to overcome the limitations of the environment and markets. It remained to be seen whether irrigated agriculture could overcome well-known problems of over-allocation of water, salinity and rising water tables (88). Recently Chilcott (105) argued that small patches of irrigation judiciously distributed throughout the landscape could provide opportunities for diversification by existing land managers of mainly pastoral enterprises and may be a better model for much of the north than large contiguous irrigation precincts.

A very important innovation during this period was the development of a computer simulation model for evaluating farming systems. The Agricultural Production Systems Simulator (APSIM) was designed as a farming systems simulator that sought to combine accurate yield estimation in response to management with prediction of the long-term consequences of the farming practice on the soil resource (106). The origins of APSIM stem directly from research in northern Australia and is employed and acknowledged nationally and internationally as a leading farming systems tool. Research during this period was more often on-farm systems trials or commercial-scale demonstrations conducted over many years (107-110), and the systems research generally provided a less than optimistic assessment of prospects for cropping in northern Australia (111-113).

The commissioning of the Australian Science and Technology Council in 1992 to review research and development in Australia's tropics brought to focus many of the paradigms that had been emerging over the previous decades. Its recommendations included the need for research to be collaborative across organisations, and to improve the sustainability of existing land uses rather than to radically alter them, and to engage in work relevant to existing land managers including Indigenous people (114). The Tropical Savannas Cooperative Research Centre in its two incarnations addressed many of these issues, largely ignoring the themes of cropping and improved pastures which had so dominated research efforts since the war.

10. AGRICULTURE AND BIODIVERSITY CONSERVATION

“The destruction of marsupials would be a material advantage to every individual in the state” Debate on administration of Queensland’s Marsupials Destruction Act 1877, Queensland Government Hansard 14/15 September 1881.

The paradigm that native fauna were vermin has had a long-standing influence on science and policy in Australia. Competition from native macropods was believed to limit the productivity of sheep and cattle. Therefore the native grazers needed to be eliminated or substantially reduced in numbers. The Queensland government’s Marsupials Destruction Act of 1877 and New South Wales’ Pastures and Stock Protection Act of 1880 and subsequent legislation arose in response to grazier’s concerns that the pasture degradation following the introduction of commercial grazing was due to grazing pressure from marsupials. Although aimed at the larger macropods, bounty hunters also targeted a wide range of smaller marsupial species (115).

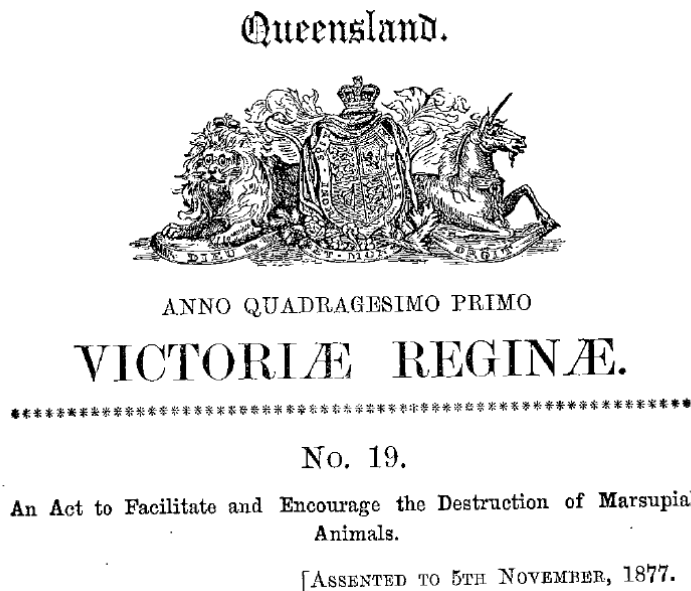


Figure 5. Queensland’s Marsupials Destruction Act was finally repealed in 1994.

The apparent paradox arising from the belief that marsupials needed to be eradicated because of their competition with stock (116, 117) and the considerable research into replacing the native pastures because they weren’t adapted to grazing (65) was seen by Abbie (118) as expressions of an attitude by settlers of “*destroying every wild thing on sight*”. As late as the 1950s much of the research into native fauna focused on their control as vermin (119). In 1960, CSIRO’s Wildlife Survey section’s prime responsibilities were supporting the control of pest species included many native species such as the euro, the red kangaroo, wild ducks (including wood duck, black duck and the grey teal), magpie geese, emu, Tasmanian native hen, black cockatoos, the Tasmanian pademelon, Bennett’s wallaby and the wombat (120). In 1964, Alan Strom, the Chief Protector of Wildlife in New South Wales had to argue the case for preservation of wombats (a declared vermin species) even within nature reserves (121). Clearly the values espoused by Christian and Davies, that agricultural production should be developed to the fullest, were also driving research into native fauna.

Although legislation to eradicate marsupials and the belief that they competed with stock led to vast efforts at hunting and poisoning marsupials for decades, it rarely led to their extinction (115, 122). Conversely, legislation to protect native animals has enabled species recovery plans to be implemented and greatly reduced the hunting pressure, but has been unable to prevent the recent widespread local extinctions of many species across northern Australia (99).

Throughout the 1960s, CSIRO's wildlife research concentrated on species deemed to be economic pests, but Ratcliffe fostered "hobby projects" out of scientific curiosity about native fauna, and gradually this grew into research efforts to support conservation of native species (119).

11. RESEARCH TO TRANSFORM A CONTINENT.

"It has been rare for agricultural research to consider the farming production system from the viewpoint of the ecosystem into which it has been cast" (123).

Attempts at major agricultural developments were marked by repeated failures (124). Although several leading scientists realised the magnitude of the challenge to develop an agricultural society in northern Australia (57, 60), and there was some vigorous debate about the relationship between economic and agronomic research (69, 76), most of the agricultural research conducted in northern Australia up until the late 20th century was short-term, small-plot agronomy on research stations. It followed a naïve attitude that "Once the more important technical problems are solved land settlement becomes mainly a question of economics..." (50).

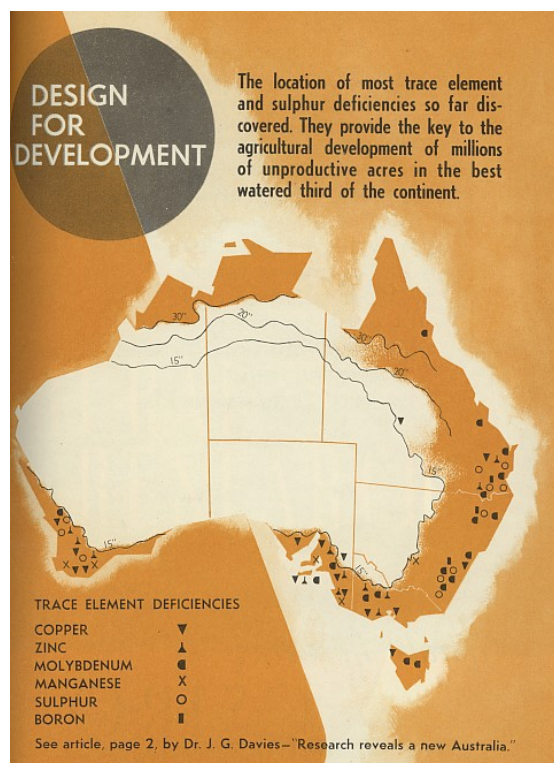


Figure 6. "Research reveals a new Australia": CSIRO researcher JG Davies' vision for transforming the wetter third of Australia. CSIRO's journal *Rural Research* 1953.

Principles for the design of agricultural experiments articulated by R.A. Fisher (125) were quickly taken up by Australian experimenters (126). However, the use of Fisher's small plot designs such as randomised blocks and latin squares, which work well for considering (for example) alternative wheat varieties in a wheat growing district were entirely inappropriate for attempting to alter land use patterns across half the Australian continent. There appeared to be little integration of the landscape and regional scale assessments of land systems, the sweeping visions for transforming half a continent, and the scale of the experiments on crops and pastures.

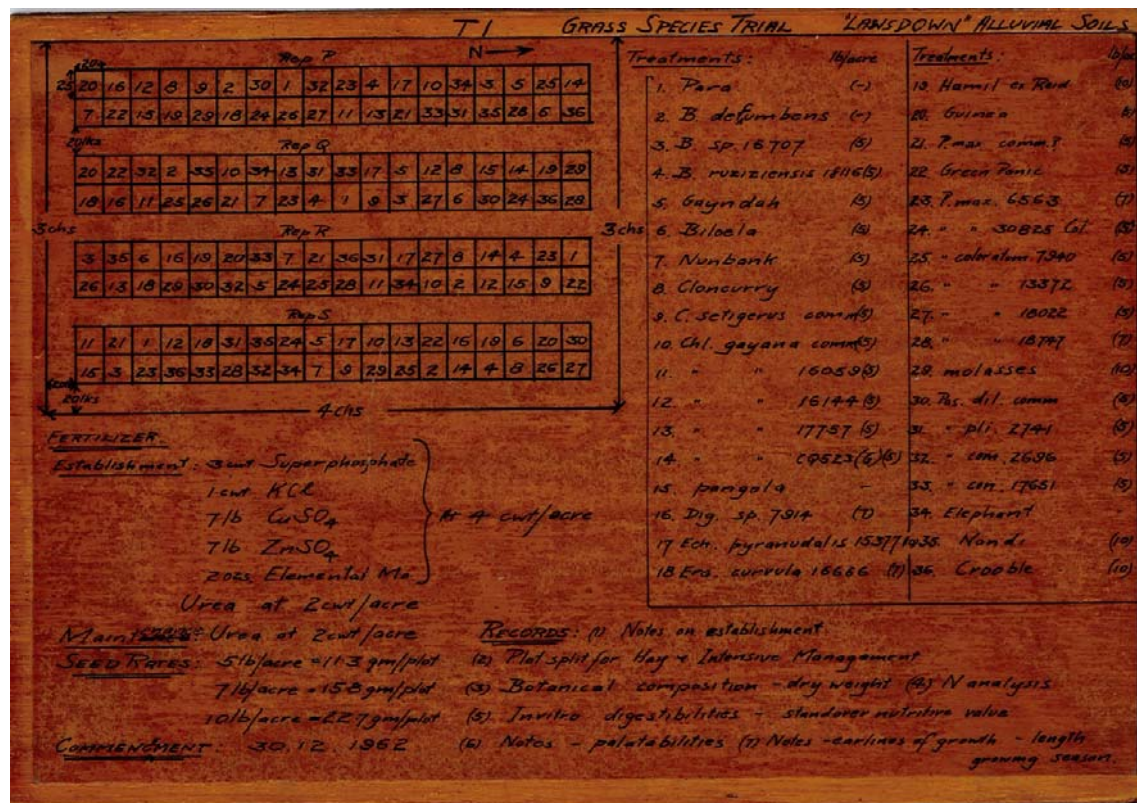


Figure 7. Small plot trials on pasture species in the 1950s and 1960s led to the conclusion of Davies and Eyles (77) there was "good evidence that improved pastures based on new pasture plants can be developed for immense areas of northern Australia, with very large consequent increases in animal production." These visions were never realised.

The small scale of much agricultural research led to Williams' (123) criticism that much agricultural research failed to consider the broader agricultural ecosystems in which they were set, leading to problems such as soil acidification, soil erosion, salinity, and biodiversity decline. As Davidson (69) argued, pineapples could be grown in Antarctica if enough money was spent, but that would not lead to a viable industry. The plot-scale of much agricultural research up until the late 20th century contributed to an over-optimistic view of the agricultural potential of northern Australia, and ignorance of many of the limitations. This was coloured, in part, by the substantially greater crop yields typically obtained on research stations than commercial farms (73).

More recently, agricultural systems research has generally provided a much more constrained assessment of cropping prospects in northern Australia (111-113).



Figure 7. “Pineapples grow well, hence the name Pine Creek” This is the original caption by the Federal Parliamentary Party visiting the Northern Territory in 1912 suggesting someone was playing a joke on naive newcomers. Pine Creek was named after the Northern Cypress Pine. Pineapples featured in Davidson’s critique of northern development. National Library of Australia picture nla.pic-an24283858. Used with permission.

12. CONCLUSIONS

More than a century of agricultural research in northern Australia has shown that there are real and substantial resource limitations that affect the region. The climate is hot and alternates seasonally between arid and very wet. Unlike southern Australia, arable soils do not occur in large contiguous areas, but are interspersed with large areas of land suitable only for grazing. The low fertility of soils and the high risks of climatic adversity are major constraints to crop production. Management systems to prevent soil erosion are critical due to the high intensity of rainfall. Minimal or no-tillage systems have transformed the ability to integrate dryland cropping with grazing (88).

Political imperatives from southern Australia have long driven the push for agricultural development of the north. These imperatives have created pressures to ignore industries and people that inhabited the north and serve the vision of an imaginary well-tended landscape, densely settled with farmers. Research on both pasture and cropping sciences has suffered from this approach. Subsidisation of development was a reigning paradigm for most of the past century. Many of the high profile private agricultural developments had a business model that required large profits from rising property values, share prices and enthusiastic government support. The history of the north is evidence of their failures. Gilruth (42) believed that statements about the opportunities being neglected in the north could be traced to either (1) those who had read only the biased laudatory accounts, but wished for some-one else to be the pioneers; (2) those who had an interest in land or a

lease and wished to realise a capital gain; and (3) business people to whom any influx of population means a profit.

Single issue policy making dominated the decision making processes and research directions for much of the past century. For agricultural researchers, working towards mixed farming, where cropping was integrated with cattle raised on ley pastures, represented a high degree of cross-disciplinary research. Research into land use now needs to integrate widely disparate disciplines including cross-cultural social science, economics, climate change, governance, environmental bio-physical science as well as the more traditional agronomic sciences.

Wadham et al. (127) argued that development pressures on marginal lands follow the boom-bust cycles of national and international economies. While the cycles of private investment in northern Australia tended to reflect that pattern, the history of the region indicates that other significant events can also trigger increasing external pressures and interest. Concerns about national security, food security and energy security have also been significant factors affecting Australia's marginal lands and triggering government attention.

The paradigm of the "*empty north*" was derived from colonialist thinking and rejection of Indigenous tenure. It ceased to have currency by the late 1960s (128), with growing recognition of the interests of local residents, and with the death of the defence imperative and the development of arguments that northern settlement policy had no implications for national security. Nevertheless, arguments about the importance of food security arose in the 1960s to justify continued pressure for northern development. Globally, food security is again coming to the fore as a critical issue (129, 130). While the past few decades have seen a rise in the extent to which local interests including Indigenous interests participate in land use debate, external drivers are still major factors in the debate about northern development. Climate change and climate variability in southern Australia is showing signs of playing the role in driving interest in the north that the paradigm of the "*empty north*" had for much of the 20th century.

The influences of climate change will be more diverse than has often been recognised. The direct effects on environmental processes in the region have been canvassed (1, 131), but for northern Australia, indirect effects through mounting pressure for increased food production, and the requirement for shifts in food production areas are likely to be far more important.

At the same time as food and production security concerns are causing growing pressure on the north, there is also growing pressure for land managers to reduce greenhouse gas emissions and increase carbon sequestration. The outworking of these factors is by no means certain, because they will be driving the system in differing directions. Concerns about food security will create pressure for land clearing and agricultural development, as happened throughout the 20th century, but concern about carbon emissions has already led to changes in tree clearing legislation and limited the ability of land holders to develop land. Climate change itself is likely to increase variability in an already highly variable climate and increase the risk to agricultural enterprises. Currently a growing tide of extinctions and range reductions are affecting native fauna across the north (99). Strategies to ensure their conservation will add further complexity to the outworking of development pressures.

13. SUMMARY

Arable agriculture made very little headway in northern Australia in an era of government subsidisation, dismissal of Indigenous rights and a naïve understanding of and even an antagonistic attitude to sustainability issues and biodiversity conservation. However, as the world's population continues to grow, and existing areas of prime agricultural land come under threat from climate change and unsustainable management practices, the economics could alter markedly and indeed has already done so for a number of sectors. Much progress has been made in recent decades on the science of sustainable farming practices suitable for northern agriculture. Developing the framework to integrate the science, economics and governance of the complex issues surrounding land management is the challenge for the next era of research in northern Australia.

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