

A (re-)assessment of Northern Australia's agricultural future

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Abstract

Agriculture is a risky business. The variables farmers evaluate and plan for include weather, markets, supply chain, finance, labour, changing policy and legislation, natural disasters, pests and disease. Forecasts of a world population approaching nine billion with more than half the middle class living in Asia by 2020 are anticipated to drive major changes in global food demand and investment in agriculture, already a major contributor to Northern Australia's economy. Northern Australia's opportunities for further agricultural development are diverse, but not agreed, and being actively explored by contemporary Australia. In February 2011, cyclone Yasi cut a swathe through Far North Queensland's natural and production environments, compounding cyclone Larry's impacts five years previous. Whilst cyclones are geographically defined, their impact manifests in the convoluted environment of world markets and social systems. How can industry expansion be contemplated when the incidence of such disasters is predicted to increase as a consequence of climate change? Now is a strategic time for planners to consider how an expanding Northern Australian agricultural industry can prepare for the disasters it will encounter whilst embracing sustainable agriculture and community well-being. This paper, through literature and personal experience analysis, considers the relevance of history to contemporary aspirations and introduces resilience alongside production as research objectives, as literature suggests that not only are resilient organisations about surviving, but thriving.

Keywords:

Northern Australia; agriculture; food security, planning; disaster, resilience, history.

Introduction

Kharas (2010) predicts a world population of 9 billion by 2020, with more than half the world's middle class in Asia. This larger, wealthier population will require more food, and prefer food of higher value, particularly meat and processed foods. Linehan *et al.* (2013) speculate that the real value of global food demand is expected to rise by 70 per cent by 2050 from 2007 levels. Cole and Ball (2010) believe it unlikely that Asia will achieve food self-sufficiency.

This demand is anticipated to provide opportunities for Australia's northern agricultural industries through proximity to Asia and perceived under-utilisation of its land resource. Australia's newly-elected Prime Minister has committed to a White Paper on the further development of Northern Australia (Liberal Party of Australia, 2013), and the incumbent Queensland government wants to double the state's agricultural production by 2040. However, anyone involved in North Australian agriculture for more than a decade would be excused for a degree of scepticism. This is not the first time grand plans have been espoused for Northern Australia, founded on the premise of underutilised land and bountiful water resources providing the wherewithal to feed the world's starving millions. Consider also that contemporary farm returns often fail to meet production costs, the social, environmental and climatic unknowns associated with increased agricultural scale, and the inherent risks in agriculture, and suddenly the future does not seem quite so clear.

This paper attempts, through a review of academic and grey literature filtered through personal industry experience, to identify whether today's aspirations to expand Northern Australian agriculture differ from past attempts, and what might be the key elements for Australia's planners and policy makers?

The historic challenges of Northern Australian agriculture

Northern Australia is vast, geographically diverse, alternatively (and at times simultaneously) very wet and very dry. It is a unique part of the tropics, with an enormous natural resource base and remarkably small human population (Lawn 2011) lying within a well-resourced and democratically governed first world economy.

This Northern Australian landscape has had tens of thousands of years of human intervention (Gammage, 2011), and the notion that the 'natural' landscape can be maintained in its pre-European state simply by excluding or limiting contemporary land uses does not stand up to scrutiny. The number of Indigenous Australians living in the north is much higher (14.3% of the population) than the national average (2.3%), but the lifestyle and land use of Traditional Owners is now typified by relatively stable population centres and cessation of nomadic lifestyles. European settlement in the late nineteenth and early twentieth centuries was instrumental in this change, and it was the search for economic opportunity that drove the invasion of Aboriginal lands (Bottoms, 2013).

From the earliest beginnings of European settlement a bright future has been forecast for Northern Australia. John McDouall Stuart in his 1865 exploration (p.6) remarked:

I have no hesitation in saying the country I have discovered on and around the banks of the Adelaide River (near present day Darwin) is more favourable than any other part of the continent... I feel confident that, in a few years, it will become one of the brightest gems in the British crown.

Australia's non-indigenous development has been succinctly described by Aschmann (1977) as one of an initial investment of capital and introduction of people (sometimes involuntary), extensive pastoralism and limited subsistence farming, followed by mineral discoveries

(often gold) that attracted enormous immigration. Extensive agriculture developed to feed these immigrants, often subsequently specialising in a commodity for export. Manufacturing and service industries developed to supply the established population, and the whole complex became economically self-sustaining. Aschmann thought that this sequence was interrupted in the north at the agricultural stage not because of climatic or soil limitations, but because, while transport was expensive, it was cheaper than local production (a cost-benefit outcome repeated in today's food-mile debates).

Australia was on the winning end of many late nineteenth / early twentieth century innovations. Mechanisation (the petrol engine, refrigeration) combined with labour shortages (driving the need to innovate) and large areas of land to allow Australia to supply cheap meat and butter to Europe and satisfy the demand for an improved working class diet. Advances in pesticides, herbicides and fertilisers continued to increase productivity. (European) farming systems based on labour-intensive methods could not compete in open markets against mechanised industrial agriculture (Barr, 2009).

The first Commonwealth Administrator of the Northern Territory, Dr Gilruth, placed great hope in the pastoral industry to develop the economy, and in 1914 the (British-owned) Vestey group of companies were allowed to build and operate the Darwin meatworks, which in turn facilitated control of vast pastoral leases. The meatworks development doubled Darwin's population but, plagued by industrial action and failure to complete the rail line to the Katherine River, proved a dismal failure. They did not open till 1917, and closed in 1920 (Carment, 1996).

The Second World War catalysed strategic concerns about the North's 'emptiness' and highlighted opportunities for development. This resulted in a government 'imbued with a newly-forged nationalism and readiness to engineer the future' establishing the North Australian Development Committee (NADC) in 1946, charged with 'investigating the region's pastoral, agricultural, mining, forestry, marine, fuel and power, and processing and manufacturing industries; and to guide systematic development of these industries' (Garnett *et al.*, 2008: vi).

Twenty years later, Dr 'Nugget' Coombs, a NADC commissioner and long-time advocate for Northern Australia, said in his opening address to the first annual seminar of the Northern Australia Research Unit (NARU) in Darwin, August 1977, that:

the optimism at the time and the prevailing views ... that growth was a good thing, that it could be achieved primarily by seeking to impose on the North a pattern of productive activity and a way of life essentially European in its origin and substantially European in its relevance. There was little attempt to envisage the gradual emergence of a more humanized environment capable of self-perpetuation, providing a context for a more rewarding life for those who already lived within it (Bauer, 1977: 8-9).

It is significant that this conference was themed 'Cropping in Northern Australia: Anatomy of Success and Failure'. An analysis of six large-scale agricultural developments, undertaken by Fisher *et al.* (1977), showed all failed to achieve their stated objectives. A particularly pertinent comment was made by Mollah (1980) in his retrospective analysis of the cropping development at Tipperary Station. In 1967, encouraged by a world-wide beef shortage, tax concessions to encourage investment, and the first stages of the Ord River development, the Tipperary Land Corporation (registered in Texas, USA), announced the biggest agricultural project attempted in Australia, with 'American know-how' and \$20 million to establish a farming community of 15,000 people, producing 300,000 t of grain sorghum annually and high quality beef cattle. These great expectations were never realised, and farming was all but abandoned after three years and the station sold back to Australian interests. Mollah's comment (p. 156) was that 'Pioneering developments in the North had no room for those who doubted their own ability but, from the outcome at Tipperary, it is equally clear that confidence is no substitute for knowledge and experience'.

Cook (2009) summarised five historic pushes for (Northern Territory) agricultural development in which government led research efforts assumed that once the science was in place, agricultural development would follow, but concluded the aspirational drivers for these initiatives related as much to addressing the perceived risks of Australia's 'empty North' as a genuine commitment to agricultural

growth. Even in the more climatically hospitable and richer soils of the Atherton Tablelands (Queensland), Gilmore (2005) considered government-sponsored agriculture was more a means of closer settlement and strategic defence than a food producing venture, and that the maize, dairy and tobacco industries so established foundered when Australian governments realigned the economy according to neo-liberal principles. In 1985, Bauer gave three reasons for the failure of large-scale agriculture in Northern Australia: (1) distance; (2) ignorance of the physical environment; and (3) a reprehensible aversion to learning by experience.

The twenty-first century has seen a focus on contemporary Indigenous management of the North Australian natural landscapes for the provision of environmental services (Cook and Williams 2012), but neither the previous policy failure, nor the emerging recognition of Indigenous environmental stewardship has stopped the on-going speculation about Northern Australia's opportunities for further agricultural development. The twenty-first century drought in Southern Australia (compounded by over-allocation of irrigation water) fed this debate to the extent that in 2007 then Prime Minister John Howard established, as part of his plan for water security, a Northern Australian Land and Water (NALW) Taskforce to:

examine the potential for further land and water development in Northern Australia, with particular emphasis on the identification of the capacity of the north to play a role in future agricultural development (Garnett *et al.*, 2008: vii).

Whilst some industry sectors consider the projections and assumptions in the NALW report conservative (Maher, 2011), the report clearly states that the future of the North should not be limited to pastoralism and/or irrigated agriculture, and that decision making should be based on a thorough and balanced assessment of the economic, social and environmental implications. A commitment to such a decision making context, assisted by ongoing technological developments, would address the first two of Bauer's concerns, but what of the 'reprehensible aversion to learning by experience'? McLean and Gray (2012) promote the 'thinking use of history' as a mechanism

for reinterpretation of the premises of major policy decisions. Without this, the potential for repeating past failure remains, particularly if the underlying policy paradigms are ill-conceived or flawed.

Food security – the driver for change

International interest in food security was focused by the 2007–2008 spike in world food prices (Figure 1) as a consequence of a shift from food to biofuel production (Fraser 2008). It has been retrospectively argued that the crisis was actually triggered by a combination of short-term factors and longer-term trends, including: a series of extreme weather events; low global stock levels; the use of food crops for biofuels; rising energy prices; export bans; and increased financial speculation; along with structural problems rooted in global resource limits (see Maye and Kirwan, 2013). But politicians and policy-makers were left in no doubt as to the potential threats to food security, the increasing interdependence of agri-food systems, and the political and social importance of affordable food (Ambler-Edwards *et al.*, 2009; Lagi *et al.*, 2011).

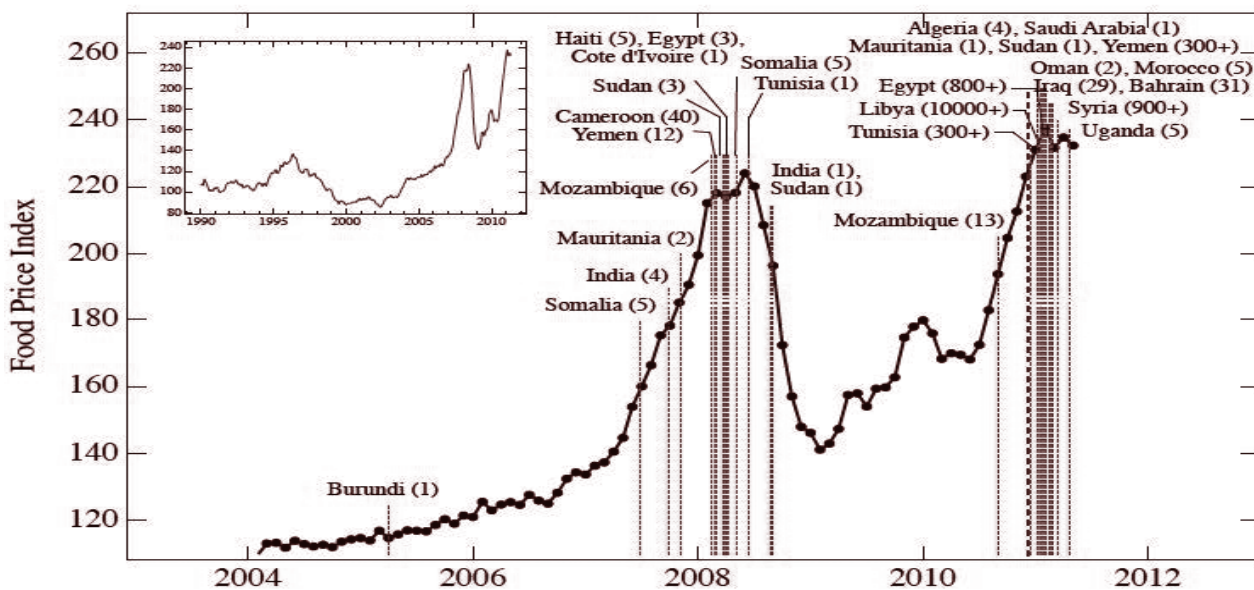
The United Nations Food and Agriculture Organisation World Food Security summit in Rome, June 2008, helped establish a consensus that food security was a key ‘master frame’ of twenty-first century public policy (Mooney and Hunt, 2009) and that the risks to food security also included slower-onset, more diffuse perturbations such as global climate change (Erickson, 2009).

But as with most complex problems, the opportunity for a simple solution fades under scrutiny. Maye and Kirwan’s editorial in the 2013 special issue on Food Security warns of the risks to agriculture’s other outputs such as nature conservation and water management from pressures to produce food and energy. In the same issue Allen (p. 137) warns that ‘solutions that move control farther from the ability of people in their everyday lives should be subjected to particular scrutiny’, and that productivist goals of doubling food output could exacerbate – not solve – problems associated with food insecurity such as energy costs, climate change, and food of low nutritional quality, and suggests that food security is a collective problem requiring a social solution. Innovative and refreshing outcomes are occurring from this debate, such as *Project Catalyst* - a Coca-Cola / WWF / Australian Government / NRM Regional Bodies / sugar industry partnership aimed at reducing the environmental impacts of sugar production on the Great Barrier Reef through innovative farming practices (WWF 2013), and along the way substantiating Coca-Cola’s social licence to source sugar from a politically stable but environmentally sensitive area (Cocco 2013).

The Australian International Food Security Centre was established in 2012 to consider Australia’s role in feeding an extra two or three billion people without irretrievably damaging the planet, and focuses on Australia’s role in research and extension (Blight 2012). The Department of Foreign Affairs and Trade Secretary Peter Varghese

told a panel on *Capitalising on the Asian Century* that ‘in a globalised world ... success lies as much in our degree of internationalisation as in domestic factors’ (CEDA 2013). But Australia’s agricultural history differs from Europe and the USA, being export-orientated around demands for food and raw materials, more-often driven by foreign investment, resulting in a lack of (or unwillingness to) finance value-adding or processing capacity (Burch *et al.*, 1999). This has locked production into low value, unprocessed, competitive commodities vulnerable to free market price fluctuations exacerbated by increasing application of neo-liberal policies (Lawrence *et al.*, 2013). Australia’s agricultural sector is the second least protected (i.e. subsidised) in the OECD (O’Meagher 2005). So despite recognition of the need to value-add, most Australian food exports continue to be commodities processed to the minimum necessary for stability and transport, with supply chains fragmented and dominated by overseas interests (Ball 2012).

The interplay of issues related to northern agriculture expansion includes: water resource management, climate change, disaster management, environmental impacts (particularly on the Great Barrier Reef), native title and other tenure issues, the future of regional communities, foreign ownership of land and production units, the economics of developing new irrigation areas, and who will pay for the infrastructure. The role Northern Australia will play in future world food security is therefore politically and socially



Time dependence of FAO Food Price Index from January 2004 to May 2011. – Red dashed vertical lines correspond to beginning dates of ‘food riots’ and protests associated with the major recent unrest in North Africa and the Middle East. The overall death toll is reported in parentheses. Blue vertical line indicates the date, December 13, 2010, on which the authors submitted a report to the U.S. government, warning of the link between food prices, social unrest and political instability. Inset shows FAO Food Price Index from 1990 to 2011. Source: Lagi *et al.*, 2011, p. 3.

contentious in addition to the structural issues raised by Bauer in 1977.

Contemporary challenges to Northern Australian agriculture aspirations

A viable and diverse agricultural industry already exists in Northern Australia, with beef, dairy, corn, sorghum, peanuts, avocados, mangoes, nuts, sugar, and a myriad of fruits and vegetables as well as plantation timber. Agriculture is a major contributor to Northern Australia's economy: in 2008/09 direct primary industry turnover for Far Northern Queensland was estimated at over \$1.7bn, with direct employment of about 9,000 people (RDA, 2011). Australia is the world's largest exporter of sheep and cattle, and eighty per cent of exported cattle are from the north, valued at \$416 million in 2006-7 (Gray 2009), and a Darwin abattoir capable of processing 220,000 head per annum is under construction (AACo, 2012). Australia's current food production is estimated to feed 60 million people annually. Whilst the total Australian agricultural output represents only one per cent of global production, Australia is the fourth largest net agricultural exporter in the world behind Brazil, Argentina and the Netherlands – well above nations like China and the USA that have enormous domestic agricultural sectors, but in net terms import just as much as they export (Keogh, 2009). When the outcomes of agricultural research are considered, Australia contributes to the diets of 400 million people worldwide (Prasad & Langridge, 2012).

The Australian Government's 2012 White Paper *'Australia in the Asian Century'* refers to the opportunities for agriculture to be a major beneficiary of forecast Asian growth, which Keogh (2012a) interprets as a signal that policy makers may now see opportunities for agriculture rather than as a sunset industry, and argues that Australian superannuation funds should join overseas pension funds in investing in agriculture (2012b). The National Farmer's Federation (2012) *'Blueprint for Australian Agriculture 2013-2020'* sets out a strong future for Australian agriculture and its supply chain.

Industry excitement about the potential for growth is understandable, but what are the aspirations of the northern-resident

and broader Australian community? Not everyone wants to live in a city, but regional residents also desire a future for their children and access to services for an aging population. Neither should the continuing appeal of the *frontier ethos* as personified by Dame Mary Durack's *'Kings in Grass Castles'* (1959) be dismissed, as not-withstanding the lessons of history, the challenge of future opportunities continues to excite individuals and the nation alike (Bendle, 2013), even though *terra nullius* never existed.

The tyrannies of distance have been significantly addressed since Bauer's time, particularly through the mining boom of the past decade, with improvements in road and rail links, port infrastructure, communication systems and employment opportunities, albeit many of these on a fly-in fly-out basis. Both agriculture and export oriented mining have strong projected growth in Northern Australia's short to medium term future, and the obvious synergies of shared infrastructure are recognised (Owens 2013). Historically though, the internal distribution of costs and benefits from mining within host regions transitioning from agricultural economies has been limited (Hoath & Pavez, 2013).

Indigenous Australian's role in the past and present management of Australian landscapes appears obvious to contemporary Australia, but has not been an easy transition, riven initially by uncertainty and community division over the implications of the 1992 Mabo High Court decision and subsequent Commonwealth Government's Native Title Act 1993 impacts on private and leasehold tenure. Today, a majority of the north is owned and managed by Indigenous Australians, many employed in community ranger programmes. These communities are actively addressing social issues and considering alternate futures and meaningful employment opportunities for their growing communities (annual population growth is 2.1% compared with 1.6% for the national average (BITRE, 2009)).

This is not to say unanimity exists - consider the divided response to Queensland's Wild Rivers legislation and contested development of the Kimberly natural gas resource. On the international stage Pieck and Moog (2009) describe

schisms in the iconic Amazon eco-indigenous alliance due to indigenous people never becoming a central part of large conservation organisations agenda, and their subsequent failure to live up to the discursive (and promotional) assurances they made to indigenous people. Cruz (2010: 421) warns that 'publishing information on a webpage does not make it more accessible to members of a local community, but rather allows that knowledge to escape local control and be used by anyone'.

The driver for many environmental campaigns has been concerns over resource exploitation. However, mining is increasingly providing opportunities for Aboriginal business and employment in Northern Australia. Fortescue Metals, an iron ore miner in the Pilbara area of Western Australia, have invested \$1 billion with Aboriginal businesses since 2010, and employs 1,000 Aboriginal people (Power, 2013). This experience contrasts sharply with historical agricultural industry engagement with Aboriginal people, characterised initially by dispossession and persecution before moving through exploitation to widespread disengagement. Even today, the Far North Queensland banana industry is heavily dependent on international backpacker labour, whilst aboriginal communities in the same region experience underemployment (personal experience and observation).

Planning for the unexpected

In February 2011, tropical cyclone Yasi cut a swathe through Far Northern Queensland's natural and production environments, compounding the impacts from cyclone Larry five years previous. Unlike cyclone Larry, Yasi occurred in the aftermath of the Global Financial Crisis and in the context of a high Australian dollar and a 'summer of disasters' throughout eastern Australia. Agricultural industry impact was widespread, but highly variable. The banana industry received extensive media coverage with 90% destruction of the Australian crop, but within 10 months was back in full production and facing chronic market oversupply and resultant low prices. The tropical fruit industry however was dealt a crippling blow that will take years to recover, if ever. Sugar cane, cattle, dairy, other tree and horticulture crops were also affected to varying degrees relative to

their geographical relation to the cyclone's path, but recovery times from Yasi did not mirror those from Larry five years earlier (personal experience and observation).

How can industry expansion be contemplated when the incidence of such disasters is predicted to increase as a consequence of climate change (King, 2010), with less climatic predictability and more disasters impacting upon an increasing and more vulnerable population (ISDR 2008, Barratt *et al.* 2009, Handmer *et al.*, 2012, Prabhaker *et al.*, 2009), and with regional and remote communities in tropical Queensland among Australia's most vulnerable in the face of climate change (Dale *et al.*, 2011)? Indeed Flint and Luloff (2005) argue that natural resource-based communities are generally viewed as being vulnerable to risks and disasters; and climate change will not only affect extreme weather events – higher temperatures and storm surge flooding could affect current crop and livestock performance, as well as the pest and disease spectrum and pressure.

Additionally, whilst cyclones are stand alone and geographically defined events, their impact manifests in the convoluted environment of world markets. As an example, the greatest concern of the Australian Banana Growers Council post-Yasi was that lack of supply to supermarkets would result in the importation of bananas from the Philippines (Australian Food News, 2011) - an event that would have more significant and persistent industry impact than one cyclone.

A factor made clear by the two cyclones was the interdependence of industries across scale and commodities: without regular banana transport south, freight costs escalated to the point government subsidy was required to ensure affordable delivery of much-needed building materials, but farmers capable of sending product south also required freight assistance; the disappearance of back-packer employment opportunities impacted on local accommodation and tourism businesses; and dairy cows could not be milked without electricity.

Implications for planners

Agriculture is a risky business. The endless variables that farmers must evaluate and plan for (often almost subconsciously)

include weather, markets, supply chain, finance, labour availability, changing legislation, natural disasters, pests and disease. Lawrence *et al.* (2013) point out that over time neo-liberal policy has sought to foster self-reliance in the management of environmental risk by Australian agriculture rather than expecting it to be addressed through government funding as a national problem, and Gill (2011) makes the important point that whilst farmers have accepted their responsibility to manage risk, their capacity to do so is often sorely tested. There is an argument that as a consequence of constantly dealing with risk, farmers are conservative when it comes to issues such as politics and the projected impacts of human-induced climate change, and it is 'understandable that farmers are cautious and contest the claims of those who would have them reorganise current production systems' (Lawrence *et al.*, 2004: 256).

Early settlers lacked the skills and knowledge of their new environment to realise that introduced European agricultural practices were often unsuited to Australia (Gray and Lawrence, 2001). Governments used pastoral lease conditions to facilitate land use intensification and closer settlement, an approach often incompatible with the unreliable climate and limited carrying capacity of the rangelands (Productivity Commission, 2002). The resulting negative impact of agriculture on Northern Australia's natural environment and biodiversity has been extensively documented, and climate change is predicted to bring new pressures to bear on both agriculture and biodiversity (Cocklin and Dibden, 2009).

The International Assessment of Agricultural Knowledge, Science and Technology for Development report (2009) describes agriculture as a multi-output activity producing not only commodities, but environmental services, landscape amenities and cultural heritage. Cocklin and Dibden (2009) postulate that it is possible to envisage mitigation and adaptation responses that would alleviate pressures on all three systems (climate, agriculture, biodiversity), and there has been a wave of interest in shifting emphasis away from productivity enhancement and towards sustainability and resilience (McNeely and Scherr, 2003; IAASTD, 2008, 2009; Nellemann *et al.*, 2009) which has been assisted through improved

regional participation in natural resource management. However, there continues to be a lack of clarity and certainty as to the property rights conferred by pastoral lease arrangements, and approaches vary across jurisdictions to allow non-pastoral land uses - generally treating them as special cases within the legislation. This lack of formal recognition reflects the narrow and prescriptive nature of pastoral lease arrangements (Productivity Commission, 2002).

There is also an emerging discussion around the need to explore alternate governance systems from global to local scales to address the contemporary social, economic and environmental challenges facing the world and improve multi-sector cooperation, particularly since 'command-and-control' regulation has been found wanting (see Taylor, 2010). Higgins *et al.* (2010) describe contemporary society's broader global shift from public to private forms of governance, and how farmer-initiated Environmental Management Systems take a proactive approach to environmental issues to avert more onerous intervention by governments. Dale *et al.* (2013) describe how linear governance systems that are poorly integrated with the wider system can constrain thinking, have limited benefit, and even be counter-productive, and describe *Governance Systems Analysis* as a systemic/adaptive means to optimise collaborative effort. Sayer (2010: 20) extends this argument, warning (contentiously) that environmentalists should be cautious in resisting agricultural innovations that may have short-term or local negative impacts on nature but which might provide better long-term options by jump starting the economic growth that people of the African continent so desperately need, and states that 'more efficient agriculture will in general be better for the environment', and that 'the ability of civil society to assert itself will be much greater when people are prosperous and well fed'.

Much of the world's current agricultural research is undertaken in, and directed towards improving, agriculture in developing countries. Pachauri (2011: 100) reminds us though that currently 'few plans for promoting sustainability have specifically built in means of either adapting to climate change or promoting adaptive capacity'. Whilst the third world research focus is right, such research

has only limited relevance to first world countries such as Australia. However, success in the latter is inexorably bridging the gap between the two situations, and Australian agriculture can demonstrate aspirational targets for sound agricultural practices in other tropical regions. To achieve this though, the skills loss and declining interest in agriculture as a career needs to be addressed. Many Australian universities have either closed or merged their agricultural faculties to compensate for a shortfall in students, indicative of a broader negative community view towards commercial agriculture (Keogh 2009).

Now is a strategic time to consider how a growing Northern Australian agricultural sector can better prepare itself for the natural, social, and economic pitfalls it will encounter, whilst embracing the principles of sustainable agriculture and recognising and fostering explicit tropical expertise. With this in mind, Walker *et al.* (2010) propose featuring resilience and transformability alongside productivity as major objectives of research, as literature suggests that not only are resilient organisations about surviving, but thriving; and the dynamic relationships between vulnerability, resilience, hazard impact, hazard change, adaptive capacity and social change in the context of climate change and disasters can inform approaches to planning for and developing community-based approaches to adaptation (Cottrell *et al.*, 2011).

In the same way that Cottrell and King (2008) emphasise the need to have an understanding of how people living in communities view risk to more effectively engage them in planning and mitigation for disasters, both agricultural industry individuals and organisations will need to be engaged, understood, and empowered as part of a disaster preparedness planning process; along with adoption of the principles described by King (2010) to achieve climate change adaptation - flexible, local, stakeholder driven, and involve all levels of government and institutions.

Agriculture is an industry connected across scale, commodity, and community, and it is this innate capacity that has delivered many demonstrations of resilience. Small growers need larger growers to attract infrastructure and service provision, but often smaller growers are the innovators that precede wider adoption. Collaboration

has provided spectacular outcomes: recognition of the value of zebu cattle by Monty Atkinson in 1926 eventuating in the Droughtmaster beef breed; the 2004 industry-driven eradication of Black Sigatoka disease from north Queensland bananas; the whole-of-industry Brucellosis Tuberculosis Eradication Campaign (BTEC); and the Natural Disaster Relief and Recovery Arrangements response to recent cyclones and floods. With experience and persistence past failures are showing signs of success e.g. the recent sale of the Ord Stage II irrigation development to Chinese interests (Govt. of Western Australia, 2013), and expanding banana production at Lakeland Downs (particularly post-cyclones).

Whilst Cottrell (2011) warns that a shared view of what constitutes resilience in general and community/social resilience in particular is likely to remain elusive, she points out that it is essential approaches taken to planning are context specific and developed in conjunction with those people who are most affected. Barrett (2013) is more direct, stating that whilst ecological resilience theory is well developed and quantifiable, social resilience is presently more 'an ubiquitous buzzword with a lot of arm-waving', but that there is 'a big opportunity for ecologist – economist collaboration' in this area.

Conclusions

Northern Australia is well placed temporally and geographically to learn from and avoid the mistakes of others in its continuing development. Historic impediments are being addressed: improved roads and vehicles; building technology, remote area power supplies, and air-conditioning; regional infrastructure, particularly in mining areas; weather forecasting; and communications, which have the additional benefit of enabling social networks over extended distances. Confusion over land tenure and native title has reduced (though pastoral lease conditions are still capable of delivering perverse outcomes), while natural resource management understanding and governance are empowering regional communities and delivering cross-sectoral outcomes.

The growing Indigenous population is actively considering their future, and their legitimacy is without question.

The international drivers for increased agricultural productivity have bipartisan recognition and support, and the perils of remaining in a bulk commodity export paradigm are recognised and the subject of active discussion. Technological innovations continue to provide opportunities for addressing Australia's higher labour costs and ability to compete in world markets. Financing options include foreign capital and the superannuation industry, though AACo's Darwin abattoir shows Australian industry is willing and able to invest. With experience and persistence, past failures like the Ord irrigation scheme are showing success.

However, there can be no guarantee that today's enthusiasm for northern development will be realised, or in time be just another step to a future realisation (though the concept of an 'end point' is itself misleading). Recognition by today's planners and policy makers of the considerable and honest analysis undertaken by the agricultural sector in the mid-1980s (Bauer, Aschmann, Mollah, and their contemporaries) and Cook's (2009) more recent work as an important learning record rather than 'an anatomy of failure' shows there can be no one determinant of successful Northern agricultural expansion. It will require integration of markets; supply chains; people and industry skills; flexible infrastructure; stable government policy, particularly for international trade and environmental management; market-driven investment in research, development and extension for national and international arenas - delivered through an adaptive planning process capable of accepting and responding to input from all levels, including the historical and individual experience from current participants.

This does not imply a 'recipe' for some clever person to develop, rather an approach that recognises and empowers a resilient and informed individual/industry/community, able to respond and adapt to challenge and adversity, and to find solutions through collaboration.

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