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The consequences of three urbanisation scenarios for northern Australia

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ABSTRACT

The Australian federal government white paper 'Our north, our future' projects that northern Australia's population could reach 5,000,000 by 2060. This represents an almost four-fold increase in population (an additional 3,700,000 people) all within the next 41 years. Given the ambiguities in the White paper about the distribution of this population, this paper ventures three settlement pattern scenarios to explore the issues these may pose. The paper concludes that population growth of the scale projected will require comprehensive, long term planning – without such planning the scale of population growth projected could result in negative environmental and societal consequences. As such, the discipline of planning in Australia should be aware of this emerging situation.

Introduction

This paper defines northern Australia as the region north of the Tropic of Capricorn (23.5° S latitude). This encompasses an area of 3,500,000 square kilometres, or 45% of Australia's total landmass, yet houses only 5% of its population. Despite its sparse habitation, northern Australia contains several small cities, major towns, and remote communities. In Western Australia, the major centres include the tourist town of Broome (population 15,000) and the mining towns of Port Hedland and Karratha (population 15,000 and 17,000, respectively). In the Northern Territory, these include the administrative city of Darwin (106,000), and in Queensland, the lifestyle cities of Cairns, Townsville and Mackay (population 140,000, 170,000 and 115,000, respectively), among others (Figure 1).

Proponents of northern development envisage often-extreme population growth, in part, because of the region's growing geopolitical importance. Indeed, northern Australia sits at the intersection of the 'two most important global axes of the twenty first century: Asia and the tropics' (Roux, Faubell, and McGauchie 2014, xi) – two regions that are projected to grow significantly in terms of population and economic might. Nonetheless, northern Australia continues to be considered a 'frontier' commensurate, to some degree, with historic frontiers such as the American West, the Canadian West and North, China's Sinkiang and Manchuria, and the Southern African veldt (Cohen 2000, 256). Because historical attempts at intensive development have been sporadic, northern Australia offers the largest intact 'savanna remaining on Earth, an extraordinarily vast, natural landscape with a

rich biodiversity of international significance' (Nix et al. 2013, 85). Indigenous cultural life in northern Australia also remains strong, bound to the landscapes, rivers, and wildlife that these traditional owners have managed for tens of thousands of years. Nonetheless, indigenous people in northern Australia also continue to experience 'chronic disadvantage' (Raupach et al. 2012, 29).

Government plans for developing northern Australia

Current federal government planning for northern Australia is encapsulated in the 'Our north, our future: white paper on developing Northern Australia' (Australian Government 2015, 1). Adopting a generally pro-development stance, in line with the conceptualisation of the north as a place of economic bounty and opportunity, the white paper declares that it should 'stand the test of time – it should be the first, and last, white paper for the north' (Australian Government 2015, 1). So as to fast track growth, the federal government has committed to providing a new \$5 billion Northern Australian Infrastructure Facility to provide concessional loans for the construction of major infrastructures such as ports, roads, rail, pipelines, and electricity and water supply (Australian Government 2015, 8). While the white paper is mute on issues of settlement patterns, there are general statements that allude to the government's support for significant urbanisation. As the report declares:

Development will require many more people living in the north. Transformation will not happen if its population inches up by a few hundred thousand over the next 20 years. It would remain a high cost, small-

Figure 1. Northern Australia existing towns and cities by population: Despite its generally sparse habitation, northern Australia does, contain a number of small cities and major towns. Plan by the author.

scale economy; more of a pilot project than a powerhouse. We need to lay the foundations for rapid population growth and put the north on a trajectory to reach a population of four to five million by 2060. (Australian Government 2015, 4)

Given northern Australia's current population of 1,300,000 (Australian Government 2015, 134), this represents an almost four-fold increase in population (an additional 3,700,000 people). The subsequent expansion in the urban area required is equivalent to 22 new Townsvilles, 36 new Darwins, or 253 new Broomes – all within the next 43 years. In this respect the white paper ambiguously refers to 'the development of major population centres of more than a million people' (Australian Government 2015, 3) – such cities would be six times the size of the current largest city Townsville, which has a population of 170,000 people.

There is a rich history in Australia of projecting over-ambitious targets for population growth. On the 1888 centenary of the arrival of the First Fleet in Sydney, a correspondent for the *Spectator* newspaper noted that 'There is every reasonable probability that in 1988 Australia will be a Federal Republic, peopled by 50,000,000 English speaking men' (Soutphommassane 2012, 132). Subsequently, others have ambitiously pitched Australia's carrying capacity as being as high as 500,000,000 (Cathcart 2010) – a projection made just

after the First World War – dwarfing Australia's current population of 23,000,000 by a factor of 20. Northern Australia has been the backdrop for such projections as well. In the mid-1980s, the Northern Territory Government established a manufacturing Trade Development Zone (TDZ), in Darwin. The Northern Territory Government invested more than \$26,000,000 in capital work in the TDZ, hoping to expand Darwin into 'a city of 2,750,000 people' by 2010 (Wu and Winchester 2015, 259) – its current population being just over 100,000.

The current city, state or territory planning of the north does not countenance the scale of population growth projected in the government's white paper 'Our north, our future'. Even the 2017 'Our north, our future' Implementation report released by the Office of Northern Australia has minimal commentary on northern settlement patterns (Office of Northern Australia 2017, 22).¹ The plan for Cairns and the surrounding Far North Queensland region scopes the period to 2031 and an additional population in the Cairns region of only 100,000 people (Queensland Government 2009, 12). Similarly, the planning scheme for Townsville has a scope that extends to 2031 and a population increase of only 110,000 people (Townsville City Council 2017, 3). Moreover, the 'Strategic Plan for Darwin', prepared by the City of Darwin, only scopes a period to 2020 and a comparatively minor population

increase of 22,000 people (City of Darwin 2012, 18) – despite being billed as the ‘long-term vision for Darwin’ (City of Darwin 2012, 22). As with Australia generally, planning continues to be organised on a city-by-city and state and territory basis (Freestone 2014, 7), and as such is spatially fragmented.

This research paper is important because the coincidence of (potentially) rapid population growth, a relative lack of long-term planning, and a ‘natural landscape with a rich biodiversity of international significance’ (Nix et al. 2013, 85) are concerning. Biodiversity losses and species extinctions over the next century are expected to be high, driven in part by climate change and land use changes that convert natural vegetation to urban uses (Dorning et al. 2015, 28; Villarreal et al. 2013, 90). This is particularly the case in relation to urbanisation on the outskirts of cities that frequently overlap with locations rich in biodiversity (Dorning et al. 2015, 28), such as in northern Australia. Moreover, this research is important because northern Australian cities such as Darwin, and towns such as Port Hedland, experience elevated levels of socioeconomic stratification between central and fringing urban areas. For reasons of societal inclusivity and cohesiveness, it is crucial that potentially rapidly growing cities in northern Australia do not compound this issue.

Method

With these issues in mind, this research paper explores the following research question:

What are the possible environmental and societal consequences of different distributions of a northern Australian population of 5,000,000?

While the credibility of the federal government’s population projections for 2060 is debatable, given that Australia’s overall population is officially projected to double to 42,400,000 in the same time period – and triple to 70,100,000 by 2101² (Australian Bureau of Statistics 2013) – such an apparently modest increase of population in northern Australia is conceivable over the longer term. To explore the implications of this scale of population growth in northern Australia, the following section sets out three scenarios, which distribute this potential population of 5,000,000 in different forms.

This ‘single themed’³ scenario planning exercise (Xiang and Clarke 2003, 897) – in which population distribution forms the dominant dimension – builds on previous land-development scenarios which have ‘been in the planner’s toolkit for several decades’ (Chakraborty et al. 2011, 251; Xiang and Clarke 2003, 885). In essence, it provides spatial representations of possible future urban urbanisation and landscape change (Villarreal et al. 2013, 90), which could result

from particular population distributions. It is intended that this process will expose different ways of thinking about accommodating population growth in the north, in a way that can open a dialogue around this issue, not prescribe a ‘correct answer’ (Logg-Scarvell, Navis, and Patrick 2015, 51).

In answering this research question, we consider three different scenarios for how the federal government could seek to distribute this northern Australian population of 5,000,000 by 2060 (Australian Government 2015) – and which we believe are plausible (Figure 2). We have constructed scenario 1 ‘growth’ on the assumption that population growth will magnify the existing distribution of urban population in northern Australia, i.e., that the four biggest urban centres will continue to get bigger. In this scenario, economic and lifestyle factors concentrate the increased population of northern Australian in the four dominant northern cities Darwin, Cairns, Townsville and Mackay – all which would have populations just over 1,000,000 by 2060.

We have constructed scenario 2 ‘decentralised growth’ on the assumption that federal planning for the decentralisation of urban population will achieve relative population ‘balance’ across northern Australia, i.e. federal, state and territory governments will decant population growth across the eight biggest urban centres in northern Australia. In this scenario, top-down government planning – typical of the Department of Urban and Regional Development in the 1970s (Oakley 2004) – sees Port Hedland, Broome, Kununurra, Darwin, Cairns, Bowen, Townsville and McKay increase in population by 462,000 people each.

We have constructed scenario 3 ‘concentrated growth’ on the assumption that the primacy of capital cities which characterises population distribution across southern Australia (Freestone 2013) will apply in northern Australia, i.e. population growth is concentrated in a primate city. In this scenario economic opportunities see northern Australia’s growing population concentrated in Darwin, the ‘unofficial capital of the north’, which would grow by 1,500,000 people by 2060, reaching a total of 1,622,000. This figure is commensurate with the Australian federal government’s 2015 vision of northern cities with ‘more than a million people’ by 2060 (Australian Government 2015, 3). The other cities of the north would accommodate the remaining 2,200,000 people collectively. These three scenarios provide reasonable coverage across a spectrum of futures.

In understanding the environmental consequences of these different scenarios we have conducted a McHargian landscape analysis (McHarg 1971) of the peri-urban regions of the northern Australia’s major cities (Darwin, Cairns, Townsville and Mackay) to understand what land could be urbanised to accommodate the increased population of the various scenarios

Scenario number	Scenario name	Scenario population distribution 2060 (distribution of +3,700,000 projected in White Paper)
Scenario 1	Growth	+3,700,000 into 4 cities Darwin= + 925,000 Cairns= + 925,000 Townsville= + 925,000 Mackay= + 925,000
Scenario 2	Decentralised growth	+3,700,000 into 8 cities Darwin= + 462,000 Cairns= + 462,000 Townsville= + 462,000 Mackay= + 462,000 Kununurra= + 462,000 Bowen= + 462,000 Broome= + 462,000 Port Hedland= + 462,000
Scenario 3	Concentrated growth	+3,700,000 principally into Darwin Darwin= +1,500,000 Cairns= +733,000 Townsville= +733,000 Mackay= +733,000

Figure 2. Scenario overview. In this paper, we consider three different scenarios for how the federal government could seek to distribute a northern Australian population of 3,700,000 additional people by 2060.

(Figure 3). Areas suitable for urban expansion we have defined as those that do not contain remnant vegetation, foreshore flats, flats, watercourses or excessively steep topography, are not prone to bushfires, are not designated reserves and are within 50 km of existing city centres. This method derives from conservation planning in which conservation priority areas are protected, essentially removing them from eligibility for development (Dorning et al. 2015, 29; Forman 2010, 200) (Figures 4–7). Such a conservation planning approach is relevant in the north of Australia generally because the north is an ‘extraordinarily vast, natural landscape with a rich biodiversity of international significance’ (Nix et al. 2013, 85).

We have conducted this geospatial analysis principally using the Geoscience Australia 1:250,000 data set (Geoscience Australia 2018), a Geoscience Australia (1 second SRTM) Digital Elevation model (Australia 2010) and fire scar mapping in relation to bush fires (National Climate Change Adaption Research Facility 2018). This landscape analysis leaves us potentially developable areas that we measure to estimate their capacity to absorb the Federal government proposed population growth.

Presuming developers develop this remaining area, we then consider the impacts on biodiversity of this urban form. The broad-brush analysis we conduct in relation to renowned urban ecologist Richard Forman’s four urban models for accommodating urban growth. The first is ‘satellite cities’ which involves focusing urbanisation concurrently around satellite cities in an urban region to help to protect the land near a dominant metropolitan area which may be of considerable ecological importance (Forman 2010, 201). The second is ‘concentric zones’ which involves concentric yet compact growth around an existing city (Forman 2010, 202). The third is ‘transportation corridors’ and

involves strip development along a major radial transportation corridor which progressively subdivides the landscape (Forman 2010, 201). The fourth is ‘dispersed sites’ which involves dispersed development and produces a wide zone of relatively low-density development, or sprawl, around the city (Forman 2010, 202) (Figure 8).

Forman’s analysis points to a clear ordering of the urbanisation models from best to worst in terms of their effects on biodiversity: (1) satellite cities; (2) concentric zones; (3) transportation corridors and (4) dispersed sites. Urbanisation in dispersed sites surrounding a metropolitan area can cause extensive nature-and-human resource degradation, and thus planners and policymakers should avoid or minimise this strategy. Wide strips of development along highway corridors (3) usually degrade creeks and rivers crossing the region, and block movement patterns of certain key wildlife species, leaving them semi-isolated in smaller sections of the region (Forman 2010, 221). We use Forman’s ordering to assess, in broad-brush terms, the potential impacts on biodiversity.

In understanding the societal consequences of the different scenarios we consider the length of sprawl of the urban form which results from this process and reflect on the ability of government to efficiently service it with public transport and thus provide access for residents in new areas to the employment opportunities, cultural attractions and conveniences of the existing urban centres. We also consider the ability of residents of new urban areas to access the natural amenity of the coastline. Both of these criteria are important, and public transport and access to natural amenity are defining factors of a city’s liveability (The Economist Intelligence Unit Limited 2012, 8). Moreover, there are numerous examples in northern Australia where governments have

Figure 3. McHargian landscape analysis. In this paper, we have used a McHargian analysis to determine the capacity of the peri-urban regions of northern Australia's cities to accommodate urban expansion.

struggled to connect far-flung suburbs with dominant city centres, and this has resulted in elevated levels of socio-economic disadvantage being concentrated in outer suburbs. Examples include the Darwin suburb of Palmerston, the Radburn-planned suburb of Port

Hedland, South Hedland (Neilson 1983, 91), and the Heavitree Gap suburb of Alice Springs (Carter 2016, 94).

In estimating the degree of 'sprawl' in each scenario, we have used a population density of 1000

Figure 4. Darwin constraints. A McHargian landscape analysis of the peri-urban areas of Darwin reveals substantial constraints to urbanisation such as low lying flats and foreshore flats and remnant vegetation: Key 1. Darwin built up area; 2. Shoal Bay Coastal Reserve; 3. Melacca Swamp Conservation Area; 4. Manton Dam; 5. Litchfield National Park.

Figure 5. Cairns constraints. A McHargian landscape analysis of the peri-urban areas of Cairns reveals substantial constraints to urbanisation such as designated reserves, forests and significant topographic features: Key 1. Little Mulgrave National Park; 2. Kuranda National Park; 3. Bilwon Forest Reserve; 4. Baldy Mountain.

Figure 6. Townsville Constraints. A McHargian landscape analysis of the peri-urban areas of Townsville reveals substantial constraints to urbanisation such as low lying foreshore flats, designated reserves, forests and significant topographic features: Key 1. Mount Surround Shirbourne; 2. Mount Cateract; 3. Mingela State Forest.

Figure 7. Mackay constraints. A McHargian landscape analysis of the peri-urban areas of Mackay reveals that it has substantial reserves of land for potential urbanisation: Key 1. Cape Palmerston; 2. Ben Mohr State Forest; 3. Mount Charlton.

people per square kilometre to house the increased populations in the three scenarios. This density is broadly commensurate with Australian cities such as

Townsville, Brisbane, Perth and the Gold Coast, which are amongst the least densely settled in the world (Hunn 2017).

Figure 8. Models of urban expansion. This diagram shows Richard T Forman's models for urban expansion. Forman's analysis points to a clear ordering of the urbanisation models from best to worst in terms of their effects on biodiversity: (1) satellite cities; (2) concentric zones; (3) transportation corridors and (4) dispersed sites.

Results

Scenario 1: Growth

In this scenario, early twenty-first-century trends towards economic centralisation and primacy⁴ in Australian cities continue, and therefore northern population growth principally occurs in the north's four major cities. This results in a situation where the dominant northern cities Darwin, Cairns, Townsville and Mackay all have populations over just over 1,000,000 by 2060. Such dominant gateway cities, by 2060, are commensurate in population size with the Australian federal government's 2015 vision of northern cities with 'more than a million people' (Australian Government 2015, 3). As a gateway, 'beta' global cities, these centres could become instrumental in linking their respective territories into the world economy (Gussen 2017, 27) (Figure 9).

This additional population for Darwin, Cairns, Townsville and Mackay requires 925 km² of urban expansion in each city region. At the same time the amount of unconstrained land in Darwin, Cairns, Townsville and Mackay is 296, 1798, 957 and 2303 km², respectively (within a 50 km radius of the existing city centres). This points to obvious growth capacity issues in Darwin and Townsville (Figure 10).

This extreme growth in the major cities of the north – a 900% increase in their existing population size in four decades – is concerning particularly if policymakers and planners do not comprehensively plan for it due to the spatial fragmentation of planning, limited timeframes and a lack of bipartisan agreement between opposing federal and state governments. As a result, it could lead to several negative outcomes.

Environmental and societal implications for Darwin

The added population for Darwin requires 925 km² of urban expansion, at the same time Darwin has only 296 km² of non-constrained land (within a 50 km radius of the existing city centre) (Figure 11). The result of this could be that developers conduct large-scale clearing of remnant vegetation to create the required area of urbanisation. Darwin would also sprawl in the form of Forman's 'transportation corridor' model which would likely degrade creeks and rivers crossing the region and block movement patterns of certain key wildlife species (Forman 2010, 221).

The societal implications of this level of growth could be negative. If forested or waterlogged landscapes were respected Darwin would sprawl in the form of a long corridor virtually connecting Darwin to Humpty Doo and Acacia Hills. This sprawl would be difficult to serve with public transport (due to the length of the corridor form) and would offer poor access to the coast and the cultural amenity and jobs which Darwin's city centre offers, as well as potentially concentrating socio-economic deprivation in far-flung inland suburbs.

Environmental and societal implications for Cairns

The added population for Cairns requires 925 km² of urban expansion and Cairns has 1798 km² of non-constrained land (within a 50 km radius of the existing city centre) (Figure 12). Nonetheless, if planning and constraints protected forested, flood-prone and steep landscapes from urban development Cairns would require the development of inland areas (in the vicinity of Mareeba, Atherton and Gordonvale) in the form of Forman's (4) dispersed sites model (4) and urban development would also sprawl in a 'transportation corridor' model (3) along the coastal strip to Babinda,

This corridor development along the coast would degrade creeks and rivers crossing the region, and block movement patterns of certain key wildlife species (Forman 2010, 221). The dispersed suburbs inland of Cairn's existing city centre would be difficult to serve with effective public transport and would offer poor access to the jobs of the city centre and the natural amenity of the coast and inland areas.

Environmental and societal implications for Townsville

The additional population for Townsville requires 925 km² of urban expansion which is roughly commensurate with Townsville's 957 km² of non-constrained land (within a 50 km radius of the existing city centre) (Figure 13). The additional 925 km² of urbanisation required in this scenario would mean Townsville would sprawl, to some degree, in the form

Figure 9. Scenario 1: Growth. In this scenario, northern population growth principally occurs in the north's four major cities. This results in a situation where the dominant northern cities Darwin, Cairns, Townsville and Mackay (and adjacent towns) all have populations over just over 1,000,000 by 2060 Plan by the author.

Figure 10. Scenario 1: Growth. This graph shows the capacity for urban expansion by city: this graph shows growth capacity issues in Darwin and Townsville.

of Forman's 'transportation corridors' model along the coast and in a 'dispersed sites' model around the existing centres of Giru and Woodstock, to the east and west of Mount Surround. These dispersed suburbs

(near Giru and Woodstock) could suffer many of the same accessibility of those surrounding Cairns and according to Forman could cause extensive nature-and-human resource degradation (Forman 2010, 221).

Figure 11. Scenario 1: Growth – Darwin. The additional 925 km² of urbanisation required in this scenario would mean Darwin would sprawl in the form of a Forman’s ‘transportation corridor’ model as far as Humpty Doo (1) and Acacia Hills (2).

Figure 12. Scenario 1: Growth – Cairns. The additional 925 km² of urbanisation required in this scenario would mean Cairns would sprawl in the form of a Forman's 'transportation corridors' model as far as Babinda (4) and in a 'dispersed sites' model around the existing centres of Mareeba (1), Atherton (2) and Malanda (3).

Figure 13. Scenario 1: Growth – Townsville. The additional 925 km² of urbanisation required in this scenario would mean Cairns would sprawl, to some degree, in Forman's 'transportation corridors' model along the coast and in a 'dispersed sites' model around the existing centres of Giru (1) and Woodstock (2), to the east and west of Mount Surround (3).

Figure 14. Scenario 1: Growth – Mackay. The additional population for Mackay requires 925 km² however Mackay should be able to easily accommodate such growth. This growth could see the areas around Marian (1) and Alligator Creek (2) urbanised in what Forman describes as the ‘concentric zones’ model.

Environmental and societal implications for Mackay

The additional population for Mackay requires 925 km² of urban development; however, Mackay should be able to easily accommodate such growth in the substantial amount of unconstrained land within a 50 km radius of the existing urban centre (Figure 14). Population growth of this scale could see the areas around Marian (1) and Alligator Creek (2) urbanised in what Forman describes as the ‘concentric zones’ model (Forman 2010, 202) which governments could fairly easily service with public transport and which should not cause substantial environmental degradation.

Summation of scenario 1 implications

Except for Mackay, the prevalence of Forman’s ‘transportation corridors’ and ‘dispersed sites’ model in Darwin, Mackay and Townsville is concerning from an environmental and societal perspective. In this scenario, the risk is that ultimately the growth of Darwin, Cairns and Townsville, in particular, could degrade the natural amenity which at current is the region’s tourism and migration drawcard (Bohnet and Pert 2010, 239). Moreover, this extreme population growth could lead to resentment from existing residents towards both overseas and Australian immigrants that they regard as threatening the access the relaxed lifestyle and access to nature originally offered by these comparatively small cities (Bohnet and Pert 2010, 246). These cities could also become heavily stratified between those who can afford housing in convenient and amenable inner and middle areas and those consigned to poorly connected outer suburbs.

Scenario 2: Decentralised growth

In this scenario federal, state and territory governments distribute the increased population of northern Australian into the eight most significant urban centres. As a result, Port Hedland, Broome, Kununurra, Darwin, Cairns, Bowen, Townsville and McKay would increase in population by 462,000 people each (Figure 15). The urban expansion – per centre – required to contain this additional population would be 462 km². Again these projections are based on a low population density of 1000 people per square kilometre found in Australian cities such as Brisbane, Perth and the Gold Coast (Hunn 2017).

A federal government-driven ‘Northern Cities’ taskforce could deliver such a pattern of population distribution if it was authorised to delineate future urban growth areas, establish spatial limits for existing centres, and coordinate city infrastructure spending (Haratsis 2010, 248) in a manner that is reminiscent of the Department of Urban and Regional

Development from the 1970s (Oakley 2004, 299). The delineation of future growth areas would need to be determined by a systematic analysis of enabling infrastructure such as existing ports and international airports, secure water supplies, economic development prospects, climate, distance from coast, present population, environmental fragility, and human carrying capacity⁵ (Cocks 1992, 216).

Significant federal government investment in infrastructure would assist in enabling the decentralisation of population growth. Such investments could include the forging of a passenger and freight rail network between Broome and Karratha on the west coast (connection the ‘lifestyle city’ of Broome to the economic powerhouse of the Pilbara and the deep-water port at Port Hedland⁶) and an upgraded passenger and freight line between Cairns and Rockhampton (reflecting a similar lifestyle to economic powerhouse dynamic). An efficient regional rail service from Port Hedland to Broome trip would take 3 hours and the Cairns to Rockhampton 5 hours. Complementing these rail connections could be a regional rail spur line from the Adelaide to Darwin rail line to Wyndham and Kununurra to Darwin. This could connect the city of Darwin with the significantly expanded Ord River Irrigation area that provides the city with much of its food.

Environmental and societal implications

The urban expansion – per centre – required to contain the additional population in this scenario would be 462 km². This amount of urban expansion poses issues for Darwin (the most constrained of the northern cities with only 296 km² of developable land) but could comfortably be accommodated in Cairns (1798 km²), Townsville (957 km²) and Mackay (2303 km²) which all have substantial reserves of non-constrained land (within a 50 km radius of the existing city centres) for this expansion to occur (Figure 16). While Darwin would sprawl in a transportation corridors which degrades creeks and rivers crossing the region, and blocks movement patterns of certain key wildlife species – Cairns, Townsville and Mackay should be able to accommodate this growth in Forman’s concentric zones model which involves concentric yet compact growth around an existing city (2010, 202) and shouldn’t lead to extensive environmental degradation.

Moreover, the moderate size of these cities that result from this scenario could be optimal for northern Australia in that they potentially offer access to natural amenity as well as a balance of job opportunities, housing affordability, income, school sizes, health services and low crime rates (MacDonald 2017). Moreover, this model of compact, concentric small-sized cities should be comparatively easy to serve with public transport and should not entrench major socio-economic divisions between city centre and peripheral suburbs.

Figure 15. Scenario 2: Decentralised growth. In this scenario federal, state and territory governments distribute the increased population of northern Australian into the eight most significant urban centres. As a result, Port Hedland, Broome, Kununurra, Darwin, Cairns, Bowen, Townsville and McKay would increase in population by 462,000 people each.

Importantly through establishing such a networked regional structure of eight cities, governments could foster ‘an urban and rural dynamic’ which is able to both ‘maintain home-grown capacity locally and

attract human capital from elsewhere’ (Dale 2014, 139). Moreover, such connections could be of vital importance to indigenous youth and young adults in remote communities whom sometimes are in desperate

Figure 16. Scenario 2: Decentralised growth. This graph shows the capacity for urban expansion by city. In this scenario, the graph reveals capacity issues only in Darwin – the other cities having comparatively higher amounts of non-constrained land for potential urbanisation.

need of an escape route from chronic disadvantage (Raupach et al. 2012, 29).

Scenario 3: Concentrated growth

In this third scenario, the presence of economic opportunities concentrates northern Australia's growing population in Darwin, the 'unofficial capital of the north', which would grow by 1,500,000 people by 2060, reaching a total of 1,622,000 (Figure 17). This figure is commensurate with the Australian federal government's 2015 vision of northern cities with 'more than a million people' by 2060 (Australian Government 2015, 3). The other cities of the north would accommodate the remaining 2,200,000 people. This growth of population in Darwin could reflect the 'balance and orientation' of the nation shifting northwards (Carroll 2005, 178). Moreover, it could be, in part, precipitated by building a high-speed rail link connection Darwin to the southern cities (Carroll 2005, 178).

A Darwin of 1,622,000 would probably function as a beta level city and would likely be instrumental in linking the Northern Territory into the world economy (Gussen 2017, 27). While not a full alpha global city, it would, to some degree, compete for global capital and workers with other smaller cities in the adjacent region (Gussen 2017, 26). Reflecting this Darwin's

economy could be partly driven by 'advanced producer services' include accounting, advertising, finance, insurance, and law delivered to the region (Gussen 2017, 26). Complimenting these roles could be Darwin's prominence as an Australian hub for global tertiary education provision (Bolleter and Weller 2013) as well as a hub for administering resource extraction operations. Reflecting these drivers, Darwin's population could continue to be richly multi-cultural and the city a gateway to the 'Asian Century'.

Environmental and societal implications

The urban expansion required to contain this additional population for Darwin is 1500 km² which would dwarf Darwin's 296 km² of developable land within 50 km of the existing city centre – but would certainly take the pressure off the other cities (Figure 18). Nonetheless, Darwin would sprawl in a transportation corridors model. This is potentially a major issue from a biodiversity perspective because wide strips of development along highway corridors degrade creeks and rivers crossing the region, and block movement patterns of certain key wildlife species (Forman 2010, 221), moreover the city would inevitably sprawl into areas of remnant vegetation and low lying, flood-prone land – both which would cause extensive environmental degradation (Figure 19).

Figure 17. Scenario 3: Concentrated growth. In this third scenario, the presence of economic opportunities concentrates northern Australia's growing population in Darwin, the 'unofficial capital of the north', which would grow by 1,500,000 people by 2060, reaching a total of 1,622,000.

Figure 18. Scenario 3: Concentrated growth. This graph shows the capacity for urban expansion by city: this graph shows growth capacity issues in only in Darwin due to the limited availability of unconstrained land. While this scenario would cause significant issues for Darwin it could certainly take the pressure off the other cities.

Given its constrained site, the urban expansion required to contain this growth could occur much further than 50 km from the existing centre of Darwin when we measure this distance along the road network. This tenuous connection between outer suburbs and city centre could lead to socio-economic stratification, as it would be difficult to serve these fringing suburbs with effective public transport and as such provide their residents with access to the cultural amenity and job opportunities of Darwin's city centre. While Darwin's extremely rapid growth could take the pressure off other cities in the north, it could however also tend to trap most federal and international investment in the region, and as such little investment would make its way to regional areas of the north – possibly leading to some resentment from other population centres and regions.

Discussion

There is no one 'correct' settlement pattern for northern Australia (Logg-Scarvell, Navis, and Patrick 2015, 51). Indeed, over the longer term, the answer lies in a hybridised approach that utilises the best aspects of the scenarios 1 and 2 in relation to changing conditions – such as climate change, economic fortunes, governance, geopolitics and disruptive transport technologies, amongst others.

However, given what we currently know – in the short term, building on the existing strengths of the major northern cities makes much sense (scenario 1) – if we employ a concentric zones model (Forman 2010, 221). These cities are where substantial investment in infrastructure has occurred to date and, as his-

tory tells us, we should fully utilise these investments before launching off into the regions in regional city building exercises (Lonsdale 1972). With prudent planning of these cities using a concentric zones model, there is also no reason the liveability, economic viability, and vibrancy of these cities cannot flourish, at least with measured increases in population.

Over the longer term, given the constrained sites of cities such as Darwin, Cairns and Townsville, and likely community resistance to dramatic population increases, there will be spatial and societal limits to their potential growth, and as such opportunities for boosting other regional centres to city status (scenario 2) – in Forman's satellite cities model (Forman 2010, 221). Anticipating the timing of these tipping points – where decentralisation from the north's larger cities to regional centres will become feasible – is notoriously difficult. Nonetheless, it may be that the tipping points for northern cities are arrived at much earlier than has been the case in the south; as such, this may occur well before the north's cities reach a population of just over a million people (as discussed in relation to scenario 1). Of course, the decentralisation of population from these dominant northern cities will also require a strong ideally national planning frameworks to coordinate this population distribution in a manner which is efficient and equitable (Haratsis 2010, 218).

Irrespective of the settlement pattern scenario, without overarching, long term planning frameworks to steer urbanisation in the north, population growth will yield negative environmental and societal outcomes (as scenarios 1 and 3 highlight). Both the 'Our north, our future' white paper, and the related implementation report (Office of Northern Australia

Figure 19. Scenario 3 – Darwin. In this scenario, the urban expansion required to contain this additional population for Darwin is 1500 km² which would dwarf Darwin's 296 km² of developable land within 50 km of the existing city centre. If planners respected the areas existing vegetation and foreshore flats the city would sprawl in a transportation corridors model as far as Humpty Doo (1) and Acacia Hills (2).

& Australian Government Department of Industry 2017) – lack this long-term, holistic spatial planning of future settlement patterns.

Such an overarching planning framework requires a partnership between federal, state/territory, and local governments to devise and implement a bipartisan settlement strategy to steer the urbanisation of northern Australia. Policy makers and planners should develop this plan in relation to a comprehensive landscape analysis of northern Australia to understand which spatial areas have the highest carrying capacity, secure water supplies, economic opportunity, and existing infrastructure such as ports and airports as well as environmental fragility – an analysis similar to that which CSIRO scientist Doug Cocks carried out in 1992 (Cocks 1992, 216).

Brendan Gleeson entitles such an overarching planning framework, an ‘Australia Plan’ (2010, 133), and Brian Haratsis proposes it could delineate future urban growth areas, establish spatial limits for existing cities, and be coordinated with an infrastructure plan directing national and global infrastructure spending (2010, 248). One key aspect of such a plan should be to lay the groundwork for the decentralisation of population from the dominant cities in the north – for when the time is right (scenario 2). This decentralisation is likely to be the most opportune in terms of maintaining the liveability of existing cities but also cause the least environmental degradation (Forman 2010, 218). The scale of planning, as embodied by an Australia Plan (or similar), would be dependent on a renewed federal government involvement in urban matters, reminiscent of the Department of Urban and Regional Development from the 1970s (Oakley 2004, 299). While an Australia Plan has obvious virtues, it is something that would be extremely difficult to reconcile with the current political climate. Nonetheless, the need for this scale of planning remains.

Regardless of the pattern of population distribution in the north, a population of 5,000,000 could dramatically outstrip the carrying capacity of the land (Lane 2017). In 2017, research by Lane revealed that even the current meagre populations of the Northern Territory and the north of Western Australia have already significantly exceeded the landscape’s carrying capacity. In fact, the only area of northern Australia that hasn’t outstripped its carrying capacity is the ‘Northern Gulf’ region east of Cairns (Lane 2017). While southern Australia also has issues in this respect, particularly along the eastern seaboard, these issues pale in comparison to those in northern Australia. From a population carrying capacity perspective, the federal government should decide whether a population of 5,000,000 in the north is something that we should aspire to at all.⁷ Moreover, in the longer term, if the worst climate change projections are borne out, some directed migration from far northern cities

such as Darwin to cities further south or indeed the southern states may be necessary. Of course, this all depends on our ability to reduce carbon emissions and limit global temperature rise, for which there exists a multitude of projections and opinions (Climate Home News 2017).

This paper has advanced three potential scenarios for a northern Australian population of up to 5,000,000, as projected in the ‘Our north, our future’ report (Australian Government 2015, 4). These scenarios raise the possible detrimental societal and environmental effects of this scale of population growth, particularly if not planned for in a holistic, long-term manner. We have intended this paper to act as a briefing to the discipline of planning in Australia – which should be concerned with these evolving issues and lobbying government through the institute.

Notes

1. It does, however, refer to ‘City Deals’ policy (recently established by the Australian Government) in which ‘the three levels of government, the community and private enterprise... work to align the planning, investment and governance necessary to accelerate growth and job creation, stimulate urban renewal and drive economic reforms.’ While a much-needed initiative, this policy is city-specific and not geared to delivering broader regional settlement patterns (Department of the Prime Minister and Cabinet 2017).
2. These are ‘series A’ projections and are the highest of the three sets of projections the Australian Bureau of Statistics produces.
3. Usually, a single-themed scenario set comprises two or three scenarios (Xiang and Clarke 2003, 898).
4. Primacy refers to the concentration of population in the capital cities. Australia generally exhibits a very high degree of primacy with 64% of Australians living in the state capital cities (Hugo 2012, 18).
5. Such a comprehensive analysis was conducted by well-respected CSIRO scientist Doug Cocks in 1992 (Cocks 1992, 216). Cocks’ mapping and selection of site for future urban growth underpin this ‘decentralised growth’ scenario.
6. Only Port Headland and Townsville have significant deep water ports (Project Gutenberg 2017).
7. The current limited carrying capacity of the north means that Darwin has Australia’s highest ecological footprint per person (7.1 hectares) compared to southern cities such as Melbourne (6.4 hectares) or Hobart (5.7 hectares) (Turner and Foran 2008, 36).

References

Australia, G. 2010. *Geoscience Australia, 1 Second SRTM Digital Elevation Model (DEM)*. <https://data.gov.au/data/dataset/9a9284b6-eb45-4a13-97d0-91bf25f1187b>.

- Australian Bureau of Statistics. 2013. *Population Projections, Australia, 2012 to 2101*. [http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features5201220\(base\)20to%202101](http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features5201220(base)20to%202101).
- Australian Government. 2015. *Our North, Our Future: White Paper on Developing Northern Australia*. Canberra: Australian Government.
- Bohnet, I. C., and P. L. Pert. 2010. "Patterns, Drivers and Impacts of Urban Growth – A Study from Cairns, Queensland, Australia From 1952 to 2031." *Landscape and Urban Planning* 97 (4): 239–248.
- Bolleter, J., and R. Weller. 2013. *Made in Australia: The Future of Australian Cities*. Perth: University of Western Australia Publishing.
- Carroll, J. 2005. "Develop the North." *Griffith Review* 9 (86).
- Carter, P. 2016. "Lines." *Postcolonial Studies* 19 (1): 94–96.
- Cathcart, M. 2010. *The Water Dreamers: The Remarkable History of Our Dry Continent*. Melbourne: Text Publishing.
- Chakraborty, A., N. Kaza, G.-J. Knaap, and B. Deal. 2011. "Robust Plans and Contingent Plans: Scenario Planning for an Uncertain World." *Journal of the American Planning Association* 77 (3): 251–266.
- City of Darwin. 2012. *Evolving Darwin Towards 2020: Strategic Plan*. Darwin: City of Darwin.
- Climate Home News. 2017. *Global Carbon Emissions Rise in 2017, Driven by China*. <http://www.climatechangenews.com/2017/11/13/global-emissions-expected-rise-2017-say-researchers/>.
- Cocks, D. 1992. *Use with Care*. Sydney: New South Wales University Press.
- Cohen, S. B. 2000. "The Polyurban Frontier in Post-industrial Israel." In *Developing Frontier Cities*, edited by H. Lithwick and Y. Gradus, 255–271. London: Springer.
- Dale, A. 2014. *Beyond the North-south Culture Wars: Reconciling Northern Australia's Recent Past with Its Future*. New York: Springer.
- Department of the Prime Minister and Cabinet. 2017. *Smart Cities Plan*. <https://cities.dpmc.gov.au/>.
- Dorning, M. A., J. Koch, D. A. Shoemaker, and R. K. Meentemeyer. 2015. "Simulating Urbanization Scenarios Reveals Tradeoffs Between Conservation Planning Strategies." *Landscape and Urban Planning* 136: 28–39.
- The Economist Intelligence Unit Limited. 2012. *Best Cities Ranking and Report: A Special Report from the Economist Intelligence Unit*. London: The Economist Intelligence Unit Limited.
- Forman, R. 2010. *Urban Regions: Ecology and Planning Beyond the City*. Cambridge: Cambridge University Press.
- Freestone, R. 2013. "Back to the Future." In *Made in Australia: The Future of Australian Cities*, edited by J. Bolleter and R. Weller, 236–243. Perth: University of Western Australia Press.
- Freestone, R. 2014. "Progress in Australian Planning History: Traditions, Themes and Transformations." *Progress in Planning* 91: 1–29.
- Geoscience Australia. 2018. *Geodata Topo 250K Series 3 – (Personal Geodatabase Format)*. <https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search?node=srv#/metadata/63999>.
- Gleeson, B. 2010. *Lifeboat Cities*. Sydney: UNSW Press.
- Gussen, B. F. 2017. "Can Charter Cities 'Anabolise' the Australian Federation?" *Public Administration and Policy* 20 (1): 18–38.
- Haratsis, B. P. 2010. *Australia 2050: Big Australia?* Adelaide: Digital Print Australia.
- Hugo, G. 2012. *Population Distribution, Migration and Climate Change in Australia: An Exploration*. Urban Management, Transport and Social Inclusion, 1–101. Canberra: National Climate Change Adaption Research Facility.
- Hunn, P. 2017. *Australian Cities among the Largest and Least Densely Settled in the World*. <https://architectureau.com/articles/australian-cities-among-the-largest-and-least-densely-settled-in-the-world/>.
- Lane, M. 2017. "Exploring Short-Term and Long-Term Time Frames in Australian Population Carrying Capacity Assessment." *Population and Environment* 38 (3): 309–324.
- Logg-Scarvell, J., R. Navis, and K. Patrick. 2015. "Scenarios for Australia in 2050: A Synthesis and Proposed Survey." *Journal of Futures Studies* 19 (3): 49–76.
- Lonsdale, R. 1972. "Manufacturing Decentralization: The Discouraging Record in Australia." *Land Economics* 48 (4): 321–328.
- MacDonald, E. 2017. *City More Liveable than Cairns, Brisbane*. <http://liveablecities.org.au/city-more-liveable-than-cairns-brisbane/>.
- McHarg, I. 1971. *Design with Nature*. New York: Doubleday/Natural History Press.
- National Climate Change Adaption Research Facility. 2018. *Fire Data – Fire Scar Maps*. <http://nccarf.jcu.edu.au/terrestrialbiodiversity/index.php/43-fire/172-fire-data-fire-scar-maps.html>.
- Neilson, L. 1983. "How Local Government Comes to Company Towns." *Australian Planner* 21 (4): 91–92.
- Nix, H., B. Mackey, B. Traill, and J. Woinarski. 2013. *The Nature of Northern Australia: Its Natural Values, Ecological Processes and Future Prospects*. Acton: ANU Press.
- Oakley, S. 2004. "Politics of Recollection: Examining the Rise and Fall of DURD and Better Cities Through Narrative." *Urban Policy and Research* 22 (3): 299–314.
- Office of Northern Australia. 2017. *Our North, Our Future: Developing Northern Australia 2017 Implementation Report*. Canberra: Office of Northern Australia.
- Office of Northern Australia & Australian Government Department of Industry, Innovation and Science. 2017. *Our North, Our Future: Developing Northern Australia 2017 Implementation Report*. Canberra: Office of Northern Australia & Australian Government Department of Industry, Innovation and Science.
- Project Gutenberg. 2017. *List of Deep Water Ports*. http://self.gutenberg.org/articles/eng/List_of_deep_water_ports.
- Queensland Government. 2009. *Far North Queensland Regional Plan 2009–2031: Planning for a Stronger, More Liveable and Sustainable Community*. Brisbane: Queensland Government.
- Raupach, M., A. McMichael, K. Alford, E. Fulton, J. Finnigan, N. Grigg, and B. Walker. 2012. "Living Scenarios for Australia as an Adaptive System." In *Negotiating Our Future: Living Scenarios for Australia to 2050*, edited by M. Raupach, A. McMichael, J. Finnigan, L. Manderson, and B. Walker, 1–53. Canberra: Australian Academy of Science.
- Roux, A., M. Faubell, and D. McGauchie. 2014. *Northern Development: Creating the Future Australia*. Melbourne: ADC Forum.
- Southommasane, T. 2012. *Don't Go Back to Where You Came from: Why Multiculturalism Works*. Sydney: Newsouth.

- Townsville City Council. 2017. *Planning Together for Townsville's Future*. Townsville: Townsville City Council.
- Turner, G., and B. Foran. 2008. *Resource Consumption and Resource Depletion*. Melbourne: CSIRO Publishing and Dordrecht: Springer.
- Villarreal, M. L., L. M. Norman, K. G. Boykin, and C. S. Wallace. 2013. "Biodiversity Losses and Conservation Trade-offs: Assessing Future Urban Growth Scenarios for a North American Trade Corridor." *International Journal of Biodiversity Science, Ecosystem Services & Management* 9 (2): 90–103.
- Wu, J., and H. P. Winchester. 2015. "Globalisation and Border Dynamics: Impacts on the Urban Development of Darwin, Australia." *Australian Geographer* 46 (2): 255–270.
- Xiang, W.-N., and K. C. Clarke. 2003. "The Use of Scenarios in Land-Use Planning." *Environment and Planning B: Planning and Design* 30 (6): 885–909.