

Sea- and tree-change phenomena in the Wet Tropics: Impacts of urbanisation and mitigation potential

Final Project Report



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Acronyms and Abbreviations

| | |
|-----------------------|--|
| CBD | Central Business District |
| DCDB | Digital cadastral database |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act (1999)</i> (Commonwealth) |
| GIS | Geographic Information System |
| IPA | Queensland <i>Integrated Planning Act (1997)</i> (Queensland) |
| NSCT | National Sea Change Taskforce |
| QLUMP | Queensland Land Use Mapping Project |
| SPP | State Planning Policy |
| TDR | Transferrable development right |
| WHA | World Heritage Area |

1. Background to the Research

1.1 *Sea- and tree-change phenomena in Australia*

The terms 'sea-change' and 'tree-change' are popular Australian expressions for what has been termed 'amenity migration' in the United States, Canada and Europe (e.g. Esparza and Carruthers 2000; Marcouiller *et al.* 2002; Burnley and Murphy 2004). As the terms imply, sea- and tree-change involves a move to the coast or a forested picturesque area. What is occurring can be described as suburbanisation of coastal and forested picturesque areas, where many of these settlements replicate suburban forms in a non-urban environment. Another related dimension of the sea- and tree-change phenomena is population growth in coastal and forested environments that in the past have been low-key holiday destinations (Smith and Doherty 2006). However, not all coastal and forest communities are growing – some areas are experiencing a decline in population (e.g. Port Pirie and Port Augusta in South Australia). What makes some areas desirable is complex and relates to many 'push' and 'pull' factors (ABS 2004; Stimson and Minnery 1998) such as reduced work opportunities or lifestyle aspirations. Sea- and tree-changers, however, migrate primarily for 'lifestyle' reasons rather than to improve their financial situation (e.g. Burnley 2005). This runs contrary to traditional migration theories, which claim that economic considerations, such as better paying employment, underpin migration decisions (Greenwood 1975).

Population movements from capital cities to non-metropolitan high amenity environs have been studied extensively over the past thirty years (e.g. Sant and Simons 1993; Stimson and Minnery 1998; Burnley and Murphy 2004). However, the significance and extent of the sea- and tree-change phenomena has been vigorously debated in the literature (e.g. O'Conner 2001; Salt 2003). A literature review of the sea-change phenomenon in Australia as well as a typology of coastal growth settings was carried out by Gurran and Blakely (2007). The typology (Gurran *et al.* 2005), prepared for the National Sea Change Taskforce (NSCT), distinguishes five idealised coastal settings based on population and distance to a capital city. The NSCT, a consortium representing more than 68 councils from around Australia and more than four million residents, was established in 2004 as a national body to represent the interests of coastal councils and communities experiencing the pressure of rapid development through population and tourism growth (National Sea Change Taskforce 2010).

While some commentators include nearby hinterland areas when studying the sea-change phenomenon (e.g. Burnley and Murphy 2004), the tree-change phenomenon (Salt 2006) has attracted less research attention. However, in 2007, a conference dedicated to the tree-change phenomena was held in Beechworth, Victoria where Trevor Budge, a senior lecturer at La Trobe University pointed out that land prices were rising in response to tree-change migration. He stated:

'As more people take their superannuation, and cash in their metropolitan properties, those places with the greatest level of amenity are realising that they are going to be swamped. Property values in the most sought-after towns had skyrocketed. In some of these places, the locals can't buy a house or the person who wants to work at the local tourist office can't afford to live there. The median house price in 2001 in country Victoria was \$121,000. By 2006, it was \$220,375.'
(The Age 2007)

Set against this national background, broad sea- and tree-change phenomena in Far North Queensland will be examined first, in the following sections, before we introduce the case study research carried out in the Wet Tropics bioregion.

1.2 Sea- and tree-change phenomena in Far North Queensland

Far North Queensland has some of the fastest growing population centres in the State outside the densely packed southeast corner. While population growth rates in coastal areas in terms of total numbers may not seem significant when compared with capital cities, the percentage growth rates experienced by coastal communities are significant when compared with their respective State and National averages. For example, the former Douglas Shire (before council amalgamations in March 2008), which is now part of Cairns Regional Council, has grown at a long-term average of just over four percent per annum, to almost double over the last twenty years from an estimated resident population of 3,030 in June 1996 to 11,275 people in June 2004 (Herron Todd White 2006). Population projections by the Australian Bureau of Statistics (ABS 2001) from 2002 to 2022 suggest continued high growth rates in this area with an overall population increase of 65% (to 17,365 people).

It can be speculated that this growth in population and associated urbanisation of coastal and hinterland areas in Far North Queensland, and in particular, in the Wet Tropics bioregion has much in common with the well documented sea-change phenomenon in other coastal regions of Australia. Similarly, the tree-change phenomenon seems worth investigating in the Wet Tropics bioregion, not only because as the land along the coastal strip becomes scarcer and less affordable, the nearby forested hill slopes may provide alternative locations to the coast, but also because the forested hills may attract changers for different reasons.

2. Methods

2.1 *The Wet Tropics study region*

The Wet Tropics bioregion is a place with exceptional environmental values (McDonald and Weston 2004). It stretches over five hundred kilometres along the north Queensland coast between Townsville and Cooktown and forms a belt approximately fifty kilometres wide (Figure 1). The region contains the highest biological diversity in Australia and is recognised as one of the mega diverse regions of the world (Williams *et al.* 2001). In 1988 some 900,000 ha (48%) of rainforest in the region was granted World Heritage status. The Great Barrier Reef, also inscribed on the World Heritage List, borders the Wet Tropics bioregion to form a unique setting where two World Heritage Areas (WHAs) meet (McDonald and Lane 2000). These environmental attributes seem to provide the ideal setting that sea- and tree-changers may be looking for when deciding whether to relocate.

2.2 *Case study areas*

The Mossman, Julatten, Kuranda/Myola, Barron Delta, Cairns and Tully/Mission Beach landscapes served as case study areas for our research within the Wet Tropics region (Table 1, Figure 1). The Mossman and Julatten case study areas are located in the northern part of the Wet Tropics bioregion, whereas the Kuranda/Myola, Barron Delta and Cairns case study areas are located central and the Tully/Mission Beach case study area in the southern part of the bioregion. Mossman's coastal agricultural landscape is surrounded by the mountainous Wet Tropics rainforest to the west and the Coral Sea to the east. The neighbouring Julatten case study area is an upland agricultural landscape also surrounded by World Heritage rainforest but opens up towards the west, where dry sclerophyll woodlands replace rainforest (Goosem *et al.* 1999). The Kuranda/Myola case study area is also an upland landscape similar to Julatten, but is not dominated by agriculture. The Barron Delta is part of the rapidly urbanising Cairns coastal landscape. The Tully/Mission Beach case study area comprises the Tully and Murray River basins. Cultivated land and remnant patches of rainforest dominate the Tully-Murray floodplain and coastal area, whereas World Heritage listed rainforest occupies approximately 64% of the basins in the higher elevations.

Table 1: Characteristics of sea- and tree-change case study areas within the Wet Tropics region.

| Case study area | Location within Wet Tropics region | Dominant land use | Dominant landscape character |
|---------------------|------------------------------------|------------------------|------------------------------|
| Mossman | North/coastal | sugarcane | agricultural |
| Julatten | North/hinterland | grazing | agricultural |
| Kuranda/Myola | Central/hinterland | rural residential | rural |
| Barron Delta | Central/coastal floodplain | urban | urban |
| Cairns | Central/coastal | urban | urban |
| Tully/Mission Beach | South/coastal to hinterland | sugarcane/ residential | agricultural/coastal |

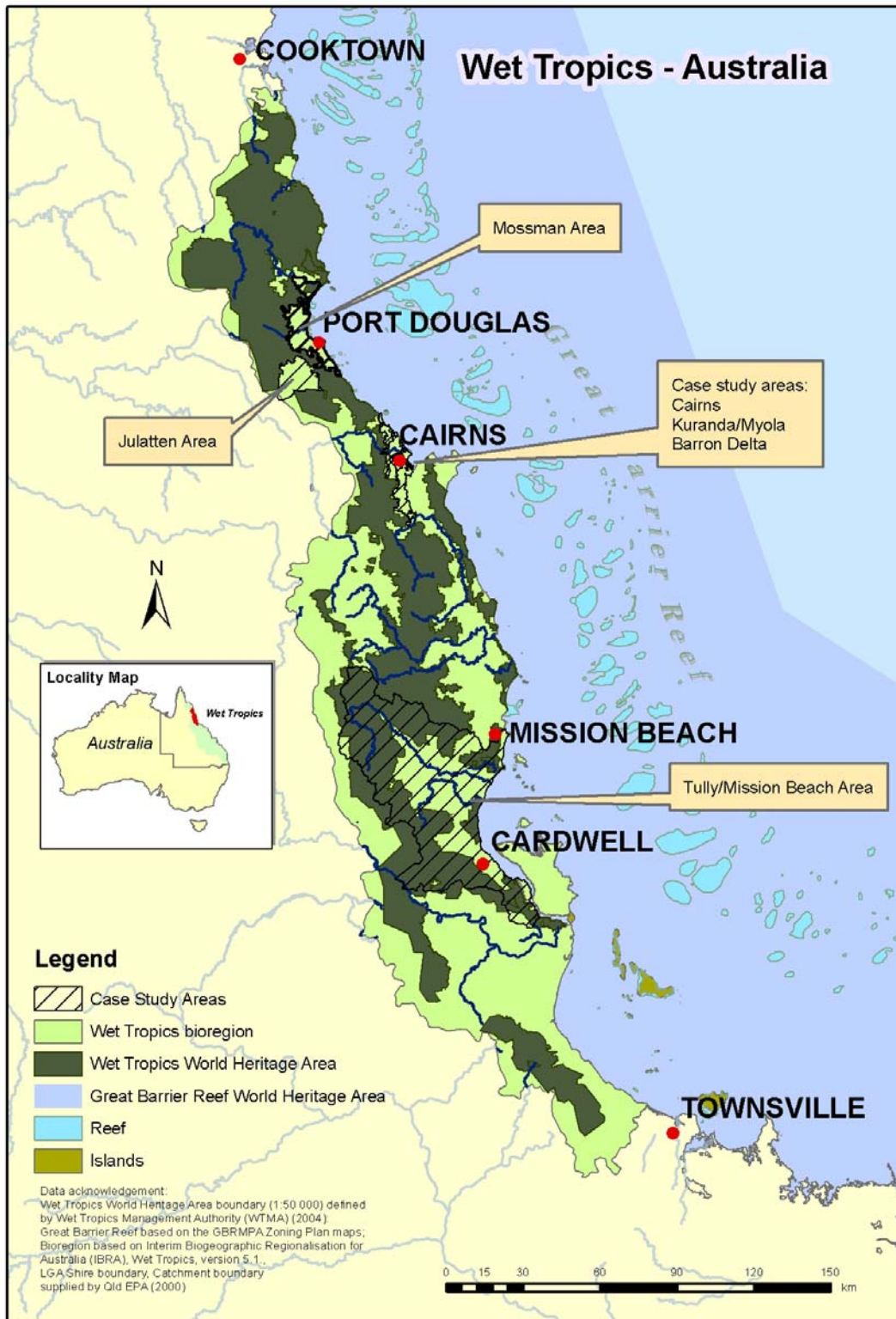


Figure 1: Location of sea- and tree-change case study areas within the Wet Tropics bioregion and relative to the Great Barrier Reef and Wet Tropics World Heritage Areas.

2.3 A mixed methods approach

The empirical data which formed the basis of this final report came from a number of projects in the Wet Tropics bioregion (Figure 1). The Mossman, Julatten and Tully/Mission Beach projects focused on sustainable land use planning (Bohnet and Smith 2007; Bohnet 2008) and reef water quality improvement (Bohnet *et al.* 2008; Bohnet and Kinjun 2009). While these studies did not specifically examine sea- and tree-change phenomena, the data gathered in these projects provided a wealth of information related to the subject, such as amenity and other values and threats to these landscapes (Bohnet and Moore, in press), and triggered further research on sea- and tree-change phenomena in the Wet Tropics. The subsequent research in Kuranda/Myola and Barron Delta area specifically focused on sea- and tree-change phenomena in the Wet Tropics with the aim to identify potential social-cultural thresholds that cause people to leave their sea- or tree-change location (Schultz 2008). The Cairns study, in contrast, examined the potential impacts of rapid urbanisation of a coastal city (Bohnet and Pert 2010).

2.3.1 Approach taken in the Mossman, Julatten and Tully/Mission Beach studies

The Mossman, Julatten and Tully/Mission Beach studies comprised a total of 91 qualitative semi-structured interviews (Silverman 2000) which were conducted with local residents representing a wide range of landscape interests, including farming, forestry, cultural and spiritual heritage, tourism/recreation, conservation and development. These interviews were analysed for emergent themes using the qualitative software package *ATLAS.ti* (Muhr 1997) to explore the sea- and tree-change phenomena, that is, why sea- and tree changers choose to migrate to the Wet Tropics.

In addition, map overlays were prepared in a Geographic Information System (GIS) for these case study areas using a number of data layers including topography, land use/land cover, protected and conservation areas, stream networks, roads and zoning information from the local government planning schemes to determine the locations where sea- and tree-changers live in the landscape. This was considered important baseline information to examine the potential long-term impacts that sea- and tree-changers might have on the biophysical environment in which they live.

Besides the semi-structured interviews, the summaries and transcripts of ten community workshops carried out in Mossman, Julatten and Tully/Mission Beach with a total of 68 participants were included in the qualitative analysis (Muhr 1997) to explore the potential long-term environmental, social, cultural and economic effects of the sea- and tree-change phenomena. Based on the results of the research, a broad review of policies that govern sea- and tree-change landscapes was carried out. This review served as a starting point for policy and planning recommendations that might help to mitigate the potential impacts of the sea- and tree-change phenomena on landscapes that are attractive to a wide range of people.

2.3.2 Approach taken in the Kuranda/Myola and Barron Delta studies

The Kuranda/Myola and Barron Delta studies comprised multiple discussion-type interviews with thirty participants and participant observation (Kellehear 1993). Participant observation included fieldwork entailing visits to participants on their properties or accompanying them to their favourite local place. A snowballing technique and purposive sampling was used to achieve a diversity of research participants (Silverman 2000). The interviews were analysed to explore why participants choose to migrate to the Wet Tropics; what aspects of living in Kuranda/Myola and the Barron Delta they value most; threats to those values and what factors may influence their decisions to move away from the area (Schultz, in prep.). The Millennium Ecosystem assessment was used to analyse the above questions (Carpenter *et*

al. 2006), to discover perceptions of values and conditions of Ecosystem Services, distinguishing between provisioning services, regulating services and cultural services.

2.3.3 Approach taken in the Cairns study

In contrast to the primarily social science based Mossman, Julatten, Tully/Mission Beach, Kuranda/Myola and Barron Delta case studies, the Cairns study utilised high resolution aerial photo mosaics that were available for 1952 and 2008 to determine the urban areas within the Cairns study area in those years. To define future urban growth in Cairns we used the urban footprint identified in the *Far North Queensland Regional Plan 2009-2031* (DIP 2009). We overlaid the high resolution black and white 1952 and digital colour 2008 aerial photo mosaics with a digital cadastral database (DCDB) layer of Cairns on the computer screen and performed a manual digitalisation of urban (i.e. residential, industrial and commercial) land use. The DCDB layer was used to increase accuracy and to reduce potential errors of inconstancy in manual digitalisation of urban areas in 1952 and 2008. This method was considered the best way to capture information regarding urban trends (*sensu* Akbari *et al.* 2003; Cunningham 2006), and made the generalisation and distinction between different land uses possible. The digital map of the urban footprint for Cairns in 2031 provided the spatial extent, i.e. the boundary, for our case study area. In our study we assumed that by 2031 the urban footprint would be fully developed and that agricultural and natural land uses within the urban footprint would be lost by 2031. To illustrate the anticipated losses of agricultural and natural land uses we included four further data layers, Queensland Land Use Mapping Project (QLUMP) (QDNRM 2004), Regional Ecosystem mapping (QEPA 2005; 2006a; 2008), Southern Cassowary (*Casuarus casuaris johnsonii*) habitat mapping (Kutt and King 2002; QEPA 2006b) and critically endangered vegetation communities (Littoral Rainforest and Coastal Vine Thickets) under the Commonwealth *Environmental Protection and Biodiversity Conservation Act (1999)* (EPBC Act). The software packages used for preparing the input data were ERDAS Imagine version 9.3 and ESRI ArcGIS 9.3. The land use data was derived from QLUMP, and was categorised into three major classes: urban, agricultural and natural. Within natural areas, areas such as water and some coast were included. Land uses identified as not urban and not natural, such as large blocks of land with apparent non-remnant vegetation or cleared for cropping, were classified as agricultural land use.

3. Results

3.1 *Why sea- and tree-changers choose to move to the Wet Tropics*

Most of the interviewees from the Mossman, Julatten, Kuranda/Myola, Barron Delta and Tully/Mission Beach case study areas mentioned some of the attributes (push and pull factors) that can be associated with the sea- and tree-change phenomenon when asked about the reasons for their move to the Wet Tropics (Stimson and Minnery 1998; ABS 2004). Interestingly, many of the interviewees identified themselves as sea- or tree-changers, in some cases as both, having moved from sea-change to tree-change locations or vice versa. In one case the family moves between living at the beach and in the nearby hinterland on a weekly basis.

One of the South Mission Beach interviewees described himself as what one may consider a classic sea-changer, i.e. someone who wanted to leave the city, in line with the storyline of the well known Australian Broadcasting Commission's (ABC) sitcom series 'Sea change'. The same interviewee also referred to another attribute of the classic sea-change phenomenon related to downshifting and foregoing income for lifestyle values (Box 1): Other sea-changers (and tree-changers) referred to the beauty and attraction of the beach as a major factor in their move from the city (Box 1).

Box 1: Sea-change 'push' and 'pull' factors

"It was a sea-change out of the big city, a chance to do something a bit different. The kids were old enough and off our hands so that's what we did ... I guess the opportunity to experience a different lifestyle away from the pressures of the city."

"Sea change [is], in effect the same thing, just rethinking values. Because after all, the money I was making in Sydney was much more than the money I make in Tully."

"The attraction was to the beach and to get away..."

"We just liked the place and the beach and we got to know people and started to make friends ... The beach is my home type thing."

Another interviewee who moved to the Whyanbeel Valley in the Mossman hinterland in the late 1980s described the lure of the landscape, which is consistent with comments made by other interviewees in the Kuranda/Myola area about the magic of the natural environment (Box 2).

Box 2: The landscape and natural environment as a pull factor for tree-changers

"We didn't approach it at all in a business-like fashion, we came out here because we liked the landscape, we liked the land. I didn't look at the soil, nice view – here is our farm [laughs] so we bought it, then I looked at the soil. We decided we wanted to live up here, good place to bring up the kids and that was the decision made. Secondly, can we perhaps make a living off this farm, that was the second decision, so all that is a sort of bonus in a way, we would have moved up here anyway. We both come from Melbourne, I worked there as teacher, lecturing at the Institute."

"...the Licuala fan palm forest, it is ancient. Some of those fan palms are five hundred years old, you walk in there and feel this amazing energy and ancient part of the forest that is almost pre-historic ..."

Some interviewees pointed out one of the advantages of living in the elevated hinterland of Cairns (Kuranda/Myola) and Port Douglas (Julatten) was the 'better', less humid and hot climate (Box 3).

Box 3: Tree-change to escape the coastal heat.

"This is a beautiful spot; this is classed by the World National Geographic Magazine as probably the fifth best climate in the world, Julatten and Mt Molloy, so people who live in Port Douglas in the hot summer, they come up here and say this is good. We live twenty-five minutes from Port Douglas and still have it and have the nice climate."

Confirming previous research findings (e.g. Walmsley *et al.* 1998), many migrants are motivated by non-economic considerations as indicated by many interviewees who settled in the Mossman, Julatten, Kuranda/Myola and Tully/Mission Beach areas (Box 4).

Box 4: Complexity of factors leading to sea- and tree-change migration

"We travelled around Australia and this is the prettiest part of Australia, the most beautiful part of Australia. ... Peter was working out from Alice Springs so we are only an hour from the airport [Cairns International Airport], we had all the mountains, we had the sea and we had three kids going to high school and as I said, 'Isn't it beautiful?' All the clouds around the hills reminded us of Bali ... we had taken the kids to Bali, they said we like it, so we said well, for the kids future, there was all the hills here if they wanted to go mountain climbing, abseiling, interested in forestry, timber, birds, trees, the whole lot. If they are interested in water sports, they could be marine biologists, they could be divers, they could own their own boat and get their licence or whatever they wanted and Peter would still be able to work out of Alice Springs. So that was our choice."

Data gathered from the different Wet Tropics case studies suggest that it is not labour market considerations that drive migration in the Wet Tropics. Instead it is a combination of lifestyle factors, such as recreational opportunities, attractive landscapes and views, an outstanding natural environment with rainforest and reef in close proximity, a pleasant climate, a good place to bring up children and access to infrastructure such as Cairns International Airport. This corroborates the findings of other Australian studies (Walmsley *et al.* 1998; Curry *et al.* 2001; Salt 2003; Burnley 2005). The importance of closeness to other places such as Port Douglas and Cairns (world famous tourist Meccas) was highlighted by many interviewees as well as the importance of a centrally located International Airport in Cairns (Sant and Simons 1993; Gurran *et al.* 2005).

3.2 What sea- and tree-changers value most in their chosen locations

The question: ‘what landscape aspects do sea- and tree-changers value most in their chosen location?’ is closely linked to the previous question of why they chose to move to these locations in the first place. This question was addressed specifically in the Kuranda/Myola and Barron Delta case studies. The following list provides the landscape values that these research participants identified using the Millennium Ecosystems approach (Table 2).

Table 2: Landscape aspects sea- and tree-changers value in the Kuranda/Myola and Barron Delta case study areas, ranked from highest to lowest in accordance with the Ecosystem Services approach (Carpenter *et al.* 2006).

| Category | Total of mentioned values |
|------------------------------|---------------------------|
| Provisioning services | |
| Trees/forest | 29 |
| Animal wildlife | 28 |
| Fresh water | 27 |
| Wild fisheries | 20 |
| Food production | 15 |
| Livestock | 14 |
| Regulating services | |
| Water/flooding | 26 |
| Natural hazard | 24 |
| Erosion regulation | 23 |
| Global climate | 23 |
| Pollution | 23 |
| Air quality | 16 |
| Riparian | 14 |
| Carbon sequestration | 7 |
| Cultural services | |
| Recreation | 27 |
| Aesthetic | 27 |
| Beach | 24 |
| Tourism | 22 |
| Spiritual and religious | 20 |

The most highly ranked landscape values/services were: (1) trees and forest, (2) animal wildlife, and (3) freshwater provisioning services, (4) recreation, and (5) aesthetic cultural services, and (6) water/flooding regulation services. Overall, these landscape values/services are in line with the reasons sea- and tree-changers stated as to why they moved to the Wet Tropics, besides other, i.e. personal, reasons. The complexity and interrelatedness of landscape values/services is illustrated in Figure 2.

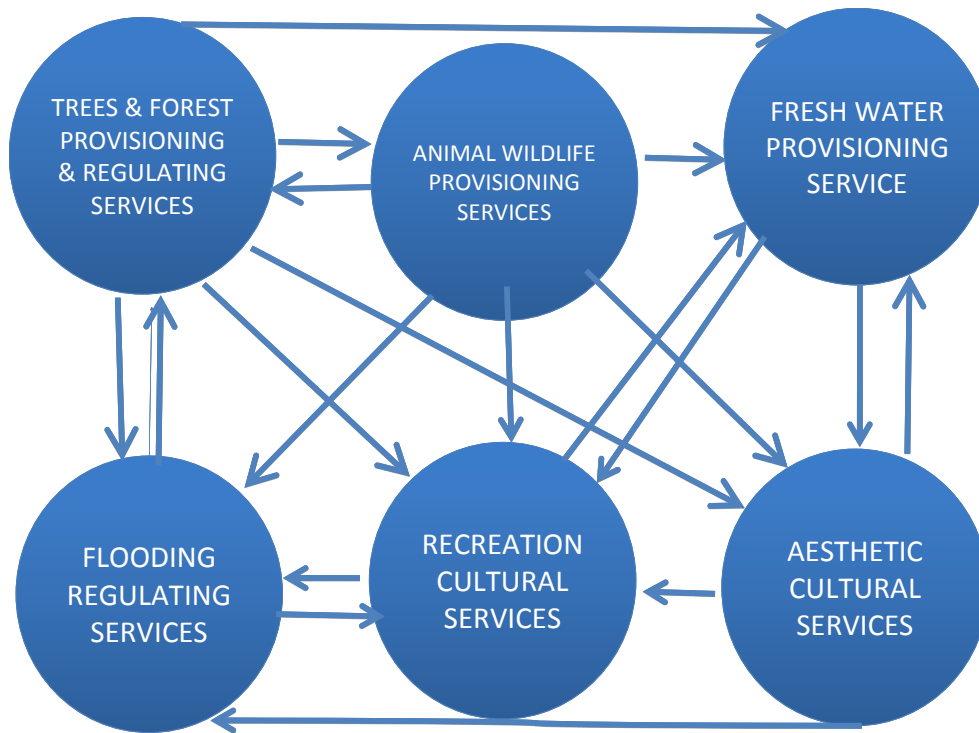


Figure 2: Links and interrelatedness between provisioning, regulating and cultural services provided by Wet Tropics landscapes.

3.3 Impacts of urbanisation on sea- and tree-change landscapes

Interviewees from the Mossman, Julatten, Kuranda/Myola, Barron Delta and Tully/Mission Beach area as well as workshop participants in Mossman, Julatten and Tully/Mission Beach identified a wide range of environmental, social, cultural and economic effects of urbanisation, i.e. the sea- and tree-change phenomena. A summary of the environmental effects is provided in Table 3 and of the social, cultural and economic effects in Table 4.

Environmental effects included location specific issues such as the loss of mangroves and aquatic biodiversity due to resort and marina development at Port Hinchinbrook near Cardwell; the loss of coastal habitats and agricultural land along the coast due to residential and infrastructure development at Mission Beach; and the loss of rainforest habitats in the Kuranda/Myola area due to housing developments. However, most of the identified follow-on effects and environmental threats have regional and national implications, although the solutions may be found at the local level. Examples include threats to endangered species such as the Southern Cassowary (*Casuarus casuaris johnsonii*) and to World Heritage values due to habitat loss, fragmentation and the impacts of human occupation in areas of environmental significance.

A wide range of linked social, cultural and economic effects (Table 3) were identified by our interviewees and workshop participants. Similar to the environmental effects, the linked social, cultural and economic effects are based on changes in land cover. For example, clearing of rainforest and changes in land use, e.g. from agricultural to residential use. From these changes, many different effects follow, such as destruction of sites of cultural, spiritual or historical significance, as well as loss of sugarcane land and affordable housing. While all environmental effects identified provide significant threats to species, habitats, landscapes and the natural resource base in the Wet Tropics, some of the identified social, cultural and economic effects may encourage more sustainable development at local and regional levels.

For example, some tree-changers identified themselves as ‘lifestyle farmers’ and contribute to diversification of and value adding to tropical agricultural products from the region. In addition, they provide local employment and attract tourists to their farms thereby contributing to a more diverse economic base and cultural identity in the region. However, these positive effects have to be carefully balanced against the possible negative environmental effects.

Many of the effects identified in Tables 3 and 4 are not unique to the case study areas. They corroborate Australian (e.g. Kelly and McKenzie 2005; Gurran *et al.* 2007; Coggan *et al.* 2008) and international findings (e.g. Casado-Diaz 1999; Lorah and Southwick 2003) related to amenity-driven migration and peri-urban developments. This implies that current planning and policy frameworks in Australia and elsewhere struggle to mitigate the effects of urbanisation. This could also be shown in our Cairns case study.

Table 3: Environmental effects of the sea- and tree-change phenomena on landscapes and communities as identified by the interviewees and workshop participants.

| | Land use issues | Follow-on effects | Threats |
|------------------------------|---|--|--|
| Environmental effects | <ul style="list-style-type: none"> • Clearing of native vegetation in coastal areas for housing and infrastructure development (South Mission Beach) • Clearing of rainforest for housing and infrastructure development (Kuranda/Myola) • Filling in of coastal swamps and wetlands for housing and infrastructure development (South Mission Beach) • Resort and marina development at Port Hinchinbrook (Cardwell) • “Absolute beachfront” development (Wongaling Beach, South Mission Beach) • Conversion of agricultural land to residential, rural residential and infrastructure development (Mossman, Julatten, Kuranda/Myola, Tully) • Changes in agricultural land use (e.g. from grazing to horticulture) | <ul style="list-style-type: none"> • Habitat fragmentation • Habitat loss • Loss of aquatic and terrestrial biodiversity • Loss of iconic species such as the Southern Cassowary (<i>Casuarius casuarius johnsonii</i>) • Coastal erosion • Hillslope erosion • Change in the visual appearance of the landscape • Loss of agricultural land | <ul style="list-style-type: none"> • Increased traffic provides threat to Southern Cassowary (<i>Casuarius casuarius johnsonii</i>) and other native wildlife • Domestic animals (e.g. cats, dogs) provide threat to Southern Cassowary (<i>Casuarius casuarius johnsonii</i>) and other native wildlife • Exotic weeds (e.g. from ornamental plants) provide threats to native biodiversity • Threats to the water supply from increases in demand from a growing population and change in agricultural land use (e.g. from grazing to horticulture) • Threats to water quality related to sediment and nutrient run-off from properties • Air and noise pollution through increased traffic • Threats to the integrity and character of the landscape, e.g. hill slope developments • Loss of natural heritage |

Table 4: Social, cultural and economic effects of the sea- and tree-change phenomena on landscapes and communities as identified by the interviewees and workshop participants.

| | Land use issues | Follow-on effects | Threats and opportunities |
|--|--|--|---|
| Social, cultural and economic effects | <ul style="list-style-type: none"> • Changes in land tenure (e.g. from crown land to freehold) • Changes in agricultural land use • Conversion of agricultural land to residential, rural residential and infrastructure development • Changing land values on the coast and nearby hinterland areas • Changing perceptions about environmental values and ecosystems services provided by sea- and tree-change landscapes • Coastal and hillslope erosion | <ul style="list-style-type: none"> • Loss of community access to sites of cultural, spiritual and historical significance • Destruction of sites of cultural, spiritual and historical significance • Increase in some segments of the population, e.g. young families, alternative people • Loss of sugarcane and grazing land • Increase in labour intensive crops • Loss of affordable housing and land due to increasing prices and government rates caused by newcomers who can afford to pay • Increased conservation efforts by local groups • Loss or damage to properties affected by coastal and hillslope erosion | <ul style="list-style-type: none"> • Loss of indigenous relationships to country • Loss of cultural, spiritual and historical landscape values and heritage • New people with different ideas moving to an area may contribute to a more diverse and tolerant community and landscape, e.g. through diversification • Improvement in physical infrastructure such as roads • Improvement in health services and other community facilities, e.g. childcare, library, community centre • Threats to the viability of the sugar mills due to reduced area under sugarcane production • Provision of local employment due to introduction of labour intensive crops • Diversification of the economic base, e.g. crop diversification, nature based tourism • New products, e.g. tropical fruit wine and ice cream contribute to new cottage industries and potentially to cultural identity • Threats to traditional agricultural industries due to the loss of sugarcane land • Threats to traditional farming culture, e.g. challenged by newcomers • Conflicts between different segments of the community due to differences in their cultures and values leading to a potential loss of sense of place • Threat to the Julatten area becoming a suburb of Port Douglas due to |

| | Land use issues | Follow-on effects | Threats and opportunities |
|--|-----------------|-------------------|--|
| | | | <p>cheaper land and close proximity to the coast</p> <ul style="list-style-type: none"> • Threat to the social fabric of the community, e.g. potential divide between cashed up newcomers, alternative people and long-term residents • Threat to the established social ambience due to the scale of population influx • Prominence of conservation groups and nature based tourism ventures may be able to contribute to a conservation culture in the Wet Tropics • Potential costs to the wider community to protect beachfront properties |

The urban areas in Cairns identified as being used for purposes such as residential living, tourism facilities and industrial and commercial uses increased from 839 ha in 1952 to 7,730 ha in 2008, over a 900% increase in total area over a 56 year period or about 16.5% annually. During this period 6,891 ha have been converted to urban use (Figure 3, Table 5) resulting in a substantial loss of agricultural and natural land use. The main loss of agricultural land has taken place south of the Cairns Central Business District (CBD), an area that has grown over the past 56 years into a large uninterrupted urban corridor contiguous with the Cairns CBD. The main loss of natural vegetation from 1952 to 2008 has occurred adjacent to the Cairns CBD and along the northern beaches (Figure 3) where areas of previous holiday hamlets have now become virtually contiguous residential suburbs.

Based on the assumption that 100% of land within the urban footprint is developed by 2031, urban land use in Cairns will increase by 7,465 ha from 8,860 ha in 2008 to 16,325 ha in 2031, a projected increase of almost a doubling (184%) in total area over a 23 year period or about 8.5% annually (Tables 6 and 7). A maximum of 3,913 ha of natural and 3,552 ha of agricultural land use will be lost to urban land use in the period between 2008 and 2031, if the urban footprint is fully developed. This equates to a maximum loss of 24% of natural and 22% of agricultural land use. Future urban growth is planned to continue south of the Cairns CBD, amalgamating the suburbs of Edmonton and Gordonvale to form an even larger uninterrupted urban corridor (Figure 3).

Due to the potential significant loss of natural land along the northern beaches we analysed the loss of Regional Ecosystems (REs) in a selected northern beaches area (Figure 4). The selected area encompassed a total of 309.6 ha REs of which 211.5 ha (68%) had been lost since pre-clearing (Table 8). Since pre-clearing (defined as vegetation present before clearing) 163.1 ha (77%) of REs with the status 'endangered' have been lost to other land uses, as well as 39.8 ha (19%) of REs with the status 'of concern'. Of the remaining 98.1 ha (32%) REs left in 2003, there are 19 ha (19%) of REs with the status 'endangered' and 65.6 ha (67%) 'Of concern' remaining within the selected area. In addition to REs, there are vegetation communities listed as critically endangered (Littoral Rainforest and Coastal Vine Thickets) under the EPBC Act located in the selected area as well as Cassowary habitat,

some of which is classed 'essential', 'general' and 'rehabilitating' (Figure 4). The Southern Cassowary (*Casuarius casuaris johnsonii*) is listed under the EPBC Act as an endangered species.

Besides the loss of agricultural and natural land uses, evolutionary landscape relicts, namely Holocene beach ridges, have been completely lost to urban growth in the Cairns CBD area during the same time period (Figure 5).

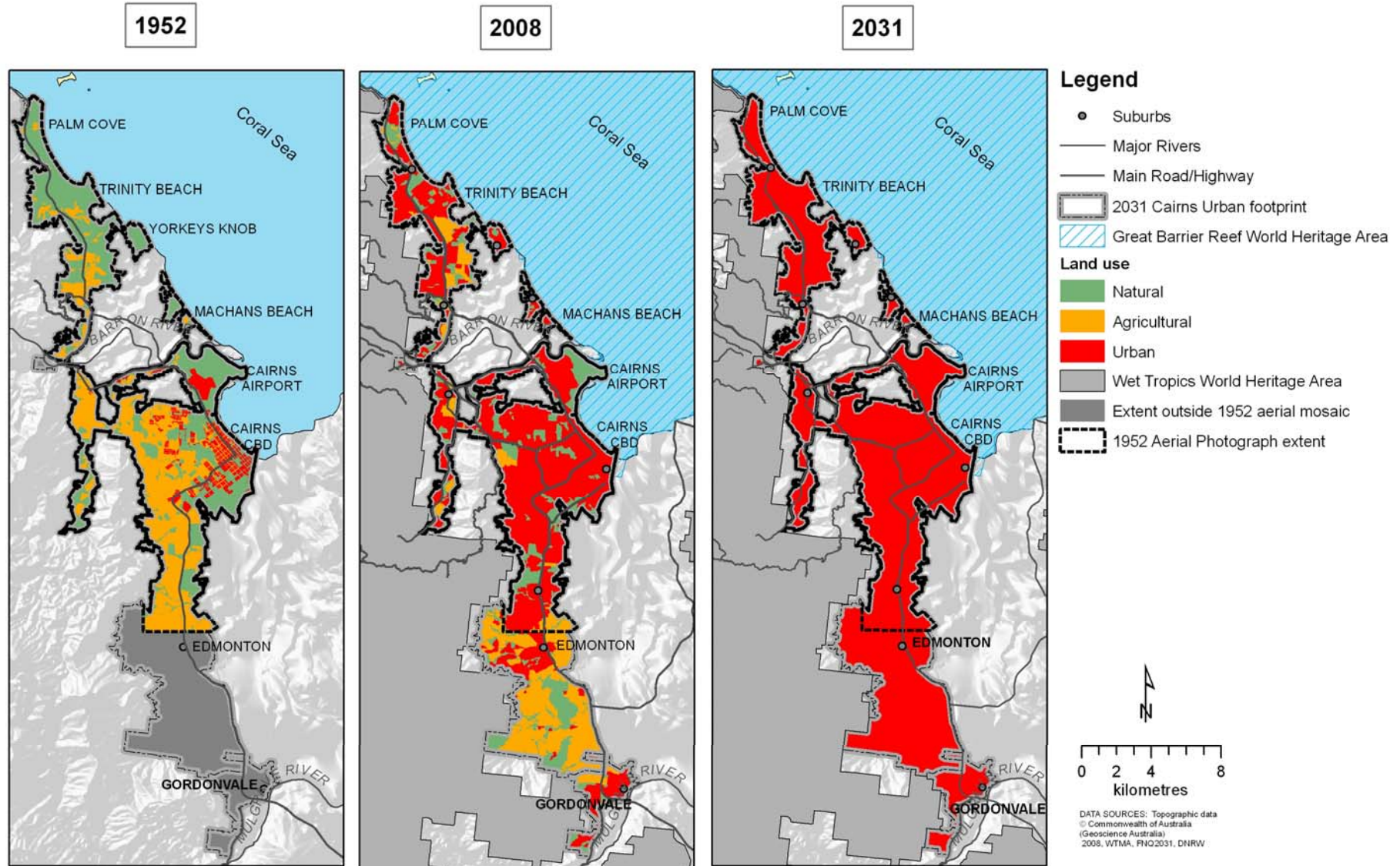


Figure 3: Main land uses and land use changes in Cairns between 1952 and 2008, and projected to 2031.

Table 5: Main land uses in Cairns between 1952 and 2031 based on intersect between extent of the 2031 Cairns urban footprint and aerial photo mosaic from 1952.

| | 1952 | | 2008 | | 2031 | |
|---------------------------------|--------|--------|--------|--------|--------|--------|
| Urban land use in ha (%) | 839 | (7%) | 7,730 | (68%) | 11,440 | (100%) |
| Agricultural land use in ha (%) | 4,754 | (42%) | 1,030 | (9%) | 0 | (0%) |
| Natural land use in ha (%) | 5,847 | (51%) | 2,680 | (23%) | 0 | (0%) |
| Total extent compared in ha (%) | 11,440 | (100%) | 11,440 | (100%) | 11,440 | (100%) |

Table 6: Main land uses in the southern part of the Cairns region between 2008 and 2031 based on extent outside the 1952 aerial photo mosaic, but inside the 2031 Cairns urban footprint.

| | 2008 | | 2031 | |
|---------------------------------|-------|--------|-------|--------|
| Urban land use in ha (%) | 1,130 | (23%) | 4,885 | (100%) |
| Agricultural land use in ha (%) | 2,522 | (52%) | 0 | (0%) |
| Natural land use in ha (%) | 1,233 | (25%) | 0 | (0%) |
| Total extent compared in ha (%) | 4,885 | (100%) | 4,885 | (100%) |

Table 7: Main land uses in the entire Cairns study area between 2008 and 2031 based on extent of the 2031 Cairns urban footprint.

| | 2008 | | 2031 | |
|---------------------------------|--------|--------|--------|--------|
| Urban land use in ha (%) | 8,860 | (54%) | 16,325 | (100%) |
| Agricultural land use in ha (%) | 3,552 | (22%) | 0 | (0%) |
| Natural land use in ha (%) | 3,913 | (24%) | 0 | (0%) |
| Total extent compared in ha (%) | 16,325 | (100%) | 16,325 | (100%) |

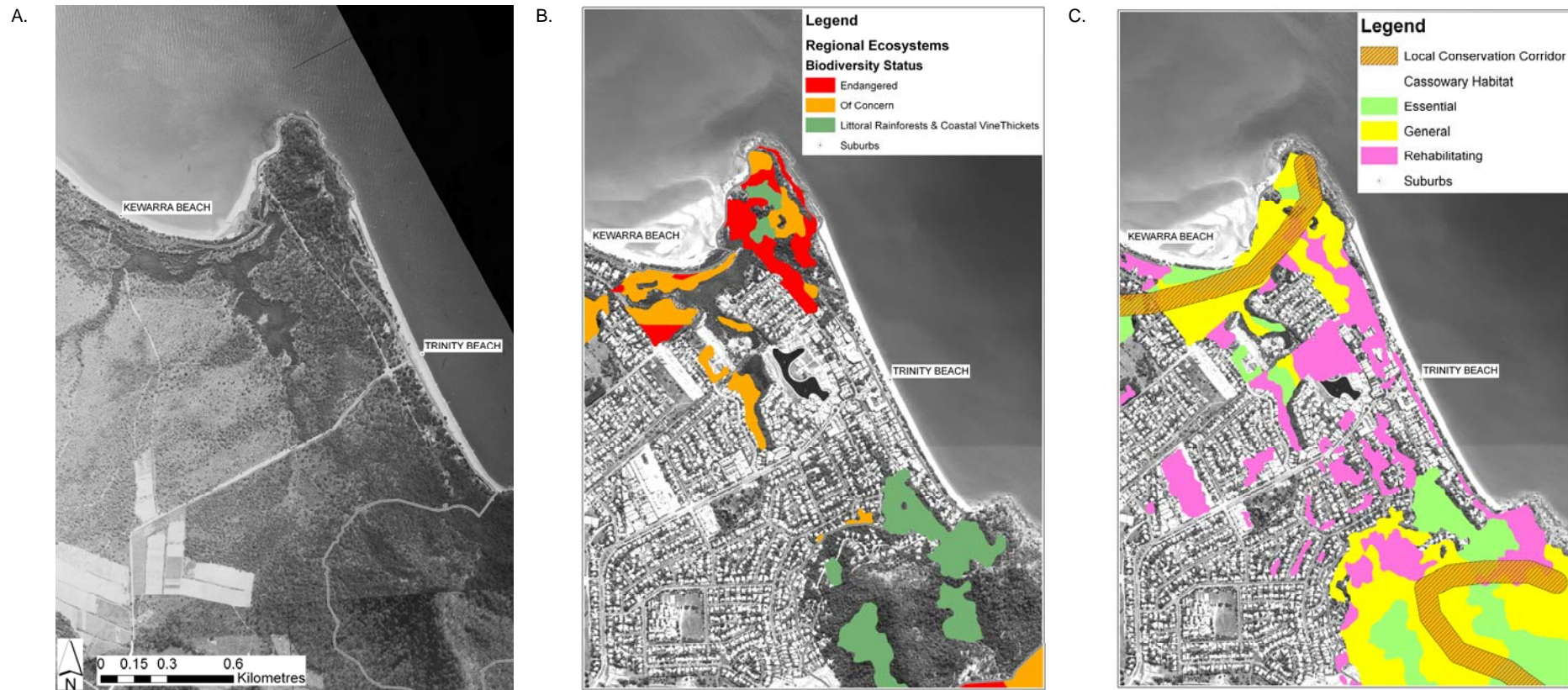


Figure 4: Example of the potential loss of coastal Regional Ecosystems (REs) and Cassowary habitat between the suburbs Kewarra and Trinity Beach in the northern beaches area of Cairns by 2031; (A) aerial photograph in 1952, (B) aerial photograph in 2008 showing urban growth, areas of REs of 'endangered' and 'of concern' status as well as Littoral Rainforest and Coastal Vine Thickets which are critically endangered vegetation communities, and (C) aerial photograph in 2008 showing local conservation corridors and habitat of the endangered Southern Cassowary (*Casuaris casuaris johnsonii*).

Table 8: Lost coastal Regional Ecosystems (REs) between the suburbs Kewarra and Trinity Beach in the northern beaches area of Cairns since pre-clearing.

| Regional Ecosystems | | Area (ha) | | |
|---|---------------------|---------------|-----------------------------|----------------------------------|
| RE Label (Goosem <i>et al.</i> 1999) | Biodiversity Status | REs pre-clear | REs lost since pre-clearing | Remaining area of REs as of 2003 |
| 7.11.26; 7.12.59; 7.2.7; 7.2.8; 7.2.9; 7.3.12; 7.3.5; 7.3.8 | Endangered | 182.1 | 163.1 | 19.0 |
| 7.11.18; 7.12.61; 7.2.11; 7.2.3; 7.3.25; 7.3.45 | Of concern | 105.4 | 39.8 | 65.6 |
| 7.1.1; 7.12.1 | Not of concern | 22.1 | 8.6 | 13.5 |
| | Total | 309.6 | 211.5 | 98.1 |



Figure 5: Loss of evolutionary landscape relicts such as the Holocene beach ridges on which the Cairns Central Business District (CBD) and adjacent suburbs have been built. (a) Holocene beach reaches in 1952 shown through different vegetation types and topography; (b) same area in 2008.

4. Governance of sea- and tree-change landscapes

Queensland local governments are responsible for preparing and implementing local planning schemes under the *Integrated Planning Act (1997)* (IPA). Each planning scheme must be in accord with State and regional interests as documented in statutory regional plans and State Planning Policies (SPPs). Most land use planning and development within the Wet Tropics is controlled by the relevant local government planning schemes and the statutory *Far North Queensland Regional Plan 2009-2031* (DIP 2009). However, for large economically significant developments, State government can step in to coordinate the development approval process under the *State Development and Public Works Organisation Act (1971)*.

While the IPA has undergone almost constant review since it was first passed into law in December 1997, there continues to be widespread criticism that the Act is process driven rather than outcome orientated (England 2004). A major justification for introducing the Act was that it would stream line the development process by integrating more than sixty different pieces of development-related legislation into one Act (England 2004). However, the complexity of the Integrated Development Assessment System process is such that so much time is spent by planners getting the process right, that often the outcomes receive much less attention (DLGPSR 2007).

Four local planning schemes cover the Wet Tropics case studies: Cardwell Shire Council (2007), Douglas Shire Council (2006), *CairnsPlan* (2009) and Mareeba Shire Council (2004). They were prepared before Council amalgamations in Queensland in March 2008 and before the *Far North Queensland Regional Plan 2009-2031* (DIP 2009) had been released in 2009. These plans were prepared under IPA which itself has the goal of achieving ecological sustainability. Under IPA each planning scheme must reflect all relevant State Planning Policies (SPPs) which prescribe matters of State interest. Examples of relevant SPPs include SPP 1/92 'Development and conservation of agricultural land', and SPP 1/03 'Mitigating the adverse impacts of flood, bushfire and landslide'. In this context, the *State Coastal Management Act* (2002) has the status of a SPP providing direction for coastal development.

The newly formed regional councils are required to amend their planning schemes now to reflect the goals of the statutory regional plan. While outside the urban footprints suburbanisation of the countryside may be reduced due to the lack of any additional rural residential areas in the regional plan, biodiversity and good agricultural land within the urban footprints may be under greater pressures from urban development than before the development of the statutory plan (Bohnet and Pert 2010).

5. Considerations for Local Government and NRM authorities on managing and remediating impacts of urbanisation

Our findings suggest spatial planning needs to better integrate environmental, social, cultural and economic issues by addressing the causes that drive change in rural areas and by engaging local communities, as also identified in Greed 2000 and Bohnet and Smith 2007. The need for better integration is especially evident in the decline of the agricultural base in rural areas, which is fuelling the fragmentation of traditional agricultural landscapes, both through urbanisation and through break up of larger land holdings. The same applies to coastal areas which are experiencing the loss of important habitats through urbanisation and infrastructure development.

The following land use planning and policy options / scenarios may warrant further consideration:

- Limit to the entitlement of a house on each rural lot. A market based transferable development right (TDR) scheme could be introduced where the rural land is the donor and residential zoned land in nearby towns is the receiver. Alternatively, a policy based on scientific and local knowledge could be introduced where landholders in identified areas lose their entitlement right of a house per rural lot. Such a scheme/policy would require major amendments to the current IPA, but might be effective in addressing the suburbanisation of the highly values Wet Tropics landscapes.
- Use of holistic planning processes such as master-planning (provided for by the IPA) and/or strategic assessment processes (provided for by the EPBC Act) in sensitive coastal and hinterland areas experiencing rapid urbanisation. These processes could also apply in identified urban footprints in which important habitats and good agricultural land is located. Environmental threats caused by sea- and tree-change phenomena, i.e. rapid urbanisation of coastal and hinterland areas, may be adequately addressed if these processes are followed through and aim to achieve environmental outcomes.
- Appropriate training and resourcing for local government planners, and access to environmental data, mapping and technical assistance from State and Federal agencies, is an important element of effective planning and policy development at the local government level for sensitive environments experiencing growth pressures.
- Conservation partnerships between local councils, community groups and residents in high growth areas experiencing land management issues. Such programs could be supported by State and Federal grants or other funding sources as part of an integrated partnership approach to more sustainable land-use in sensitive areas.
- Coastal councils to join the National Sea Change Taskforce which acts in the interest of coastal councils and communities experiencing the pressure of rapid development through population and tourism growth.

The above land use planning and policy options/scenarios would require greater collaboration between Local, State and Federal government agencies with responsibilities in land use planning and natural resource and asset management. Queensland has a number of opportunities to address the issue of sea- and tree-change growth pressures in the far North. Building on the recent amendments to the IPA which now provides for statutory regional planning and master planning of high growth areas would provide a great starting point.

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