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Final Report

How 'valuable' are the ecosystem services of the Wet Tropics World Heritage Area to residents and tourists?



Michelle Esparon, Natalie Stoeckl, Silva Larson,
Marina Farr and Joann Schmider



Australian Government
Department of the Environment

 **Reef &
Rainforest**
RESEARCH CENTRE

How ‘valuable’ are the ecosystem services of the Wet Tropics World Heritage Area to residents and tourists?

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Acronyms Used In This Report

AUS	Australian
AUD	Australian dollars
CB	Contingent Behaviour
CV	Contingent valuation
DERM	Department of Environment and Resource Management
ES	Ecosystem services
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
JCU	James Cook University
LGA	Local Government Area
LS	Life satisfaction
NERP	National Environmental Research Program
NOAA	National Oceanic and Atmospheric Administration
OLS	Ordinary Least Square
PCA	Principal Component Analysis
QLD	Queensland
RAP	Rainforest Aboriginal Peoples
RAPA	Rainforest Aboriginal Peoples Alliance
RRRC	Reef and Rainforest Research Centre Limited
TE	Tropical Ecosystems
UNESCO	United Nations Educational Scientific and Cultural Organisation
WTA	Willingness to accept
WTMA	Wet Tropics Management Authority
WTP	Willingness to pay
WTWHA	Wet Tropics World Heritage Area

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Executive summary

Background

- ❖ The research described herein, was supported by the Australian Government as part of its National Environmental Research Program (NERP). The NERP comprised 5 main research hubs, each with a specific focus.
- ❖ The research reported on here was undertaken as part of the Tropical Ecosystem (TE) Hub which addresses issues of concern for the management, conservation and sustainable use of the World Heritage listed Great Barrier Reef (GBR) and its catchments, tropical rainforests including the Wet Tropics World Heritage Area (WTWHA), and the terrestrial and marine assets underpinning resilient communities in the Torres Strait.
- ❖ This report focuses on issues relevant to the management and conservation of the WTWHA.

Aim, Objectives and Scope

- ❖ The overarching aim of this project was to improve our understanding of the value which residents and tourists place upon the ES of the WTWHA. To satisfy this aim, three specific objectives were devised, namely to:
 1. Improve our understanding of the relative importance or 'value' of the WTWHA's ES to residents and tourists;
 2. Make predictions about the way in which resident and tourist 'values', and thus management, conservation and marketing priorities may alter in the future as both population and tourist numbers change; and
 3. Improve methods for assessing 'values' by comparing state-of-the art non-monetary valuation techniques with more 'traditional' valuation techniques.
- ❖ This report thus provides an account of the key ES provided by the WTWHA which residents and tourists find important (or 'valuable'). In doing so, it highlights conservation, management and tourism/ marketing priorities. This information will be of immediate use to the tourism industry, to managers and policy makers in the region.

Generic methods

- ❖ We ran workshops with key stakeholders to ensure that information collected and compiled in this project was relevant to their needs. During these workshops, we asked participants to consider our 2 targeted groups of beneficiaries (residents and tourists) and then: (1) identify and prioritise regionally relevant ES (or 'values') likely to be considered important by those groups; and (2) identify and prioritise key 'changes' or 'management issues' likely to affect those 'values'. As we expected, many of the values identified for each beneficiary group were similar.
- ❖ Insights from the workshop and literature review were used to develop 2 questionnaires, designed to elicit information about both the 'total' and the 'marginal' value of key ES associated with the WTWHA. We deliberately structured questions to ensure we could use a variety of different economic valuation techniques, so that comparisons could be made between them. These included contingent valuation, contingent behaviour questions, expenditure and life/tourist satisfaction techniques. Our life/tourist satisfaction type questions sought information about the relative importance of and satisfaction with 27 different 'values' (mostly ES, but market and other social values were included for comparative purposes). We also sought respondents' reactions to potential

deteriorations in these values (our contingent behaviour –type questions) and their willingness to pay to help protect these values (contingent valuation questions).

- ❖ The questionnaires were tested in several situations to ensure clarity of questions, namely with: (1) participants from the workshops; (2) other stakeholders who had shown interest in the study; (3) colleagues; and (4) a pilot mail-out to a small sample of householders.
- ❖ Questionnaires were mailed out to a sample of residents within and adjacent to the WTWHA. We also contracted the Rainforest Aboriginal Peoples Alliance (RAPA) to collect data in Indigenous communities across the WTWHA. RAPA also helped us to ensure that culturally apposite ‘language’ was being used in the questionnaire and that we were measuring the things that ‘matter’ to the traditional owners. Tourists were approached at the lagoon in Cairns as well as at its domestic and international terminals – undertaking 2 hours of data collection activity at each location, each month for 12 months.
- ❖ We received 1167 completed questionnaires: 160 were from Indigenous residents, 386 were from non-Indigenous residents and 621 were from visitors. Data were summarised using descriptive statistics, geographical information systems (GIS), leximancer (qualitative analysis of open-ended questions), by conducting various non-parametric tests and using different types of regression analysis (ordinary least squares regression, ordinal regression, seemingly unrelated regressions, and hurdle models). The specific methods adopted, depended upon the particular research questions being addressed.

Key findings

The relative ‘value’ of ES provided by the WTWHA

- ❖ We found commonalities between respondents: all indicated that the safety of family/friends/travelling companions was the most important thing for overall quality of life &/or choice of destination. Being able to spend time with loved ones and having access to good quality schools, hospitals, roads, etc. (if necessary) were next on the list, closely followed by environmental values such as having healthy native plants and animals, undeveloped scenery and iconic species. Economic factors such as the jobs and incomes associated with mining, tourism and agriculture, or having many shops, cafes and restaurants were generally considered to be less important than these environmental and social factors.
- ❖ The protection of places with Aboriginal cultural values and being able to learn about culture and country were, unsurprisingly, very important to overall quality of life for Aboriginal respondents. These factors were ranked lower in importance by our non-Indigenous sample – instead, having some ‘control’ over what is happening in their lives was more important. Good weather (sunshine) and going to the GBRWHA were essential components of a satisfactory visitors’ trip.
- ❖ Tourists were generally satisfied with their safety and that of their travelling companions, the weather, being able to relax and reflect, and with the scenery. Similarly, residents were also satisfied with the safety of their loved ones and with the time spent with them. Indigenous residents were also satisfied with community activities.
- ❖ Importance scores were almost always less than satisfaction scores, particularly for intrinsic environmental values, signalling a potential issue of concern. Moreover, the ‘gap’ between importance and satisfaction was relatively small for tourists, larger for non-Indigenous residents, but very large for Rainforest Aboriginal residents. There are potentially many reasons for these differences, one being varying reference points / baselines.
- ❖ Using PCA with Varimax rotation and Kaiser normalisation, our 27 resident importance scores collapsed into 6 factors, labelled as: society, environment, access to nature,

culture, industry and city. Society and environment had consistently higher scores than factors linked to industry. Culture also had higher importance scores than industry.

- ❖ For tourists, our PCA yielded 5 groups of factors from the original 27 values, highlighting a clear distinction between different types of visitors. Some came to enjoy a variety of things, some are more interested in experiencing culture, for some it's the safety and quality of infrastructures that matters most, while others came for the city/community entertainment or to do business. 'Locals' (primarily aiming to visit a place close to home) also stand out as a distinct group.
- ❖ Our leximancer analysis of responses to an open ended question: "how satisfied are you? Why do you feel that way?", highlighted 10 core themes and 14 concepts. "Live" and "beautiful" were the most frequent and related concepts in the text – clearly signalling the importance of aesthetic values. "Family" had a strong connection with "work", "friends", "community", and "healthy". These concepts appeared near one another because of statements such as:
 - "I am blessed to live in such a beautiful place and climate"
 - "I am satisfied with my lifestyle and job, and having a healthy family"
 - "Healthy, great place to live, satisfying family life"
- ❖ For tourists, the leximancer analysis revealed 10 core themes and 21 concepts. Here too, aesthetic values were strongly evident: "beautiful" and "rainforest" were mentioned the most frequently and were the most strongly related concepts with others. Below are examples of tourists' views on the reasons they are satisfied with their trip:
 - "Beautiful beach and rainforest"
 - "Beautiful landscape, endless amount of activities, friendly people"
 - "Beautiful place and nice people"

Do different people 'value' different things?

- ❖ We used Ordinary Least Squares (OLS) regression to look for statistically significant relationships between the 'importance' scores people assigned to various factors and various socio-demographic and economic descriptors.
- ❖ Although there was widespread agreement across all groups of residents that family was more important to overall quality of life than the environment which, in turn, was more important than other market or economic factors, there were significant differences between different groups.
 - Those dependent upon mining, manufacturing, ports and/or agriculture consistently rated social and environmental factors as being less important than those associated with other industries. So too did males, and 'singles'. Males were also less satisfied (than females) with many different factors.
 - Indigenous respondents and those associated with retail and tourism both gave higher importance scores to environmental values; Indigenous people also rated family values as being more important than other respondents – as were those with large households.
 - Results were similar when analysing the grouped factor scores (from our PCA). Those dependent upon mining, manufacturing and/or ports for their household income perceived the environment to be relatively less important than those dependent upon other sectors. Those dependent upon agriculture felt that cultural factors were generally less important to their overall quality of life than others. Culture was deemed more important to Indigenous residents than to non-Indigenous residents, but males, those in agriculture, and those earning a high income thought that Indigenous values were relatively less important than their respective counterparts. Those born in QLD were likely to value 'social' factors more highly, and 'city entertainment' less highly than those born elsewhere.
- ❖ Patterns were also evident in the tourist data.

- Origin matters: Visitors from QLD considered safety of family and environmental factors to be relatively less important 'drawcards' than visitors from elsewhere in Australia.
- Single travellers were likely to be less satisfied than other travellers about a variety of different factors; so too, were the visitors earning relatively high incomes and those from Asia. European visitors and those from north America were generally more satisfied with various aspects of their trip than Australian domestic visitors.

'Marginal' values in the WTWHA: willingness to pay to improve

- ❖ Almost 20% of Indigenous respondents were unwilling to contribute any amount of money to protect Aboriginal culture or prevent weeds and pests from evading the native flora and fauna, despite these values being in the top five of most important contributors to their overall quality of life. The (un) willing rate was even higher amongst non-Indigenous residents: between 30% and 50% indicating that they would not be willing to pay anything at all to improve things which they themselves had indicated were vitally important to their overall quality of life. More than a quarter of tourists (31%) were not willing to pay any money towards the maintenance of undeveloped scenery and peacefulness of the area, despite earlier comments about the 'importance' of this in their decision to visit the region (note that the maintenance of undeveloped scenery and peacefulness of the area was ranked the second most important factor on this trip). Thirty-nine percent of our tourist sample was not willing to pay any amount towards the protection of Aboriginal culture. Respondents thought that the preservation of the WTWHA was a community responsibility, and the amount they were willing to pay was contingent upon 'others paying too' (respondents did not want to be the only person paying).
- ❖ We used a hurdle model (simplistically, a two-part regression) to test for statistically significant relationships between socio-demographic and economic descriptors of our respondents and their stated WTP to protect various environmental and cultural values. As expected, income was always a statistically significant factor (WTP is linked to ability to pay), but we also found evidence to suggest that industry of association matters: those dependent upon the mining and manufacturing/port sectors were generally willing to pay less for any 'value' than those associated with other industries; those in the tourism and retail industry were generally willing to pay more to protect healthy native plants and animals and scenery, but less to protect Indigenous cultural values than those associated with other industries.
- ❖ Our (hurdle) analysis of visitor responses to WTP again revealed differences. Generally, males were willing to pay less than others; as were visitors from QLD (likely because the question was framed as a per-visit payment, and they are likely to visit more often). Those from Germany were also generally willing to pay less than domestic (non QLD) visitors, and after controlling for other factors such as income.

'Marginal' values in the WTWHA: likely reaction to a 'change'

- ❖ Both residents and tourists were asked to tell us how they would respond to a series of 12 hypothetical 'changes'. Residents were asked to tell us how the change would affect their overall quality of life; tourists were asked how the change would have affected their overall decision to visit the region.
- ❖ Responses reinforce the message from the prior segments: environmental and cultural factors are important to overall quality of life, and some types of environmental degradation would have a stronger adverse impact on overall quality of life than a 20% increase in prices (compared to elsewhere in Australia). For tourists, the worst hypothetical change is having more rubbish in the rainforest and rivers. The next biggest

'turn-off' would be a decline in the undeveloped scenery and peacefulness of the area, followed by clarity of rivers. These responses clearly reinforce the importance of aesthetic values.

- ❖ We used OLS regression to look for statistically significant associations between socio-demographic and economic descriptors of respondents and their stated reaction to those hypothetical changes. Again, we found evidence to suggest that different people 'value' and are thus likely to react differently to different things. Those dependent upon mining and agriculture for household income were generally less bothered by the prospect of environmental deterioration than those associated with other industries. To a lesser extent, this was also true of males. The more education a respondent had, the less negatively did they respond to the prospect of higher prices, fewer infrastructures, or fewer cafes, shops and theatres.
- ❖ For tourists, it seems that older people were more concerned with the prospect of fewer cafes/shops, more tourists or having less time to spend with friends and family. Those from Germany were more concerned (than visitors from elsewhere) by the prospect of more rubbish; those from Asia seemed to be relatively more concerned by the prospect of degraded scenery or murkier rivers than those from elsewhere.

Conclusions

- ❖ Multiple lines of evidence all suggest that the most important thing in life (or in travel) to our group of respondents was the safety of family/friends/travelling companions. Spending time with those people is also vitally important. When those social basics are satisfied, it is the environment (and related aesthetics) that comes to the fore. Economic issues (e.g. the jobs and incomes associated with different industries, having many café's and restaurants) were considered, by respondents to our surveys, to be comparatively less important.
- ❖ The WTWHA's rich Indigenous culture is an attraction for international visitors, and having more information about it would lead to some extending their stay in the region. Indigenous residents too would be more satisfied if this was the case, i.e. if there were more awareness about country. For local visitors, however, learning more about the Aboriginal culture is not a priority.
- ❖ Despite widespread agreement on a 'core' ranking (family > environment > economy), multiple lines of evidence suggest that different people value things differently. For residents, it seems that industry of association and gender are strongly associated with values; for tourists, values differ most markedly by origin. As such, it is clear that changes to the demographic or economic composition of the community will be associated with changes to community values, preferences, and priorities.
- ❖ Cross-method comparisons suggests that non-traditional valuation methods (such as asking about the importance of different factors relative to market factors, or asking about likely reaction to hypothetical situations) highlight similar patterns to the more traditional valuation methods (such as contingent valuation, used here). Contingent valuation type questions are often rejected by respondents (with relatively high non-response rates), and there are consequent complications when analysing responses to control for such problems. This study suggests that contingent behaviour approaches may thus offer themselves as a viable, and more socially acceptable, alternative – although significant refinements to the methods used here would be required before they could become mainstream, and they are clearly not suited to all situations.
- ❖ Many of the values investigated here appear to be inherently inseparable – particularly aesthetic values: beauty was consistently linked to environmental features such as healthy native plants and animals, clear rivers and a lack of development. Those seeking to explore aesthetic values further, may thus need to recognise those relations, considering the use of holistic type approaches (e.g. scenarios), rather than attempting to value individual 'bits'.



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1 Introduction

1.1 Understanding, managing and conserving Australia's unique biodiversity and ecosystems

Australia is renowned for having some of the most unique and diverse ecosystems worldwide (e.g. the Great Barrier Reef (marine and coastal), Lake Eyre (inland aquatic) and the Wet Tropics (terrestrial)). These ecosystems support around 570,000 different species (equivalent to more than 5% of the world's plants and animals) (Chapman, 2009). Approximately 94% of Australia's amphibians, 93% of its reptiles, 87% of its mammals, 86% of its vascular plants and 45% of its birds, are endemic. Despite its high level of endemism, increasing pressures such as the clearance and fragmentation of habitats, unsustainable use of natural resources, pollution, changing fire regimes, the introduction of exotic species, declining water levels and quality, coupled with the consequences of climate change, have led to the demise and decline of many species (ABS, 2010). Cumulatively, the effects of these impacts are a major threat to Australia's biodiversity.

Both historical and contemporary decisions and actions have contributed or are contributing to the consequential loss of biodiversity (ABS, 2010). Maintaining Australia's extraordinarily biodiverse environments is thus critical. Having better information on how ecosystems function, how to monitor their health, how to maintain and build their resilience, how to use ecosystems sustainably and how to make better use of markets to protect biodiversity, will assist decision-makers in delivering effective environmental management, policies and programs both now and in the future.

The Australian Government recognised the salient role of research in this quest, and in 2010 established the National Environmental Research Program (NERP). NERP's principal aim was to:

"Improve our capacity to understand, manage and conserve Australia's unique biodiversity and ecosystems through the generation of world-class research and its delivery to Australian environment decision makers and other stakeholders"

Subsequently, up to AUS\$20m were allocated each year over the period of 2011-2014 to support applied research that:

- ❖ Has a strong public-good focus and public-good outcome;
- ❖ Is end-user focused and addresses the needs of the Australian Government and other stakeholders in developing evidence-based policy and improving management of the Australian environment;
- ❖ Is highly innovative and aims to achieve world-class research and an international standing in the chosen field of research;
- ❖ Enhances Australia's environmental research capacity;
- ❖ Is collaborative and builds critical mass by drawing on multiple disciplines from multiple research institutions to address challenging research questions;
- ❖ Provides results accessible to government, industry and the community; and
- ❖ Includes focussing on synthesis and analysis of existing knowledge.

Operationally, the NERP encompasses 5 main hubs (see the NERP website for a detailed description of each hub):

1. Tropical Ecosystems Hub
2. Environmental Decisions Hub
3. Northern Australia Hub
4. Landscapes and Policy Hub
5. Marine Biodiversity Hub

The research about which this report is written was undertaken as part of the Tropical Ecosystems (TE) Hub which addresses issues of concern for the management, conservation and sustainable use of the World Heritage listed Great Barrier Reef (GBR) and its catchments, tropical rainforests including the Wet Tropics World Heritage Area (WTWHA), and the terrestrial and marine assets underpinning resilient communities in the Torres Strait. Within this Hub alone, there are a total of 38 research projects and 2 communications and knowledge brokering projects, which are organised under 13 programs, within 3 themes as outlined in Figure 1 and Appendix 1. This report is associated with Project 12.3, theme 3, and discusses findings that will assist key decision makers in government, industry and the community in managing the WTWHA. From this point forward, the phrases ‘the region’ and ‘the area’ are used interchangeably with the acronym ‘WTWHA’, for ease of reading.

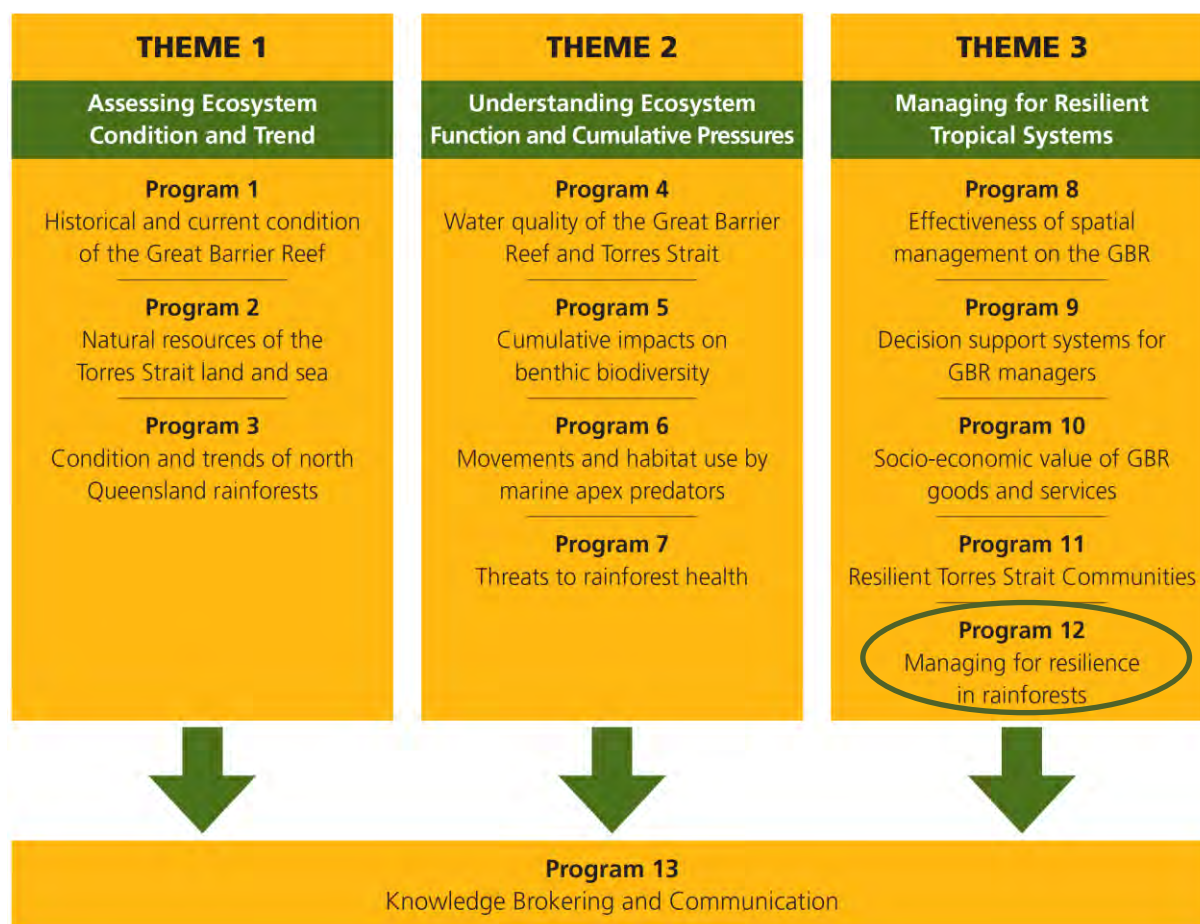


Figure 1: Themes and programs of the NERP Tropical Ecosystem Hub

1.2 Situating the research

The WTWHA is home to a rich variety of flora and fauna, and contains spectacular scenic vistas. It is also home to 20 tribal groups of Rainforest Aboriginal people. Despite the richness of the region’s natural and cultural ‘values’, relatively little is known about them. Before continuing, it is, however, important to clarify what we mean by the word ‘value’.

Although the word ‘value’ is often used synonymously with price, it means different things to different people. Social scientists for example, use the term ‘value systems’ when discussing either an individual’s or a society’s set of principles, norms and beliefs (Jackson et al. 2011).

Ecologists often refer to environmental 'values' as a concept entirely separate and disconnected to social or economic interpretations of 'value', while economists are more likely to take a utilitarian view: measuring 'value' in terms of the contribution which a particular good or service makes to the well-being (or 'utility') of an individual (Stoeckl et al. 2012). It is a slightly modified version of this last perspective that we take in this report.

Formally, we adopt an ecosystem services (ES) view of 'value'. ES are defined as the benefits people derive from ecosystems – the support of sustainable human well-being that ecosystems provide (Costanza et al. 1997; Millennium Ecosystem Assessment (MEA), 2005; Haines-Young & Potschin, 2013). We thus consider the 'value' of a particular ecosystem service (or indeed the 'value' of any good or service) to be commensurate with the contribution it makes to well-being. We use this very anthropocentrically focussed approach not because we believe that people and nature are separate or that only human (or economic) values count, but rather because it facilitates 'valuation' of those services (economic, social, aesthetic and moral) (Haines-Young & Potschin, 2013). Clearly, we do not interpret absence of price as being indicative of absence of value.

As discussed in more detail in section 3.1.2, the WTWHA provides many ES. But most studies in the region have been undertaken by biophysical scientists; only a small handful has been formally 'valued' in economic studies. To the best of our knowledge there is only one that has considered a broad range of ecosystem services (Curtis, 2002) – where the opinions of 50 'experts' (with the Delphi technique using multi-criteria analysis) were combined with property-market information that was used to generate estimates of the 'value' of numerous different ES. We are aware of no other study that has sought to estimate the 'value' of a variety of ES in the WTWHA using data collected from the population at large. As such, significant knowledge gaps remain.

1.3 Project aims and scope

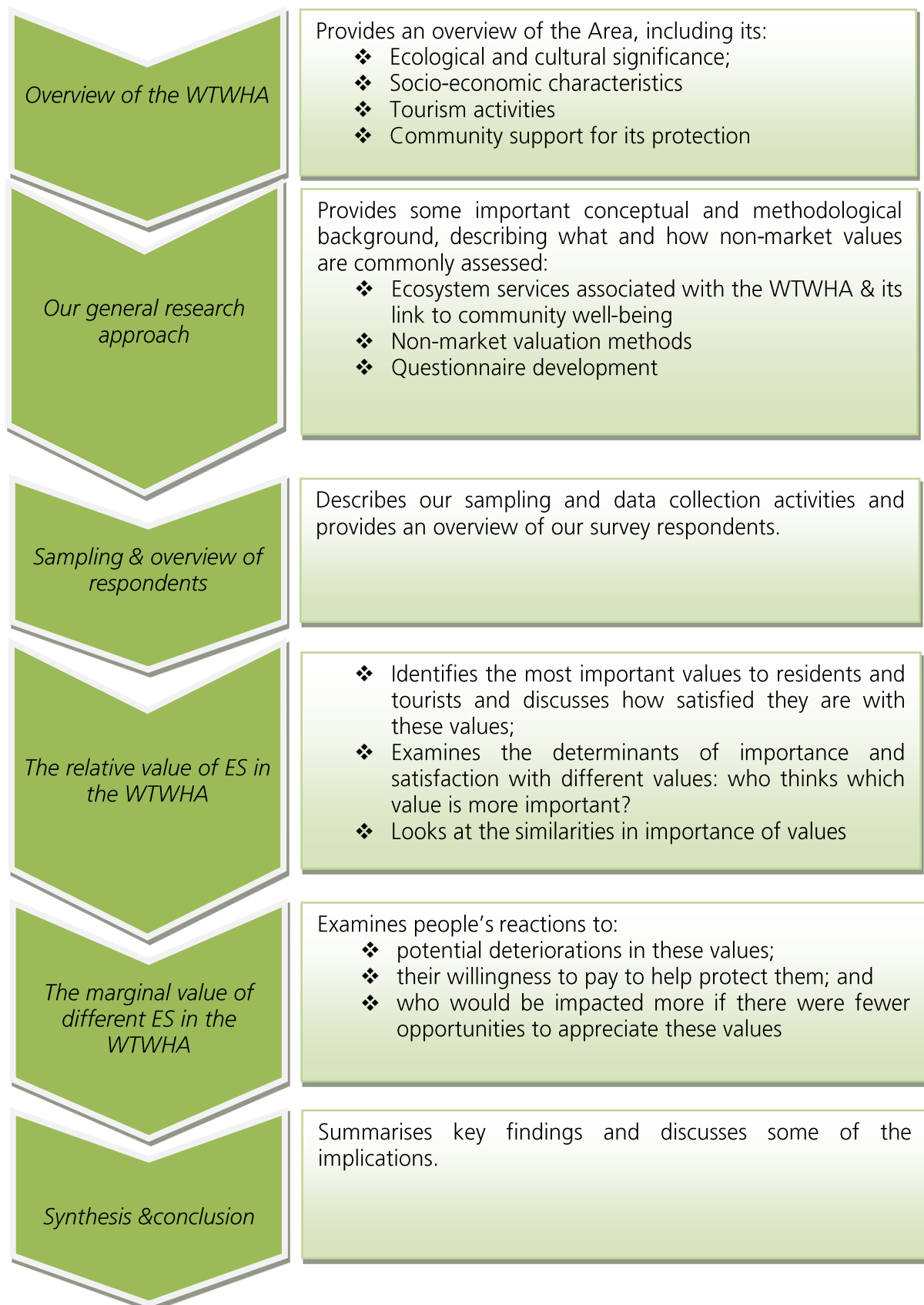
The overarching aim of this project is thus to **improve our understanding of the value which residents and tourists place upon the ecosystem services (ES) provided by the WTWHA**. By considering a broad range of ES and by assessing their importance *relative* to each other and *relative* to other social and economic goods and services, this study goes beyond mere livelihoods and consumptive values, considering the overall contribution of the WTWHA to human well-being. To satisfy this aim, 3 specific objectives were devised, namely to:

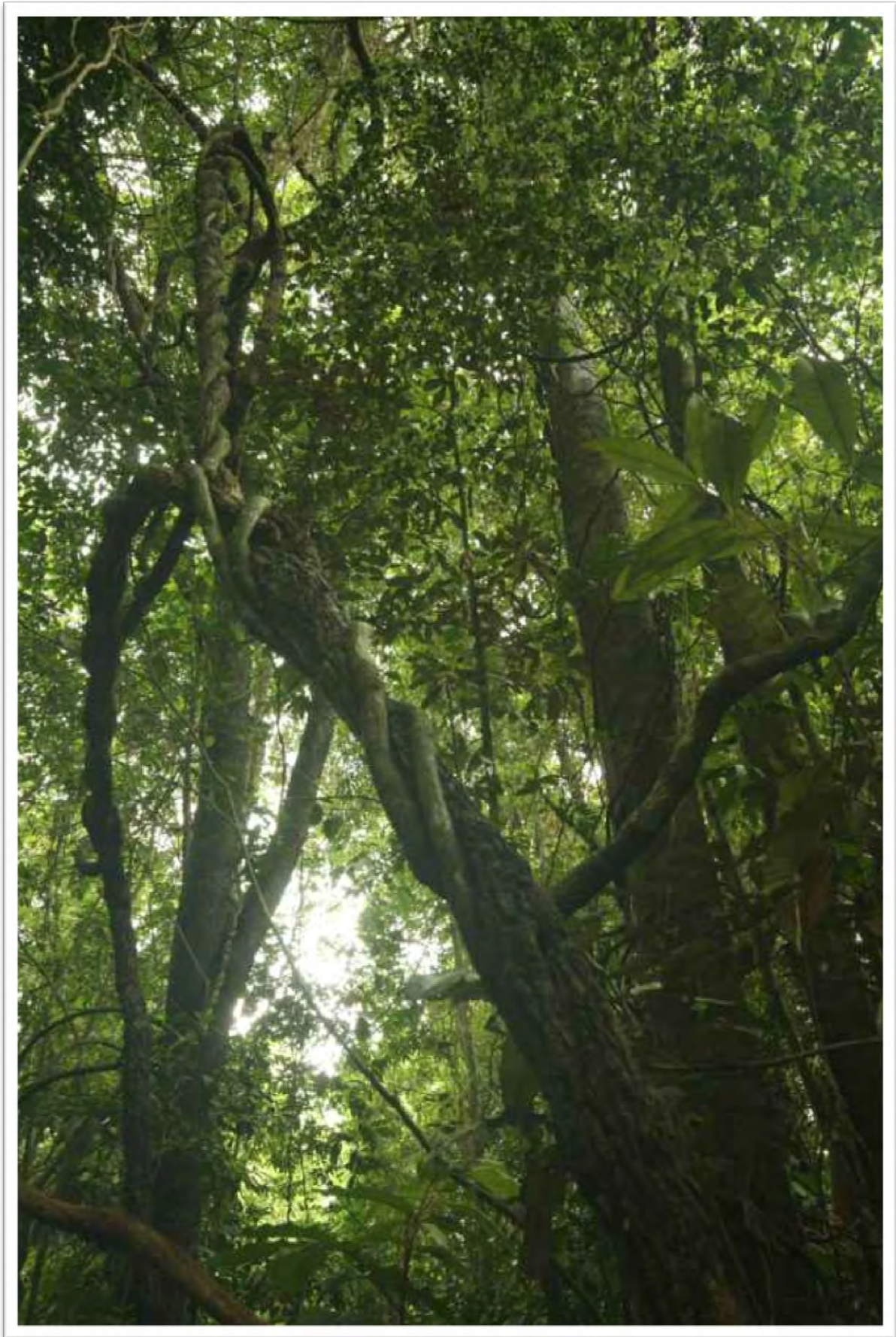
1. Improve our understanding of the relative importance ('value') of various ES provided by the WTWHA to both residents and tourists;
2. Make predictions about the way in which resident and tourist 'values', and thus management, conservation and marketing priorities may alter in the future as both population and tourist numbers change; and
3. Improve methods for assessing 'values' by comparing state-of-the art non-monetary valuation techniques with more 'traditional' valuation techniques.

We note that different people often wish to use the results from economic 'valuation' exercises in different ways. Some simply want to raise public awareness of the importance of an ecosystem (or ecosystem service). Others want to use results to help assess the way in which people and/or the economy might be impacted by particular management changes (e.g. reductions in scenic amenity, increases in weeds and pests). In economic jargon, it is as if the first group require information about the 'total' value of various ES provided by the WTWHA (*relative* to other values), while the second group could more usefully benefit from information about 'marginal' values (or trade-offs; the way in which people might be affected by change). We aimed to generate estimates of both.

1.4 Report structure

The rest of the report is organised as follows:





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2 Overview of the Wet Tropics World Heritage Area

2.1 An ecologically rich region

Recognised for its scenic panoramas of rainforest canopy, rugged gorges, wild rivers, waterfalls, giant trees and ferns and iconic species, the WTWHA is home to Australia's greatest diversity of animals and plants (WTMA, 2014). It comprises 900,000 hectares (just 0.26% of the continent) (WTMA, 2014) and extends approximately 450 km from Cooktown in the north to Townsville in the south, and west across the Atherton Tablelands to Ravenshoe (Figure 2). It is adjacent to the Great Barrier Reef World Heritage Area (GBRWHA), making this region the only one in the world where two world heritage areas exist side-by-side.



Figure 2: The Wet Tropics World Heritage Area and surrounds
(Source: WTMA, 2014; reproduced with permission)

On December 9th 1988, the Area was granted World Heritage status (Wet Tropics Management Authority, 2009b; UNESCO, 2010), having satisfied all 4 of 10 of the World Heritage Committee's 'natural' criteria (no cultural criteria were included). These 4 natural criteria were:

1. It is an outstanding example of the major stages in the earth's evolutionary history;
2. It is an outstanding example of ongoing geological processes, biological evolution and human interaction;

3. It contains superlative phenomena, formations and features; and
 4. It contains important and significant habitats where threatened species of animals or plants of outstanding universal value live.
- (See Appendix 2 for more details on how the Area justified inclusion for each criterion).

Inscription on the World Heritage Register entails the responsibility of preserving such a significant asset. Australia thus has an international duty for ensuring the protection, conservation, presentation and transmission to future generations of the Area. The Wet Tropics Management Authority (WTMA) has statutory authority for its protection and management and reports to both the Australian and Queensland Governments. One of the primary roles and responsibilities of the Authority is to present the Area so people can enjoy and appreciate its many outstanding values.

2.2 An historically and culturally rich region

The Area is culturally rich with thousands of generations of Traditional Owner heritage. Although the region's cultural values have been recently recognised nationally, they are yet to be considered as being of universal value by the World Heritage Committee. Much effort has been made since the World Heritage listing in 1988 and is ongoing, driven by the Traditional Owners of the Area with conservation and economic and civil society partners, with the hope that traditional values will also be acknowledged as core part of the Outstanding Universal Values of the Area.

The WTWHA is the traditional estate of the region's Rainforest Aboriginal peoples, whose culture has been intimately associated with the Wet Tropics landscape for thousands of years. In fact, it is the only place in Australia where Aboriginal people enduringly inhabited a rainforest prior to European arrival. Permanent habitation of the rainforest by the Aboriginal peoples is evidenced by numerous camping places and archaeological sites (Aboriginal Rainforest Council, 1997). Such strong associations with the Area means the rainforest Aboriginal peoples hold a great wealth of ecological and management knowledge about its flora and fauna, landscapes and resources. Their ability to use 14 toxic plants as food, including the diverse and complex techniques employed to process them (e.g. ground ovens to soften toxic nuts, certain streams to leach out the toxins) are clear examples of outstanding heritage values to Australia (Commonwealth of Australia, 2012). Another significant illustration of the cultural practices of the Aboriginal peoples is their ingenious and unique use of fire to manage vegetation communities of the rainforest and plant specific methods to regulate the lawyer vine (a climbing palm with spiny stems) (Commonwealth of Australia, 2012).

Around 9 language family group nations (Yalanji, Djabugay/Djabuganjdjii, Yidinji, Dyirbal/Djirbalngan, Warrgamaygan, Warrungu, Nyawaygi, Gugu Badhun and Mbabaram) constituting 20 distinct Traditional Owner Groups (Sunrise and Sunset Yalanji, Djabugay, Gunggandji, Muluridji, Mamu, Ngadjon, Yidinji, Yirrganydji, Bandjin, Djiru, Girramay, Gugu-Badhun, Gulnay, Jirrbal, Nywaigi, Warrgamay, Warungnu and Wulgurukaba peoples), over 120 warras and barras (sometimes named as clans), over 600 extended family groups (who to this day are key decision making structures), 20,000 persons, and over 80 cultural and natural resource management legal entities, embody the cultural richness of the Area with ongoing traditional spiritual and custodial connections to Country, Culture and Kin (RAPA, 2013, 2014). Each of the 24 contemporary identity groups continues to hold customary obligations for the management of their respective traditional estate under Aboriginal laws and customs (RAPA, 2013, 2014). Their traditional boundaries are identified by geographical features such as rivers or mountain ridges, which are also identified as key places of intangible heritage values (story places, stories, dances and spiritual beings) (Figure 3) (RAPA, 2013).



Figure 3: Rainforest Aboriginal people in and around the WTWHA
(Source: RAPA, 2013 – reproduced with permission)

Clearly, to the Rainforest Aboriginal peoples, Country and its natural features and resources are central to their way of life, they are key facets to their spirituality, culture, social organisation and economic use. Their ongoing protection and preservation are thus integral to their cultural survival and to managing Country across the region (RAPA, 2013).

2.3 A diversely populated region: Social and economic background

The WTWHA falls within the boundaries of 9 local government areas (LGAs) (Figure 4). Of these, 3 LGAs account for 82% of the Area: Cairns regional council (31.63%); Tablelands regional council (25.21%); and Cassowary Coast regional council (25.16%). Within the Area, there are around 100 plots of privately owned land, while an estimated 2500 properties adjoin its 3000km boundary (WTMA, 2012).

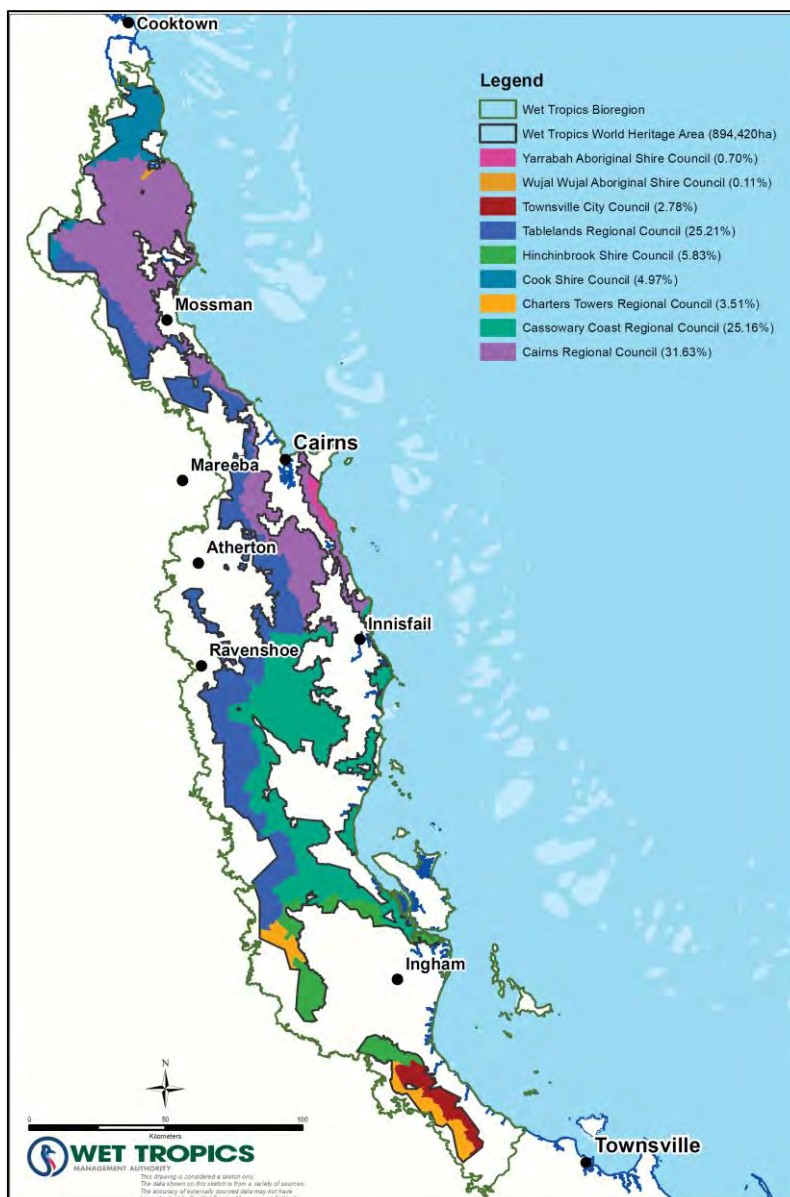


Figure 4: Shire councils in and around the WTWHA
(Source: WTMA, 2013, reproduced with permission)

Following is a description of the socio-economic profile of the 3 LGAs combined (i.e. Cairns (purple), Tablelands (blue) and Cassowary Coast (green), within which the majority of the Area is contained). At June 30th 2013, the 3 combined LGAs were estimated to contain 210,550 residents; 21.1% were aged 0-14 years, 66.3% 15-65 years and 12.6% were over 65 years old (Figure 5). The median age was 37.8 years, 2.4 years older than the median age of 35.3 at the same time in 2003.

The region is growing rapidly, with an average annual rate of 1.6% over the last 5 years. It is predicted that 270,000 people will live in the WTWHA by 2016 (WTMA 2012) and by June 2036, the population is forecast to be 304,949 people. Within the region, the Cairns regional LGA is projected to have the largest population, estimated to grow to 244,083 persons (an average annual rate of 1.9%). More than 700,000 are estimated to make up the broader population by 2031 (this includes other LGAs within and around the WTWHA) (WTMA, 2012).

Almost all of the expected future growth (in absolute terms) is likely to be contributed by those aged 40 and above. It seems there will be relatively fewer people in the 20-39 age cohorts, perhaps due to people moving away from the region for (employment) opportunities elsewhere. Lower birth rates are expected and so are lower death rates, increasing the age of the population (Figure 6) (Queensland Government Statistician's Office, 2014).

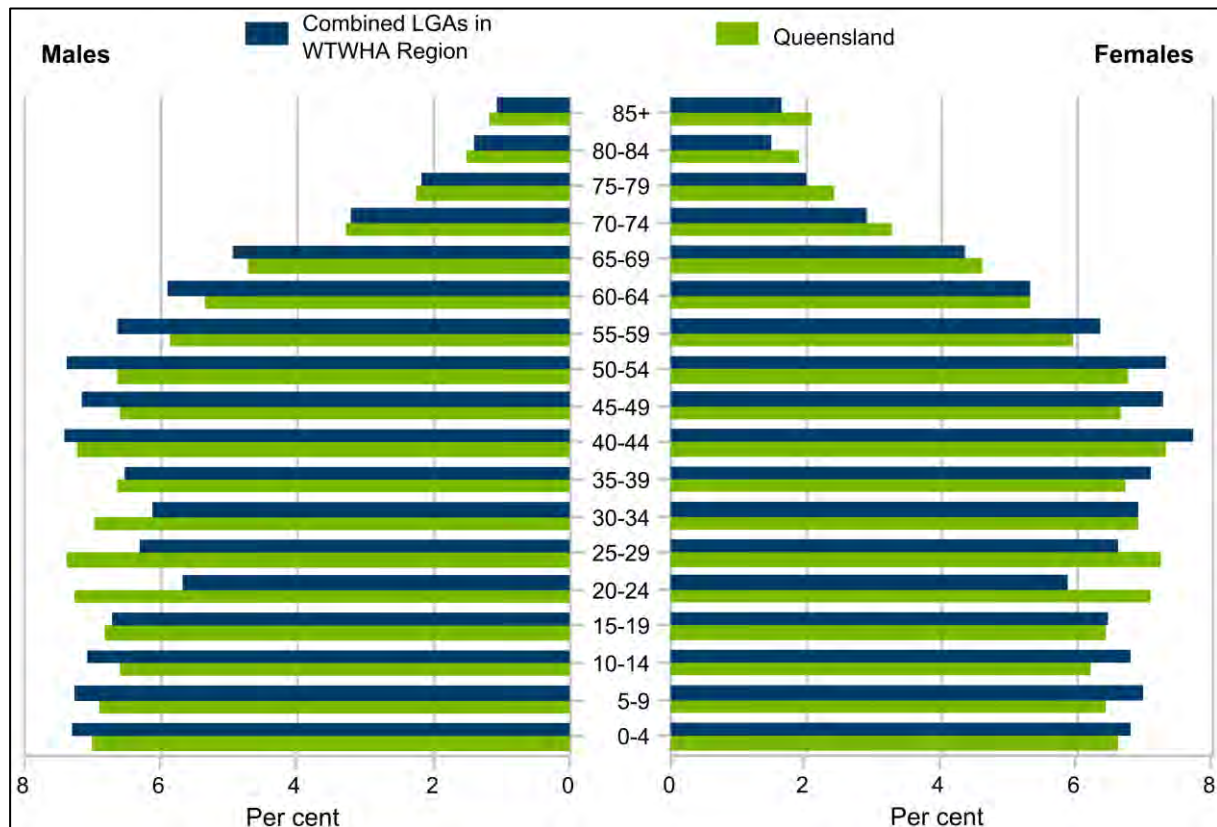


Figure 5: June 30th 2013 estimated resident population pyramid by age and gender for LGAs in and around the WTWHA compared to Queensland,
(Source: Queensland Government Statistician's Office, 2014)

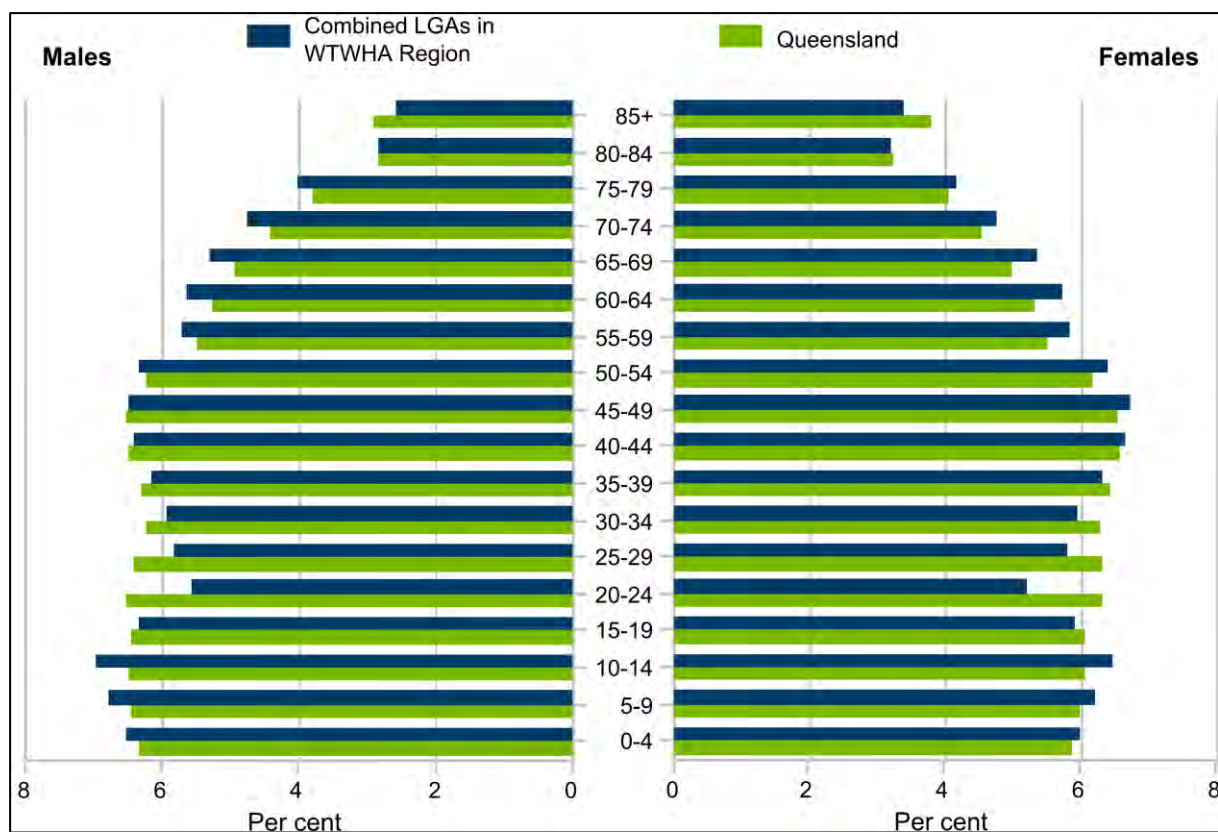


Figure 6: June 30th 2036 projected population pyramid by age and gender for LGA's in and around the WTWHA compared to QLD
(Source: Queensland Government Statistician's Office, 2014)

Migration is also a key factor contributing to the regions' population growth. In 2011, 36,534 people (18.8%) moved to these LGAs. More than 36,000 people were born overseas (18.4%). In that same year, there were more than 51,000 families: of those, around 40% were couple families with children. For 78,232 people (or 52.7%), Year 11 or 12 was their highest level of schooling. The median total personal income was \$30,167 per year while the median total family income annually was \$68,590. Around 7,407 families (14.4%) were considered low-income families (i.e. those families earning less than \$600 per week or less than \$31,200 per year). Around 12.2% of employed people worked in Health care and social assistance industry followed by 11.7% in the Retail trade industry. The Accommodation and food services industry provided 8.9% of employment (Figure 7). The highest specialisation ratio of 1.68 was in Agriculture, forestry and fishing industry. The majority of employed people worked as professionals (16.4%), followed by technicians and trades workers (15.9%) (Figure 8). The unemployment rate was 6.9% in December 2013 (Queensland Government Statistician's Office, 2014).

As regards the number of facilities, these LGAs had 42 aged care services and 1947 aged care service operational places, as at June 30th 2013. At that time, there were 93 schools and 15 hospitals. By June 2014, there were 742 approved new houses compared to the same time the previous year (\$257.3 million of building value) (Queensland Government Statistician's Office, 2014).

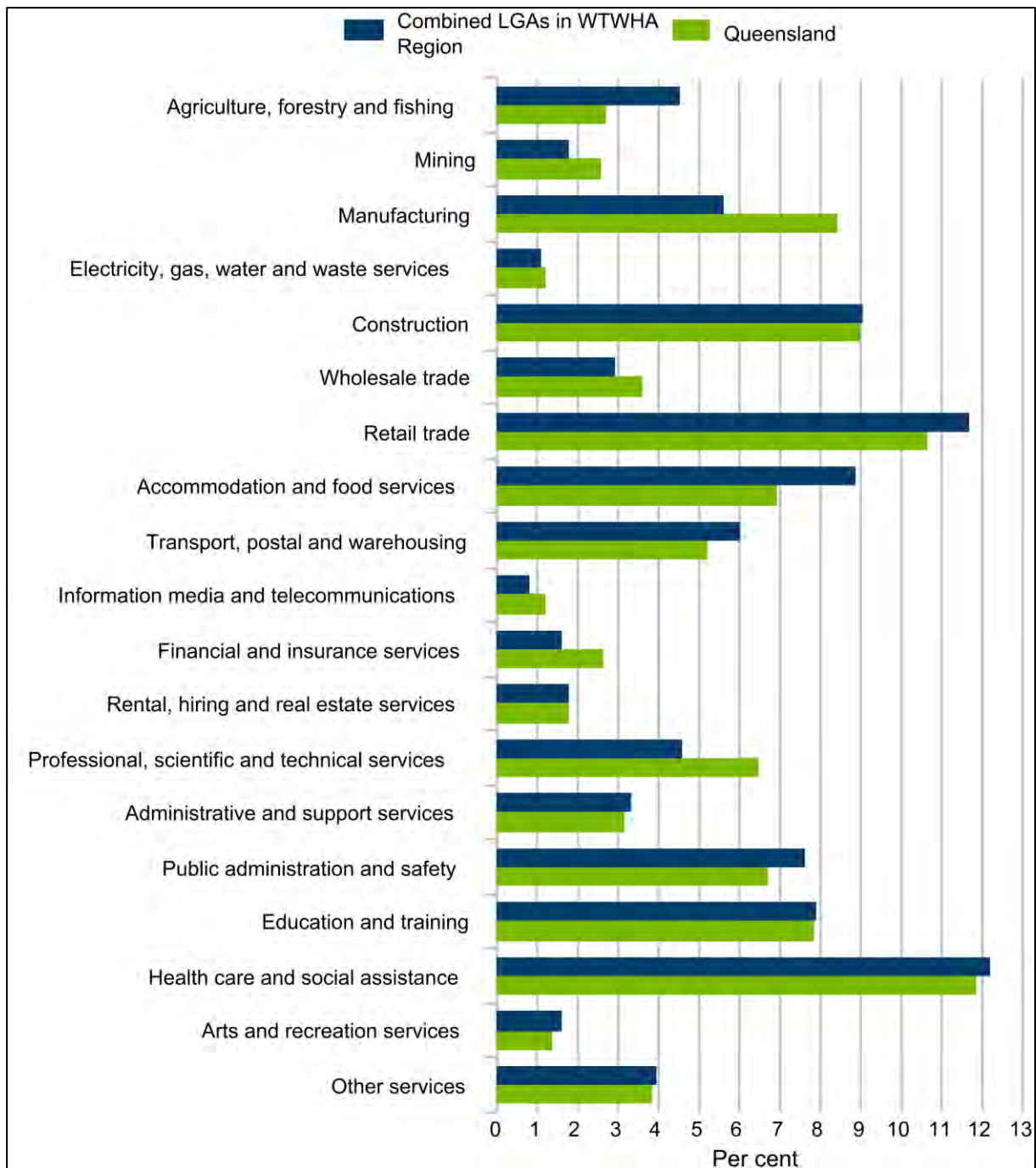


Figure 7: Percentage of workforce employed by industry – LGA's in and around the WTWHA compared to Queensland

(Source: Queensland Government Statistician's Office, 2014)

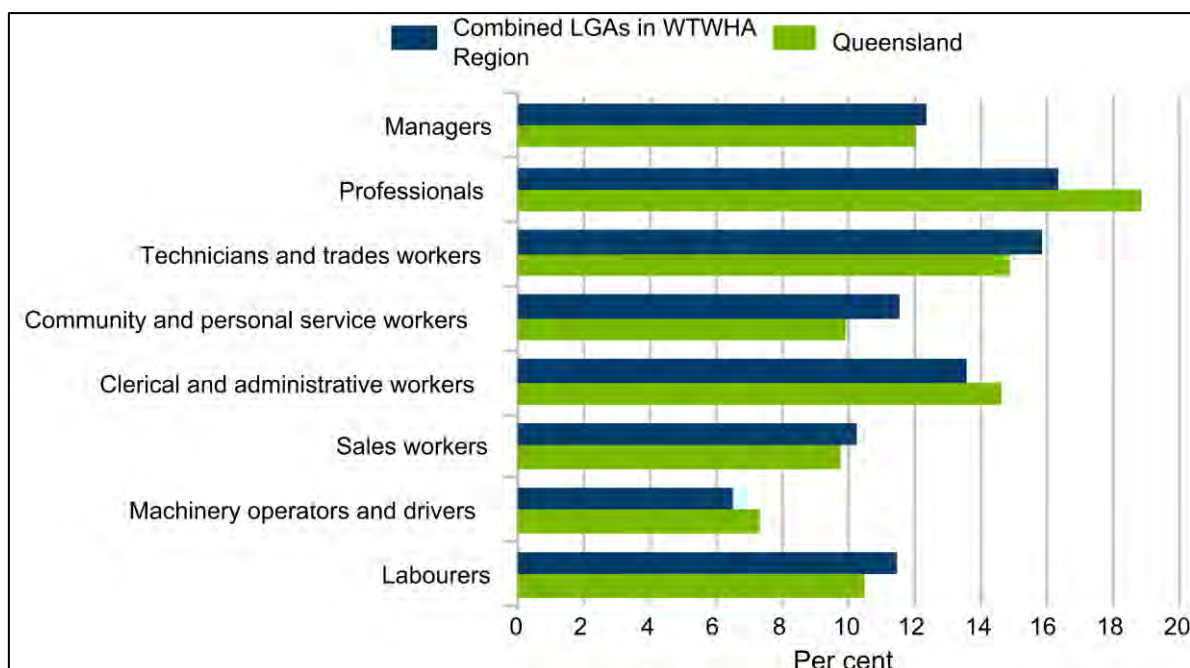


Figure 8: Percentage of workforce by occupation – LGA's in and around the WTWHA compared to Queensland

(Source: Queensland Government Statistician's Office, 2014)

2.4 Tourism in the WTWHA

The WTWHA is one of the most popular tourism attractions in Australia and is frequented by about 5 million local and international visitors annually. Long-term data collected by Prideaux and his team over the period 2007-2014, indicate that many visitors also come to the region to see the Reef; indeed the Reef is the main drawcard to the region (Prideaux et al. 2014, Figure 9). That said, the rainforest also features prominently; and having two adjacent World Heritage Areas undoubtedly helps make the region attractive to many.

Tourism is the fastest growing industry in the Wet Tropics, providing significant economic benefits, including employment opportunities (Queensland Government, 2009). Moreover, the Wet Tropics has been identified as one of the most significant money-earning World Heritage Areas in Australia (Gillespie Economics, 2008). Visitors to the WTWHA were estimated to contribute: \$2,058.0 million in annual direct and indirect output or business turnover; \$927.1 million in annual direct and indirect value added; \$606.8 million in annual direct and indirect household income; and 13,351 direct and indirect jobs (Gillespie Economics, 2008). Development of the Cairns international airport has made the region more accessible, with increases in global travel a key factor contributing to the region's growth (Queensland Government, 2009).

Most visitors to the region are domestic tourists (>80%), particularly during the Australian winter months. However, the region is becoming increasingly popular with overseas visitors as well. Day trips to the rainforest tend to be most common among visitors who arrive in Cairns – they either drive themselves to the WTWHA (in their own cars or hire cars) or participate in a commercial tour (Driml & Common, 1996).

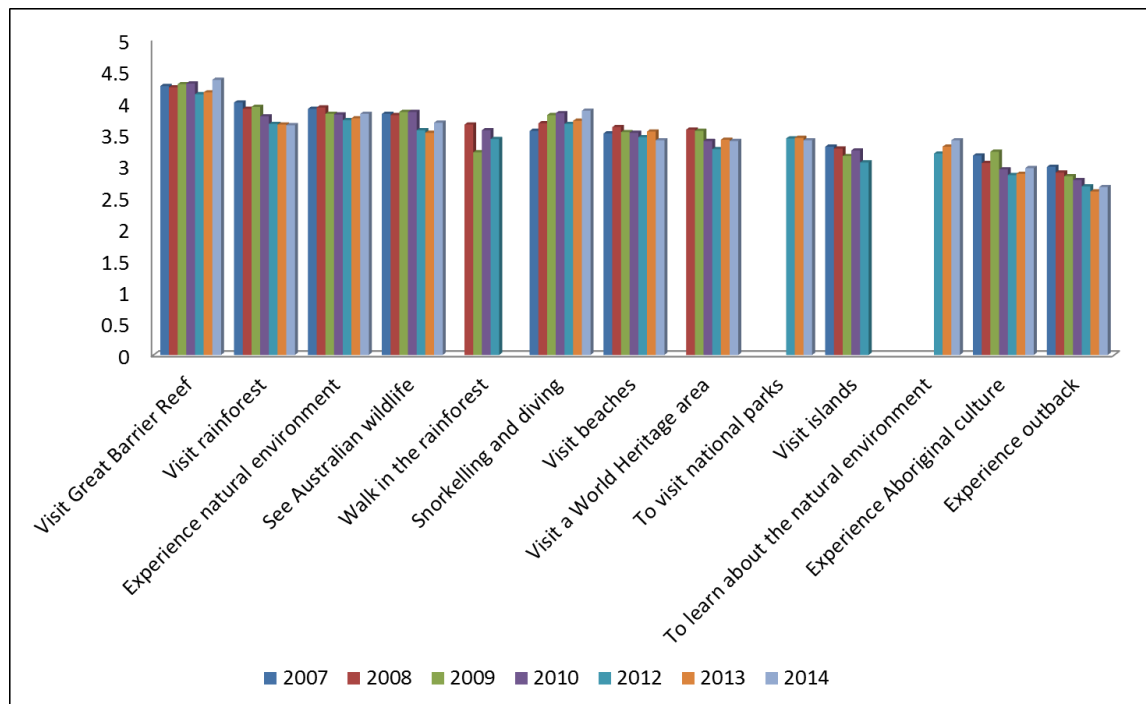


Figure 9: Primary motives for visiting region from 2007 - 2014 *

*Scale: 1 = Not at all important to 5 = Very important

(Source: Prideaux et al. 2014)

The region contains over 200 visitor sites and 150 managed walks (WTMA, 2009), and has the highest concentration of ecotourism operators in Australia and arguably in the world (Tony Carters and Associates, 2010). Businesses of different types and sizes operate in the area, offering a variety of different activities from easy guided walks in the rainforest to 4WD tours into the most secluded areas of the rainforest (tours). There are numerous accommodation options from rural farm stays to luxury resorts (accommodations) as well as award winning attractions like Skyrail, in addition to wildlife parks (attractions) (Cairns Unlimited, 2011).

As noted earlier, the Area is also culturally rich with more than 20 Aboriginal Traditional Owner groups having ongoing traditional connections to land in and near the Wet Tropics (Ignjic, 2001). These continuing affiliations with the Area provide an important resource for regional tourism and a key source of employment for the Rainforest Aboriginal people. Indigenous tourism ventures encompass storytelling, tour guiding, camping, cultural centres, traditional dance and the production and sale of arts and crafts (Ignjic, 2001; Zeppel, 2002). These tourism enterprises are not just socio-economic opportunities for the Indigenous people, but importantly, an economic pathway for sustaining the cultural heritage¹ values of the Area's cultural landscape (WTMA, 2011).

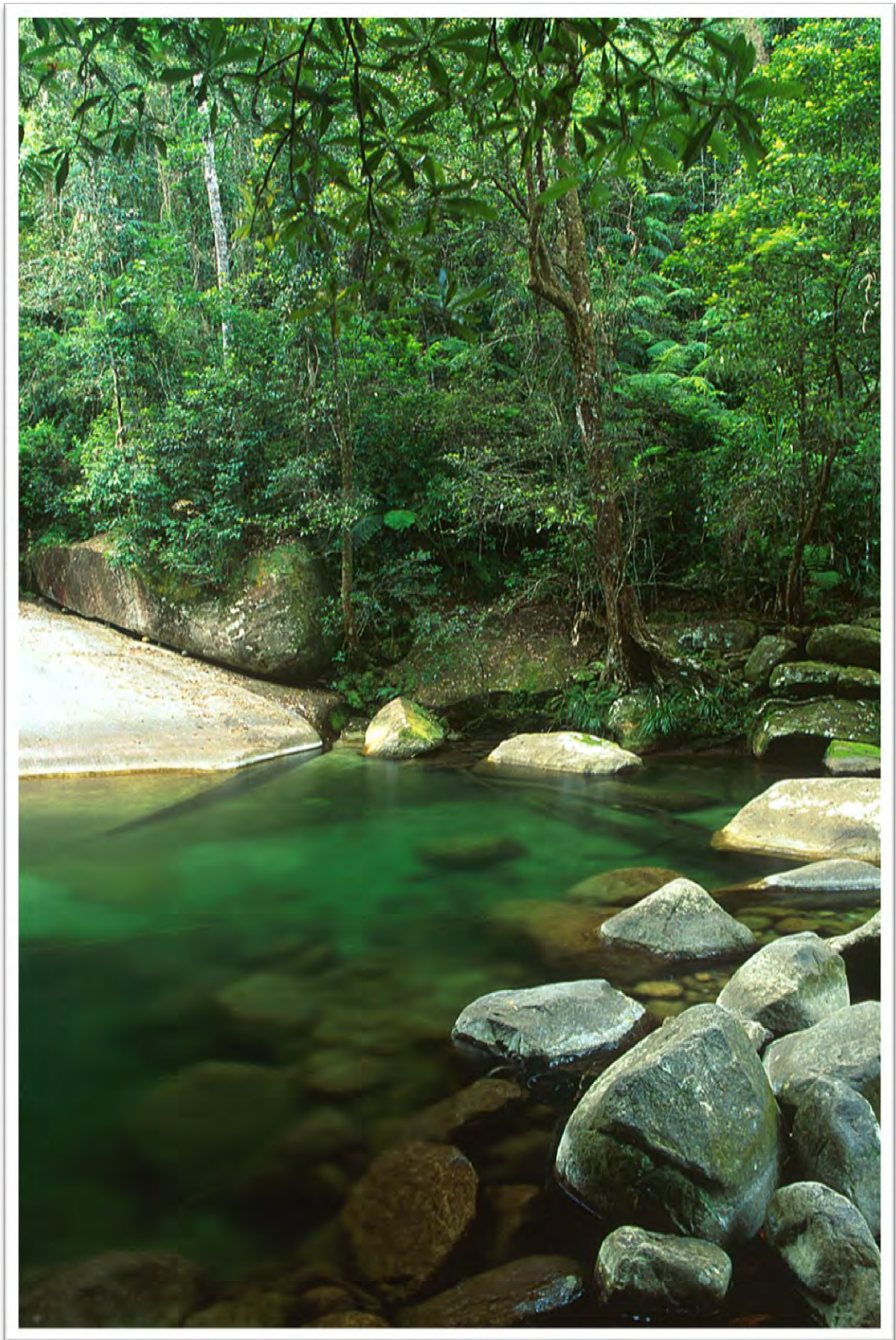
2.5 Community support for the protection of the WTWHA

The initial bid for World Heritage status was not given full support at that time – by either the then Queensland Government, or by some within the community who saw it as a threat to the

¹ Cultural heritage is defined as “the ways of living developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values” (Australian Heritage Commission, 2001, p. 58).

timber industry and to livelihoods. However, surveys conducted over the last 20 years reveal increasing support and active community stewardship for the Area as well as a high level of satisfaction with its management (McNaire, 1992, 1993 1996; Nielsen, 1999; Bentrupperbäumer & Reser 2003, 2006; Carmody & Prideaux, 2008). For example, community support for its listing has grown from 50% in 1996 to over 80% in 2007. There is a high level of awareness of the importance of protecting the natural environment, particularly those areas that are refuges for endangered plants and animals (Carmody & Prideaux, 2008). A variety of locally-based community groups actively engage in conservation practices such as revegetation of degraded lands and creeks. Some of these groups have been set up through the voluntary efforts and initiatives of many private landholders whose efforts are critical towards the retainment and rehabilitation of habitat and wildlife corridors, fire management, control of weeds and pests and the maintainance of water quality and flows. As new threats emerge and financial pressures challenge management resources, such community support is increasingly desirable (WTMA, 2012).

Moreover, community surveys have shown growing support for the inclusion of Aboriginal cultural heritage in the World Heritage listing of the Wet Tropics, rising from 63% in 2002 to 72% of respondents in 2007 (Carmody & Prideaux, 2008). During that same period, support for Aboriginal co-management of the Area also increased from 58% to 66%, respectively. Evidently, the significance of having a World Heritage Area at their backdoor is embedded in the communities of this region, with the WTWHA perceived as an integral part of their quality of life and environment. There is a strong sense of place, social identity and cohesion.



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3 Our general research approach

3.1 Conceptual background and ES literature in the WTWHA

3.1.1 Ecosystem services and human well-being

As noted in section 2.1, ecosystem services (ES) are defined as the benefits people derive from ecosystems – the support of sustainable human well-being that ecosystems provide (Costanza et al. 1997; Millennium Ecosystem Assessment (MEA), 2005; Haines-Young & Potschin, 2013). Fundamentally, this means that people are connected to, depend on, and benefit from nature.

The link between people and nature is, however, complex, and these complexities are even more apparent when attempting to value (in monetary terms) an entire ecosystem, such as the WTWHA. Some researchers have attempted to do this by generating monetary estimates of the value of several ecosystem services, and then adding giving the *Total Economic Value* (TEV). However, ecosystems are intricate and multifaceted systems, composed of non-linear, inter-dependent components (Koch et al. 2009), and many ecosystems services are inter-related; they are often overlapping and thus are difficult to separate from one another (Fu et al. 2011). As such, additive approaches to estimating the 'value' of an entire ecosystem risk double-counting (Balmford et al. 2011; Fisher & Turner, 2008; Hein et al. 2006; Stoeckl et al. 2014)².

To help avoid problems such as these (at least partially), the Common International Classification of Ecosystem services (CICES) was designed. One of the key considerations for the design of CICES is its resonance with other widely used frameworks and terminologies often used in discussing ES, the highly influential Millennium Ecosystem Assessment (MEA) being its starting point (Haines-Young & Potschin, 2013). Unlike the MEA and others, CICES is more hierarchical in structure, with the highest level (known as 'sections') being the 3 recognised categories: provisioning, regulating and maintenance, and cultural. Below these major 'sections' are nested a series of 'divisions', 'groups' and 'classes' (Figure 10 and Table 1)

² Formally, it is only valid to estimate the *total economic value* of an entire ecosystem using additive approaches if:

- the marginal utility of income is constant across all individuals, meaning that social values can be estimated by simply adding individual values (Adler and Posner, 1999);
- substitution effects and budget constraints are properly accounted for (Hoehn and Randall, 1989);
- general equilibrium effects are either minimal or are controlled for when estimating V_i^j (Carbone and Smith, 2013); and

all components, j , contribute to the utility of each individual, i , in an additively separable manner, so that total values can be estimated by adding the value of components without risk of double counting (Serafy, 1998).

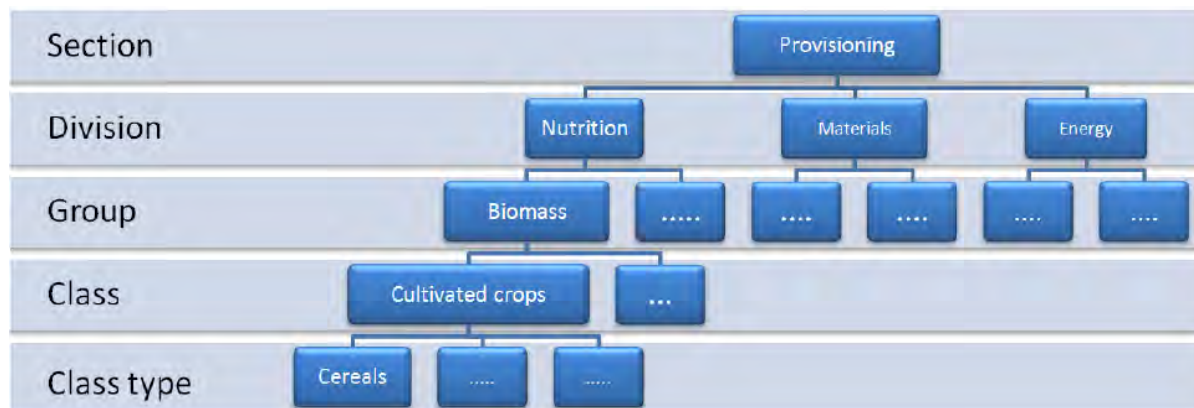


Figure 10: Hierarchical structure of Common International Classification of Ecosystem Services (CICES)
(Source: Haines-Young & Potschin, 2013)

Table 1: Sections, divisions and groups within the CICES
(Source: Adapted from Haines-Young & Potschin, 2013)

Section	Division	Group
<i>Provisioning</i> All nutritional, material and energetic outputs from living systems.	Nutrition	Biomass Water
	Materials	Biomass, Fibre Water
	Energy	Biomass-based energy sources Mechanical energy
<i>Regulation & Maintenance</i> All the ways in which living organisms can mediate or moderate the ambient environment that affects human performance.	Mediation of waste, toxics & other nuisances	Mediation by biota Mediation by ecosystems
	Mediation of flows	Mass flows Liquid flows Gaseous / air flows
	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection Pest and disease control Soil formation and composition Water conditions Atmospheric composition and climate regulation
<i>Cultural</i> All the non-material, and normally non-consumptive, outputs of ecosystems that affect physical and mental states of people.	Physical and intellectual interactions with ecosystems & land-/seascapes	Physical and experiential interactions Intellectual and representative interactions
	Spiritual, symbolic & other interactions with ecosystems & land-/seascapes	Spiritual and/or emblematic Other cultural outputs

Another key distinction between CICES and other ES classification systems is the exclusion of *supporting services* (i.e. those services that are necessary for the production of all other ES, such as soil formation and nutrient cycling (MEA, 2005)). This exclusion is based on the rationale that in order for ecosystems and economic valuations to be linked, it is the 'final outputs' from

ecosystems that are essential; not the underlying (supporting) services. Focusing on only final outputs helps to reduce the risk of double counting.

In this study, we thus focus on the value of ES that are provided by the WTWHA (e.g. swimming in clear, clean rivers, enjoying the scenic beauty and peacefulness), the potential impact of their degradation, and people's willingness to pay for their protection/maintenance. Following the principals outlined in the CICES, we focus on 'final outputs', our aim being to understand the 'value' of ES to residents of, and tourists to, this region.

3.1.2 Ecosystem services in the WTWHA

The WTWHA provides many ES (Figure 1) – many of which have been studied in detail by ecologists and other biophysical scientists (Table 2). Some researchers have even provided information that allows us to carefully describe the way in which these services contribute to human well-being. For example, McJanet et al. (2008) found that cloud stripping in the high altitude rainforests of the WTWHA contributes to precipitation, which feeds stream flow and water supplies. As such, several creeks flow even in the dry season. Local rivers can thus be used for power (there are two hydro-electricity stations in the region: *Koombooloomba Dam* on the Tully River and *Barron Falls Hydro* on the Barron River (WTMA, 2012)). Tourists also use the rivers for recreation (white water rafting); and agriculturalists use the water for production. Insects that use the rainforest interact with nearby agricultural crops assisting with pollination (Cunningham & Blanche, 2008). Plantation crops such as coffee receive similar benefits from the Area's birdlife (WTMA, 2012).

That said most studies in the region have been undertaken by biophysical scientists; only a small handful have been formally 'valued' in economic studies. This is illustrated in Table 2 which presents a non-exhaustive list of studies in the WTWHA categorised by type of ecosystem examined, and by type of study (e.g. biophysical, general background, economic valuation). Most economic 'valuation' work has focused on recreational / tourism values. To the best of our knowledge there is only one that has considered a broad range of ecosystem services (Curtis, 2002) – where the opinions of 50 'experts' (with the Delphi technique using multi-criteria analysis) were combined with property-market information that was used to generate estimates of the 'value' of numerous different ES. We are aware of no other study that has sought to estimate the 'value' of a variety of ES in the WTWHA using data collected from the population at large. As such, significant knowledge gaps remain.

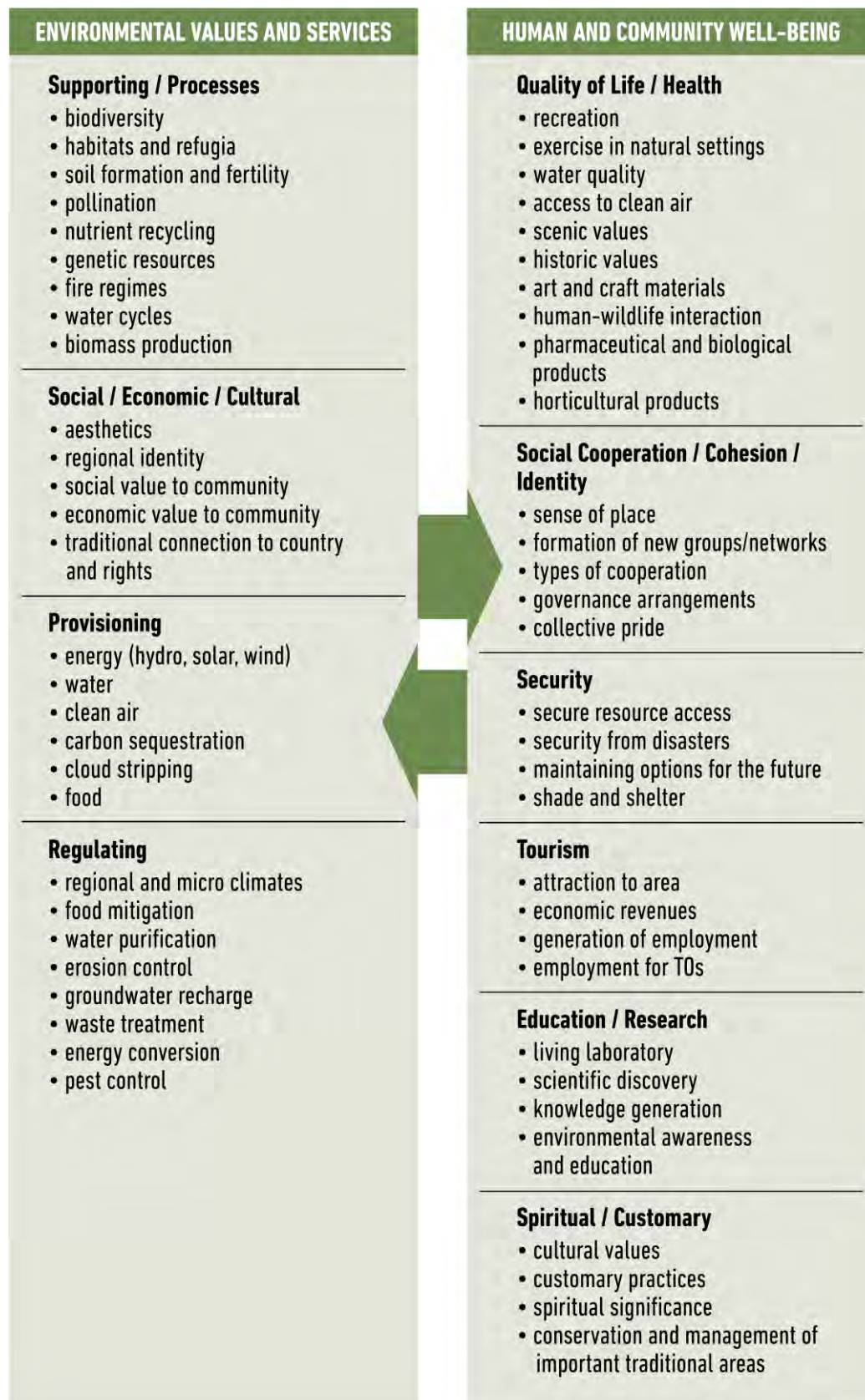


Figure 11: The link between environmental values and services and human and community well-being in the WTWHA

(Source: WTMA, 2012 – reproduced with permission)

Table 2: Significant gaps in understanding of 'values' associated with the WTWHA

Note the different colours: dark green denotes journal articles; medium green denotes books or book chapters; and light green denotes reports

	Services	Biophysical studies	Background studies	Indigenous studies	Economic/valuation studies
Cultural services	Recreation/Tourism	WTMA (2008; 2010; 2011; 2013) Pert et al. (2010)	Pearce (2008) WTMA (2009; 2010) Carmody & Prideaux (2008, 2011)		Cook & Harrison (2002) Gillespie Economics (2008) Deloitte Access Economics (2013)
	Australian icon		Carmody & Prideaux (2008, 2011)		Gillespie Economics (2008) Curtis (2004)
	Cognitive/Scientific research/education	Stork et al. (2014) WTMA (2008; 2010)		Gratani et al. (2011) WTMA (2010; 2011)	
	Aesthetics	WTMA (2008; 2013) Pert et al. (2010)	Carmody & Prideaux (2008)		Curtis (2004)
	Heritage/spirituality/customs/knowledge systems	WTMA (2008; 2013) Gratani et al. (2011) Hill et al. (1999)	Pearce (2008)	WTMA (2011) Hill et al. (2008) Knudtson & Suzuki (1992) Panell (2008) Pryor (1998)	
	Sense of place	WTMA (2008) Knudtson & Suzuki (1992)	Carmody & Prideaux (2008, 2011) McNaire (1992, 1993, 1996) Bentrupperbäumer & Reser (2002, 2003, 2006)	Hill et al. (2008) Knudtson & Suzuki (1992) Panell (2008) Pryor (1998)	
Provisioning services	Food/water	WTMA (2008; 2013)	Curtis (2004)		Curtis (2004)
	Pharmaceutical products	WTMA (2008)			
	Genetic resources	WTMA (2008)			Curtis (2004)
	Agriculture	WTMA (2008)	Curtis (2004)		
	Cloud stripping	McJanet et al. (2008)			
Regulating services	Carbon sequestration	WTMA (2008) Preece et al. (2012)	Hunt (2008)		
	Flood mitigation	WTMA (2008) Pert et al. (2010)			Curtis (2004)
	Ground water recharge	WTMA (2008)			Curtis (2004)
	Pest control	WTMA (2008)			
	Carbon /water cycles	WTMA (2008) McJanet et al. (2008) Pert et al. (2010) Richards et al. (2003) McKergow et al. (2005) Preece et al. (2012) Richards et al. (2003)			Curtis (2004)
	Climate regulation	WTMA (2008) Preece et al. (2012)			Curtis (2004)
	Erosion control	McKergow et al. (2005)			Curtis (2004)

Supporting services	Habitat & refugia	Hilbert et al. (2007) Pusey et al. (1995) Schneider & Moritz (1999) Hilbert et al. (2001)			Curtis (2004)
	Ecosystem health (resilience)	WTMA (2011) Mackay et al. (2012)			
	Pollination	Boulter et al. (2008)			Curtis (2004)
	Biodiversity	Catterall et al. (2012) Garnett et al. (2010) Kikkawa (2008) Metcalf & Ford (2008) Pusey et al. (2008) Mackay et al. (2012) Williams et al. (2008) Pert et al. (2010) Schneider & Moritz (1999) Williams & Bolitho (2003) Stork et al. (2014)	Hunt (2008)	Hill et al. (1999) Hill et al. (2008)	Curtis (2004)
	Soil creation	Rasiah et al. (2004)			Curtis (2004)
	Nutrient cycling	Rasiah et al. (2004) Richards et al. (2003) McKergow et al. (2005)			Curtis (2004)
Management of services	Conservation/ Resources	Pert et al. (2012) Waterhouse et al. (2012) WTMA (2013) Hilbert (2010) Stork et al. (2014)	Emtage & Herbohn (2012) Carmody & Prideaux (2008)		
	Cultural			Hill et al. (1999) Panell (2008)	
	Scientific (for research)	WTMA (2010; 2011) Stork et al. (2014)			
Threats to services	Land-use and its flow on impacts on the GBR (mainly agriculture's use of fertilisers, etc.)	Brodie et al. (2005) Faithful & Finalyson (2005) Shaw et al. (2010) Waterhouse et al. (2012) Rasiah et al. (2004)			
	Climate Change	Hilbert et al. (2001) Hilbert et al. (2007) Hilbert (2010) Shoo et al. (2005) WTMA (2008; 2011) Williams & Bolitho (2003)			
	Deforestation/ agriculture/grazing	Rasiah et al. (2004) Pert et al. (2012) WTMA (2013) Waterhouse et al. (2012)			
	Biodiversity loss	Catterall et al. (2012)			

3.2 Theoretical background and methodological choices

3.2.1 Determining WHOSE values to assess

Identifying whose point of view to include in any study is an important consideration, since people's perceptions of what is 'valuable' differs. Pagiola et al. (2004) cogently illustrated such differences using a forest-based ecosystem as an example: the international community was found to derive most benefits from biodiversity conservation and recreation; the national community derived most benefits from water services and the extraction of forest products; and local communities derived most benefit from the extraction of forest products. The key point to be made is that if one had conducted a study of the 'value' of the forest and included:

- a. Only 'local' residents, then one would have concluded that the forest is of value because of its (marketable) 'products'; or
- b. Only members of the international community, then one would have concluded that the forest is of most value because of its conservation and recreation uses.

As noted in sections 1.2 and 1.3, this project sought to help fill a gap in the literature regarding Indigenous and non-Indigenous residents' and tourists' perceptions of the different 'values' of the WTWHA. As such, determining whose value to consider was a relatively easy task in this instance: we needed to consider Indigenous and non-Indigenous residents of and tourists to the WTWHA. In subsequent sections, we look for similarities and differences in 'values' across these three groups.

3.2.2 Determining WHAT 'values' to assess and WHY

Having decided whose opinions/'values' to include in a valuation study, one must then decide what to 'value'. As noted in section 3.1.2, significant knowledge gaps regarding the 'value' of ES in the WTWHA exist; the key problem here being that it would have been impossible to fill all gaps, so we needed some means of identifying the most important gaps to fill. When doing this, it helps to think about WHY one wants to 'value' an ecosystem system or an ES. That is, one needs to carefully define the end use and audience for one's study (WCPA, 1998). Doing so ensures that the study is carried out efficiently and effectively, and that information generated is relevant.

Previous research has highlighted the significance of stakeholder engagement (before, during and after results are collected) if wishing to maximise research relevance (Preskill & Jones, 2009; Pomeroy & Douvere, 2008, Stokes et al. 2006). Understanding different interests and expectations from the start increases the likelihood that the outcomes will be used for learning, decision-making and taking action (Preskill & Jones, 2009). Stakeholder participation can occur at various times during the life of a project: whilst defining research questions and thus developing questionnaires; whilst collecting data; and/or whilst determining how best to analyse and present data. In this study, stakeholders were engaged at all three stages. Moreover, there are numerous organisations and individuals who have a professional and personal interest in the WTWHA; we attempted to engage with many by having open participatory workshops in the region.

To be more specific, we held three workshops for this project: the first one took place in September 2012, in Cairns, followed by another two in June (Brisbane) and August (Cairns) 2014. The September workshop was mainly used to gather ideas while the latter two workshops were mainly used to follow-up and report back results. Several presentations were also made during the course of the project to inform others about the progress being made (For a full list of these presentations see Appendix 3). More details are provided below.

The first workshop was attended by representatives from:

- ❖ Wet Tropics Management Authority
- ❖ Department of National Parks, Recreation, Sports & Racing
- ❖ Tourism Tropical North Queensland
- ❖ Alliance for Sustainable Tourism
- ❖ Tropical Tablelands Tourism
- ❖ Wildlife Tourism Australia
- ❖ Tour operators
- ❖ Centre for Rainforest Studies
- ❖ Tree Kangaroo Mammal Group
- ❖ Cairns & Far North Environment Centre
- ❖ Cairns City Council

The workshop attendees were provided with background information about the project and of the importance of their contribution in ensuring that the information collected was of relevance to both the WTWHA and their organisations. Participants were also provided with information including some preliminary findings of a parallel project which was underway at the time (*Project 10.2 Socio-economic systems and reef resilience* – also a NERP funded project we were involved in). Because these two projects were similar, this helped us illustrate, to those attending the workshops, a variety of different ways in which information about ES ‘values’ could be used and presented, thus allowing participants to select and focus on the approaches most suited to their needs.

The participants were split into 2 groups, with one group identifying and prioritising regionally relevant goods and services for assessment (task 1), and the other identifying and prioritising key ‘changes’ likely to be of interest to managers (task 2) for consideration in the surveys. To ensure that all participants had a chance to contribute to both tasks, they were asked to switch groups (and thus topics) half way through the workshops. Although many factors often overlap between visitors and residents, when discussing each task, effort was made to discuss both stakeholders separately.

As expected, several values were identified for consideration. To help narrow the list, participants were each given 5 “votes” (dotted stickers) and these votes were used to prioritise values for assessment.

For residents, key values were those associated with forest health, scenery, culture Indigenous and European (e.g. mining, cattle), opportunities for employment (a value which could potentially be compared to and/or traded off against other ‘core’ values), accessibility to the WTWHA and importantly, the quality of access, and the sense of community (i.e. social cohesion)³. For tourists, participants identified: the presence of iconic species, landscape (e.g. waterfall, scenic drives), water quality and walking tracks as the most important values for assessment⁴.

³ Other values identified as worthy of consideration in the assessment exercise (albeit receiving fewer ‘dots’ than the ones mentioned above) were: Proximity to other cultures and environments – such as PNG and the Torres Strait (i.e. the geographic value); the ‘interactive’ value of having two world heritage sites side by side (i.e. the WTWHA and the GBRWHA); Water quality; Cultural festivals; Congestion (notably for camping purposes); Amenities; Ability to participate in activities; Urban sprawl; Land clearing; Botanical gardens.

⁴ Other values for evaluation included: Therapeutic values; Opportunities for solitude; Quality of guided tours; Uniqueness of Australian rainforests; Accessibility to WHA sites; Cultural festivals; Botanical gardens; Cultural history; Healthy parks

The final lists of items selected for assessment by residents and tourists (with descriptors provided by participants) are provided in

Figure **12** and Figure 13 respectively.

Benefiting either directly or indirectly from the jobs & incomes created by:
The tourism industry
The mining industry
The agricultural industry
Other industry/sector (e.g. fishing, retail, education etc.)
Being able to access the rainforest via:
Walking tracks &/or dirt roads
Bitumen roads & bridges
Rail/Skyrail
Being able to:
Learn more about a unique & ancient Australian environment
Hear from Aboriginal people about their sense of place (culture & country)
Go on rainforest walks
Visit waterfalls &/or swim in clear, clean rivers/streams/waterholes
See iconic species in the wild (e.g. cassowary, kangaroos, rattle birds, etc.)
Relax and/or reflect in a natural environment
Enjoy uncrowded camping & picnic areas
Enjoy the scenic beauty & peacefulness of the rainforest (sights, sounds & smell)
Having:
Healthy native plants & animals (e.g. free from diseases, pests & weeds)
Beautiful undeveloped scenery to look at
Two world heritage sites side-by-side (i.e. the WTWHA and the GBRWHA)
Protecting:
Places that have Aboriginal cultural values
Places that have other cultural values (e.g. European/Asian)
The WTWHA either for its own sake or for future generations (even if you have never been there & never plan to go)
Being able to:
Spend time with friends & family
Enjoy city-entertainment (e.g. spending time at cafés, museums, etc.)
Have some 'control' over what is happening in your life
Join in community activities (e.g. attend cultural/environmental festivals)
Knowing that:
Friends & family are healthy & safe
Good quality roads, hospitals, schools, etc. are there if need be

Figure 12: List of values selected for assessment – Residents

Finding a place where the price matched my budget
Visiting a place which is close to where I live
Having good quality accommodations, shops & restaurants
Having quality guided tours &/or attraction venues
Being able to access the rainforest via:
Walking tracks &/or dirt roads
Bitumen roads & bridges
Rail/Skyrail
Being able to:
Learn more about a unique & ancient Australian environment
Hear from Aboriginal people about their sense of place (culture & country)
Go on rainforest walks
Visit waterfalls &/or swim in clear, clean rivers/streams/waterholes
See iconic species in the wild (e.g. cassowary, kangaroos, rattle birds, etc.)
Relax and/or reflect in a natural environment
Enjoy uncrowded camping & picnic areas
Enjoy the scenic beauty & peacefulness of the rainforest (sights, sounds & smell)
Go to the Great Barrier Reef World Heritage Area (GBRWHA)
See iconic marine species (e.g. whales, dugongs, turtles)
Enjoy sunshine & warmth
Having:
Healthy native plants & animals (e.g. free from diseases, pests & weeds)
Beautiful undeveloped scenery to look at
Two world heritage sites side-by-side (i.e. the WTWHA and the GBRWHA)
Protecting:
Places that have Aboriginal cultural values
Places that have other cultural values (e.g. European/Asian)
The WTWHA either for its own sake or for future generations (even if you have never been there or never plan to go)
Being able to:
Spend time with friends & family
Enjoy city-entertainment (e.g. spending time at cafés, museums, etc.)
Attend to business, go to meeting/conference
Join in local activities (e.g. attend cultural/environmental festivals)
Knowing that:
You & travelling companions are healthy & safe
Good quality roads, hospitals, etc. are there if need be

Figure 13: List of values selected for assessment - Tourists

As part of task 2, participants were asked to identify demographic, economic, development or other 'changes' &/or management issues that affect the 'core' values of the WTWHA.

The most significant 'changes' (management issues) identified for possible consideration related to: access; construction of roads and other infrastructures; iconic species; water; weeds and pests; aesthetics; and Indigenous culture. As was the case with the previous task, we asked participants to help prioritise the list of 'changes' to be assessed using coloured 'dots'. Our final list of potential changes to focus on (including a change in prices to facilitate comparisons with market-related changes) appears in Figure 14.

If local prices rose by 20% compared to other places in Australia
If there were twice as much rubbish (e.g. bottles, plastic) in the rainforest & in the rivers
If there was half as much chance of seeing an iconic animal (e.g. cassowary, kangaroo, rifle birds, musky-rat kangaroo)
If there were fewer native plants & animals to look at & twice as many pests & weeds
If there were half as many walking tracks
If there were twice as many tourists
If the rivers changed from clear to murky
If the undeveloped scenic beauty & peacefulness of the area declined
If you could spend only half as much time with friends & family (compared to now)
If there were half as many cafés, shops, theatres, etc. in your local area
If there were half as many good quality roads, hospitals & schools in your local area
If there was more public information about Aboriginal cultural values of the area

Figure 14: List of 'changes' for assessment – Residents and Tourists

3.2.3 Determining HOW to assess 'values'

Having determined what values to assess (and why), one must next determine how to undertake the assessments. Economists have developed numerous different techniques for assessing the monetary worth of various ES (Figure 15).

1. Valuation techniques that use market prices		Most useful when valuing services that have a market value – e.g. Goods produced, Tourism
(a) Changes in the value of Output	}	Often used to value regulating services (e.g. the amount people pay to prevent beach erosion)
(b) Loss of Earnings		
(c) Preventive expenditures (mitigation costs)	}	
(d) Replacement cost		
2. Revealed preference techniques		Can be used to value market and <u>some</u> non-market goods and services – e.g. Recreation, Environmental quality
(a) Property or land value approach	}	
(b) Travel cost approach		
(c) Wage differential approach		
(d) Acceptance of compensation		
3. Stated preference techniques		In theory, can be used to value almost anything – depending upon how the questions are structured; doesn't always have to use \$
(a) Contingent valuation	}	
(b) Choice modelling / Conjoint analysis (contingent rating, contingent ranking and choice experiments)		
(c) Paired comparison		
4. Benefit Transfer		'Borrowing' estimates from other regions and using them instead

Figure 15: A range of valuation techniques
(Source: Adapted from Gregersen et al. (1987), Driml (1994) and Grey (1996)

Although economists tend to use terms such as *Total Economic Value (TEV)*, direct and indirect use-value and non-use values, there is a correspondence between those terms, and the terminology associated with the literature on ES (Stoeckl et al. 2014; Haines-Young & Potschin, 2013).

Assessing the monetary worth of ES that are exchanged in the market is relatively straightforward: one simply needs to identify markets for them, gather data about prices paid in these markets, and determine the amount of the good or service traded on the market (WCPA, 1998). The monetary worth of tourism, for example, can be quantified by looking at direct sales to tourists i.e. expenditures on accommodations, food and entrance fees, etc (although many tourism impact studies also consider the way in which that money flows through the economy, thus affecting other sectors – see, for example Deloitte Access Economics, 2013; Stoeckl et al. 2010; Driml 1999). Similarly, the monetary worth of harvests can be measured through income from sales (which may include user fees or access charges).

Where markets do not exist, other techniques are required and, as depicted in Figure 16, there are a variety of methods available. Revealed preference techniques can be used if there is at least some 'link' between the ES of interest and the market. For example, the link between house prices and scenic views can be capitalised on to estimate the monetary 'value' of a view (simplistically the difference in price between 2 houses which are similar in all respects except for the fact that one has a nice view).

If there are no market prices, and if there are also no 'links' between the ES of interest and the market, then one must construct a 'hypothetical market' using stated preference techniques⁵ such as *Contingent Valuation* and *Choice modelling*. Simplistically, it is as if researchers ask people to tell them how much they would be willing to pay for different ES, if a market for them existed. If using monetary systems such as these to generate estimates of 'value', one needs to consider the distribution of income⁶, but there is a growing body of literature on subjective well-being and overall life satisfaction (LS) which provides yet another way of looking at the 'value' of the environment – a good review of which can be found in Kristoffersen (2010). These stated preference approaches use non-monetary methods for generating quantitative assessments of the relative importance of a range of different values – some of which have been successfully trialled in and around Northern Australia (See: Larson, 2009; Delisle, 2009; and Stoeckl et al, 2012, Larson et al, 2013, 2014 and Stoeckl et al, 2014 for published examples).

It was clear that we were going to need to use one single valuation approach to assess all of the values, so that meaningful comparisons could be made. This is necessary because different types of valuation approaches (Figure 15) generate different types of 'values' that cannot always be added or compared. To explain, note that some valuation techniques generate estimates of *Price* - denoted by the dark blue line in

Figure 16. In contrast, some techniques generate estimates of *Expenditure* – represented by the blue rectangle in

Figure 16. Others generate estimates of:

- ❖ Consumer surplus - CS (the amount that a consumer would be prepared to pay for a good, over-and-above what is actually paid) – shown as the purple triangle in
- ❖ Figure 16;
- ❖ Total Willingness to pay (WTP) = expenditure plus CS (i.e. the blue rectangle plus the purple triangle);
- ❖ *Changes* in expenditures – the dark red rectangle; and/or
- ❖ *Changes* in CS – the yellow trapezoid in
- ❖ Figure 16.

⁵ Stated preference techniques are thus open to criticisms for their hypothetical nature, and choice modelling in particular, may require complex designs (from choice sets characterized by a number of attributes and attribute levels, the complexity of which increases as the number of attributes investigated increase) (Bech & Gyrd-Hansen, 2005; Kuhfeld, 2010). Contingent valuation's ability to generate high estimates of Willingness-to-pay (WTP) is considered problematic (Greiner & Rolfe, 2004) thus leading some researchers to question its reliability (e.g. Hausman, 1992; Diamond & Hausman, 1994). Nonetheless, Duffield & Patterson (1991) argue that the differences between real (i.e. observed) WTP and contingent valuation estimates are negligible and predictable enough, and a wide panel of experts associated with the National Oceanic and Atmospheric Administration (NOAA) (Arrow et al. (1993, p.3) support this conclusion.

⁶ Willingness to pay is a function of ability to pay, which depends on income/wealth. As such, valuation approaches which rely on dollars give more weight to the preferences of the wealthy than to the preferences of the poor.

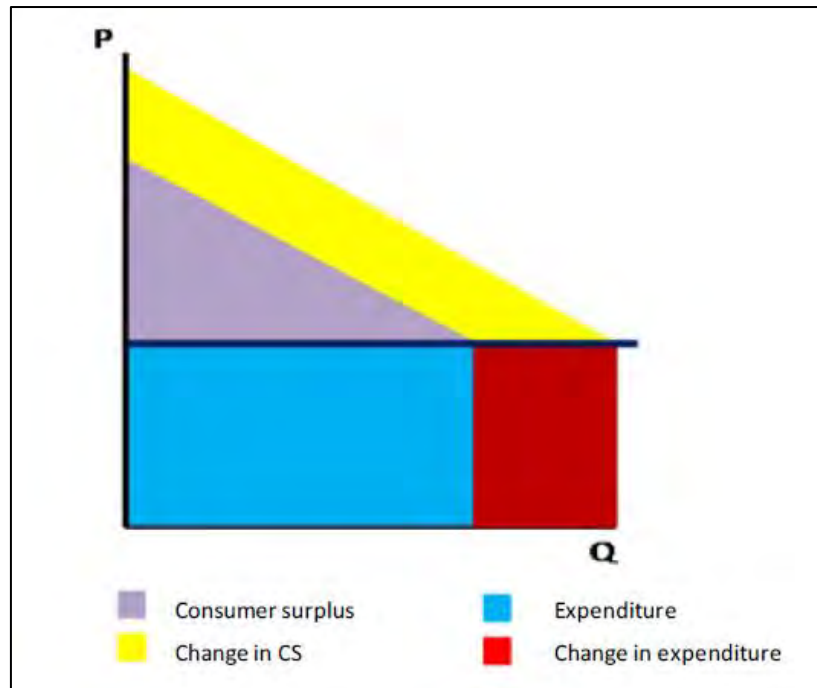


Figure 16: Stylised representation of the different types of estimates generated by various valuation techniques.

Accordingly, even though most valuation techniques generate estimates of 'value' that are denominated in dollars, this does not mean that estimates can be validly compared. One way to ensure it is valid to compare estimates, is to generate those estimates using identical methodological approaches.

Many of the values identified for assessment (

Figure **12** and Figure 13) have little or no relationship with the market. So in this project it was clearly going to be necessary to use at least some stated preference approaches. Correctly designed choice modelling and contingent valuation surveys require significant amounts of questionnaire 'space' (particularly choice modelling experiments, which can require respondents to participate in numerous choice experiments each taking several minutes). We thus decided to rely, primarily, upon the life-satisfaction approach, although we also included some contingent behaviour and contingent valuation questions which focused on a smaller subset of the 'values', so that we could look for insights by also comparing methodological approaches. All of these methods are discussed in more detail in subsequent sections of this report.

Finally, it is important to reiterate a point made in the introductory section of this report: some valuation techniques allow one to estimate the total monetary 'value' of an ecosystem or ecosystem service, others generate estimates of marginal value.

Estimates of the 'total' worth of an ecosystem or of an individual ecosystem service are particularly useful if seeking to:

- ❖ Describe the current state of affairs – for example, determining that one good or service is of more 'value' (or more important) than another;
- ❖ Highlight the importance of a value; or
- ❖ Address 'all-or-nothing' management/policy questions such as: what losses would the region suffer if the entire WTWHA region ceased to exist?

Managers are not always faced with all or nothing choices (rainforest or no rainforest). Rather, they often need to make choices 'at the margin', and may, for example, need information that helps answer questions such as:

- ❖ What losses would the region suffer if development eroded (rather than erased) some of the region's values (e.g. if new enterprises affected aesthetic or biodiversity values)?
- ❖ Would more people (tourists) come to the region if we could improve resource 'y'?
- ❖ What compensation should be sought (monetary or otherwise) if development 'x' takes place?

Discussions with key stakeholders (during workshops – see section 3.2.2) indicated that we were likely to want estimates of both 'total' and 'marginal' values, for a broad range of ecosystem services.

3.3 Questionnaire development

3.3.1 Initial drafts

We blended insights from the literature and the workshop, to identify appropriate valuation 'strategies' and to develop a structured outline for the two planned questionnaires (linking specific types of questions and 'values' to particular valuation techniques). As discussed previously, our literature review emphasised the need to understand the managerial or policy context before selecting a valuation tool. Our stakeholder workshop confirmed that we needed to explore the *total* value (or importance) of some ES to residents and tourists, and also the likely response of residents and tourists to changes in those services (i.e. *marginal* values). Moreover, the values identified for assessment (

Figure 12 and Figure 13) comprised many non-use values (e.g. existence and bequest, aesthetics). As such, it was clear that we were going to need to use at least some stated preference techniques since the other techniques cannot estimate non-use values. We were also cognisant of the significant gap between rich and poor (Stoeckl et al. 2011; Carson et al. 2009), so were keen to ensure that we used both monetary and non-monetary assessment techniques. Workshops participants, particularly those interested in tourism, also raised interests in learning more about tourists' expectations and perceptions, which ultimately links with visitors' satisfaction with the experience. We viewed that as an important theme for both tourists and residents (i.e. asking about both importance and satisfaction).

Based on the above considerations, we decided to use:

1. A variation of the life-satisfaction approach to assess
 - a. The (total) 'value' of a wide variety of ES benchmarked against some market goods and services and also some 'social'/community goods and services (
 - b.
 - c. Figure 12 and Figure 13);
 - d. The effect of changes in those ES on overall quality of life (benchmarked against market and social changes) - Figure 14;
2. The contingent valuation approach (willingness to pay (WTP)⁷ to assess *marginal changes* in four of the key issues identified in (b), namely:
 - ❖ To protect native plants and animals from pests and weeds

⁷ People reveal their value for the benefits of ecosystem goods and services through their WTP for those benefits, and they also reveal their value for these benefits through their WTA compensation for forgoing the benefits (WCPA, 1998). We concentrated on WTP.

- ❖ To maintain undeveloped scenery and peacefulness
- ❖ To improve water quality
- ❖ To protect aboriginal cultural values;

We drafted 2 questionnaires: 1 for residents and 1 for tourists. These were then sent for feedback to all stakeholders who attended the workshop, and also to those who were unable but had indicated keen interest in the project. When drafting these questionnaires, we wanted to ensure some similarity with questionnaires developed for our corresponding study in the Great Barrier Reef World Heritage Area (*Project 10.2: Socio-economic systems and reef resilience*), so as to be able to make comparisons between marine/reef and terrestrial/rainforest 'values'.

The key inputs requested were on issues of appropriateness, relevance of the data and clarity of the questions. Examples of the sorts of feedback received include: the need to consider values beyond just those of the visual/aesthetics (e.g. sounds and smell), well-being benefits, and inclusion of whether respondents actually engage in volunteering activities as this is a good indicator of their altruistic tendencies.

3.3.2 Input from the Rainforest Aboriginal Peoples Alliance (RAPA)

Given the cultural richness of the area, we felt it was important to ensure that we did not just seek the views of people who are visiting the region, but also the views of those who have lived in the region for tens of thousands of years. This would allow us to make comparisons between the views of tourists, non-Indigenous and Indigenous residents. As such, we sent copies of the questionnaires to RAPA so as to ensure that culturally apposite 'language' was being used in the questionnaire and that we were measuring the things that 'matter' to the Traditional Owners.

Briefly, RAPA is the regional leadership group across Rainforest Aboriginal peoples (RAP) within the Wet Tropics region. Its philosophy is focused on actively supporting the on-ground Traditional Owner networks on matters such as culture, native title and natural resource management legislation related matters alongside community development and governance. As the peak body for the Rainforest Peoples, RAPA carries out distinct functions:

1. Providing support to Rainforest Aboriginal corporations, companies, organisations and networks;
2. Developing policy positions on matters relevant to RAP, country and culture;
3. Being the collective voice of the RAP;
4. Advocating on behalf of the RAP; and
5. Engaging with all levels of government, non-government organisations, the private and community sectors to promote the interests of Rainforest Aboriginal people, culture and heritage, and the lands and waters of the Wet Tropics region (RAPA, 2013).

Examples of feedback received from RAPA include:

- ❖ Change "Traditional / Indigenous cultural values" to "Aboriginal cultural values";
- ❖ Add an Aboriginal cultural element to question 5 - e.g. "Spend time with Traditional Owners learning about culture and country"; and
- ❖ "Are you or any of the people who normally live with you, Rainforest Aboriginal persons or other Aboriginal and/or Torres Strait Islander persons"?

RAPA was also keen to learn more about how important it was for residents and tourists to:

- ❖ "Hear from Aboriginal people about their sense of place (culture and country);
 - ❖ "Protect places that have Aboriginal cultural values"; and
 - ❖ "If there was more public information about Aboriginal cultural values of the area".
- Related to this, information on people's WTP to protect such places was also sought.

3.3.3 Final questionnaires

Appendix 4 and Appendix 5 contain copies of the resident and tourist surveys respectively. As noted earlier, we designed the survey in a way that was deliberately similar to the GBRWHA surveys to facilitate comparisons of values between the two ecosystems. That said, the WTWHA surveys were more focused on aesthetic values and Indigenous cultural values. Another point of difference between the two was that in this current study, we included 'social' values (e.g. safety of family/friends/travelling companions, quality of infrastructures such as hospitals and schools). As such, we are able to assess the importance of the environment, aesthetics and Indigenous values *relative* to 'social' values as well as to market values (e.g. employment).

Core sections of our resident questionnaire thus included questions about:

- ❖ The socio-demographic background of respondents (age, income, etc.);
- ❖ How often residents go to the WTWHA, and what they do while there;
- ❖ The importance of various goods and services provided by the WTWHA to overall quality of life and satisfaction with those goods and services;
- ❖ Satisfaction with life overall;
- ❖ People's perceptions about the way in which their overall quality of life would be affected by changes in various environmental, cultural and market factors (e.g. higher prices, reduced water clarity); and
- ❖ Willingness to pay (WTP) for improvements in various environmental and cultural attributes in the WTWHA.

When developing the tourist questionnaire, we sought to keep questions similar (to enable comparisons) but altered the wording of some segments. As such, core segments of this questionnaire included questions about:

- ❖ The socio-demographic background of respondents PLUS background about travel party and origin;
- ❖ How often visitors had been to the WTWHA in the past and what they did (or planned to do) while on this particular trip;
- ❖ Questions about the importance of various goods and services to their overall decision to come to the region (in contrast to the resident survey which asked about importance to overall quality of life);
- ❖ Their satisfaction with the trip overall (in contrast to the resident survey which asked about satisfaction with life overall);
- ❖ The way in which their decision to come to the region would have been affected by changes in various environmental, cultural and market factors (in contrast to the resident survey which asked about the way these things would affect overall quality of life);
- ❖ Expenditure while in the area; and
- ❖ WTP for improvements in various environmental and cultural attributes.

Importantly, we randomised the order of items presented to respondents for assessment. We did this, given evidence from literature that respondents are highly sensitive to the order in which questions are presented (especially if asked to evaluate a long list of items) (Cai et al. 2011, Lasorsa, 2003). We thus produced 24 different versions of the resident surveys and 24 different versions of the tourists surveys: all surveys contained exactly the same set of 'values' (those listed in

Figure 12 and Figure 13), but the order in which the 'values' being assessed (on page 2 of the questionnaires) varied. We also varied the bid-range presented to respondents on the WTP questions (some had \$500 as the highest value, some had \$750, some had \$1000 and some had \$2000), since respondents can be sensitive to this (Farr, et al. 2013).

Subsequent sections of this report provide much more detail about the various methods used, including information about the specific framing of questions, and the analysis of data.

3.3.4 Pre-tests

First we pre-tested the questionnaires with colleagues and then with some of the stakeholders who had attended workshops to ensure coherence and relevance. We then mailed-out 100 surveys to a sample of residents, within and adjacent our study area. There were no major issues with understanding of the questions being asked, so this provided us with confidence for the main mail-out. We made minor adjustments to the design and layout for clarity, the final version being that which is displayed in the Appendices.