

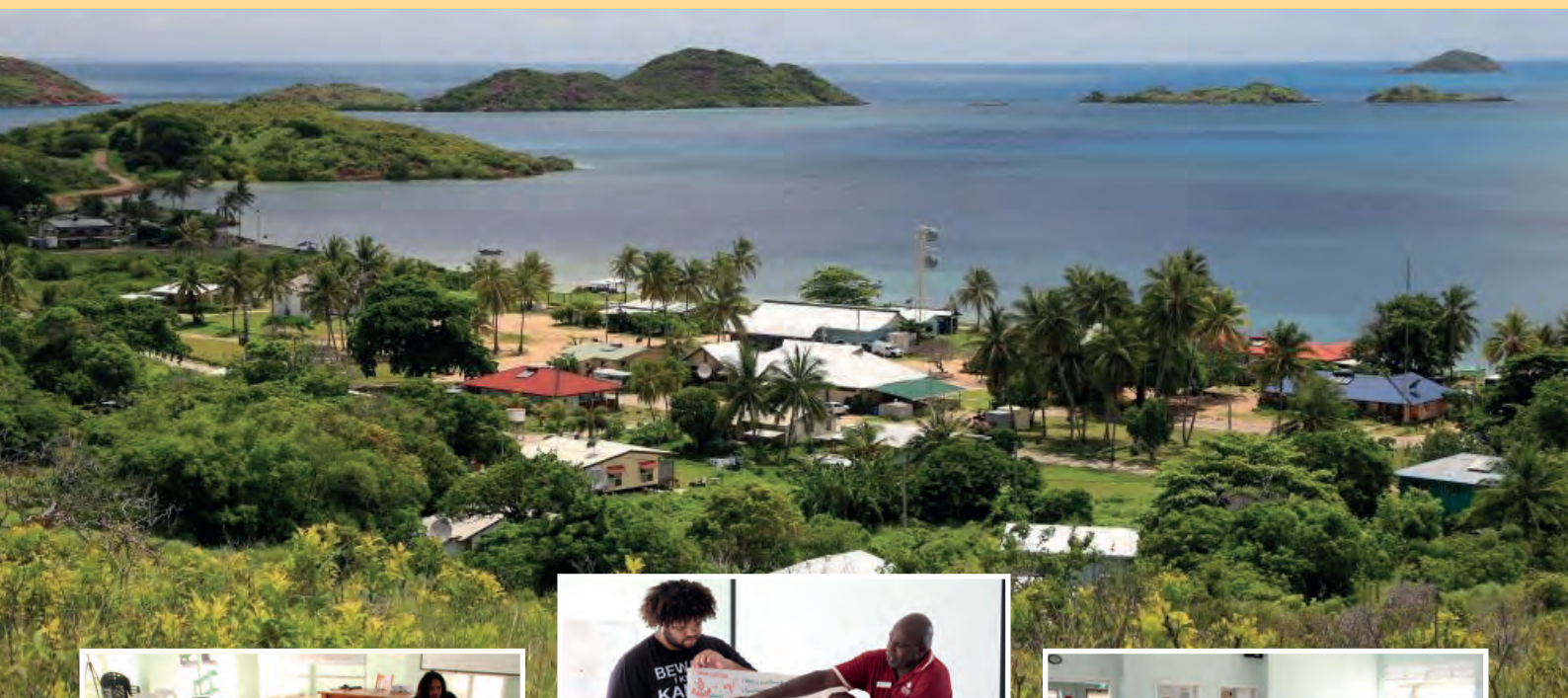


National Environmental  
Research Program

TROPICAL ECOSYSTEMS *hub*

Technical Report

## Mabuiag Yesterday, Today and Tomorrow: Community Future Scenarios and Adaptation Strategies



Bohensky, E., Butler, J.R.A., Rainbird, J., Skewes, T., McGrath, V.,  
Nai, F., Maru, Y., Morseu, F. and Lankester, A.



Australian Government  
Department of the Environment

Reef &  
Rainforest  
RESEARCH CENTRE

# **Mabuiag Yesterday, Today and Tomorrow: Community Future Scenarios and Adaptation Strategies**

Project 11.1 Building Resilient Communities for Torres Strait Futures

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# Contents

Acronyms .....	ii
Acknowledgements .....	iii
Executive summary .....	iv
1. Introduction .....	1
1.1 Project background .....	1
1.2 Mabuiag Island .....	2
2. Methodology .....	3
3. Mabuiag Island scenario planning .....	5
3.1 Community consent and invitations .....	5
3.2 Workshop process .....	6
4. Workshop results .....	9
4.1 Session 1: What are the drivers of change for livelihoods on Mabuiag? .....	9
4.2 Session 2: What are the desired and possible futures for the Mabuiag community? .....	17
4.2.1 Desired future vision for Mabuiag Island community .....	17
4.2.2 Mabuiag historical timeline .....	17
4.2.3 Future scenarios for Mabuiag Island .....	18
4.3 Session 3: What impact will the Business as Usual future have on human well-being? .....	25
4.4 Session 4: What is the resilience of the Mabuiag community today? .....	31
4.5 Session 5: What are priority adaptation strategies to build a resilient Mabuiag community? .....	34
4.5.1 Adaptation strategies .....	34
4.5.2 Results and next steps .....	35
5. Workshop evaluation .....	40
References .....	42
Appendix I: Workshop agenda .....	44

## Acronyms

<b>AIMS</b> .....	Australian Institute of Marine Science
<b>AFMA</b> .....	Australian Fisheries Management Authority
<b>AQIS</b> .....	Australian Quarantine and Inspection Service
<b>CCAM</b> .....	Conformal Cubic Atmospheric Model
<b>CEA</b> .....	Community Enterprises Australia
<b>CSIRO</b> .....	Commonwealth Scientific and Industrial Research Organisation
<b>DAFF</b> .....	Department of Agriculture, Fisheries and Forestry
<b>DOGIT</b> .....	Deed of Grant in Trust
<b>DOE</b> .....	Department of Environment
<b>DFAT</b> .....	Department of Foreign Affairs and Trade
<b>EGS</b> .....	Ecosystem goods and services
<b>IBIS</b> .....	Islanders' Board of Industry and Service
<b>IPCC</b> .....	Intergovernmental Panel on Climate Change
<b>NAQS</b> .....	Northern Australia Quarantine Strategy
<b>NERP</b> .....	National Environmental Research Program
<b>NGO</b> .....	Non-government Organisation
<b>PBC</b> .....	Prescribed Body Corporate
<b>PNG</b> .....	Papua New Guinea
<b>RRRC</b> .....	Reef and Rainforest Research Centre Ltd.
<b>SES</b> .....	State Emergency Services
<b>TOs</b> .....	Traditional Owners
<b>TSRA</b> .....	Torres Strait Regional Authority
<b>TS</b> .....	Torres Strait
<b>TSIRC</b> .....	Torres Strait Island Regional Council
<b>TSPZ</b> .....	Torres Strait Protected Zone
<b>WP</b> .....	Western Province (PNG)

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Damian Miley	TSRA Land and Sea Management Unit
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John Rainbird	TSRA Land and Sea Management Unit
Miya Isherwood	TSRA Land and Sea Management Unit
Shane Fava	Australian Fisheries Management Authority
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Drs. Jack Katzfey, Sara Busilacchi and Russell Wise (CSIRO) assisted with data collation and workshop preparation. Wayne Spencer (RRRC) assisted with the design of the resilience poster.

## Executive summary

The Torres Strait is a region of rich natural and cultural values, with tight linkages between its environmental assets and the livelihoods of local communities. The Torres Strait Treaty between Australia and Papua New Guinea explicitly aims to protect Indigenous communities' livelihoods on both sides of the border, and improve them through sustainable economic development. As Australia's northern border with Papua New Guinea (PNG), however, the region is potentially under increasing pressure from PNG population growth, extractive development and exploitation of shared Torres Strait marine and seabed resources. Global drivers such as peak oil, fluctuating economic conditions and climate change will also have complex positive and negative impacts on livelihoods. Because of the rapid and increasing rate of change and uncertainty, it is important to discuss predictions of potential changes and plan proactively rather than respond reactively. This requires the design of 'no regrets' strategies which bring benefits under any conditions of future change, and which are flexible and therefore less likely to be 'mal-adaptive'.

Through participatory scenario planning with Torres Strait communities and regional stakeholders, informed by integrated ecosystem services, climate and resilience modeling, this project aims to explore potential future scenarios on a spread of communities throughout the region, identify 'no regrets' strategies to protect livelihoods and achieve sustainable economic development. In July 2011-December 2014 the project aims to:

1. Provide information to communities and regional stakeholders to advise strategic decision-making, including the Torres Strait Treaty process;
2. Identify 'no regrets' adaptation strategies;
3. Provide suggested mechanisms to increase the capacity for communities and stakeholders to avoid mal-adaptive strategies;
4. Support the development of TSRA community-based adaptation planning as a tool to attain their local aspirations.

This report summarises the fourth scenario planning workshop, which was held at the community level on Mabuiag Island. Nineteen community members attended, including the PBC Chair and Senior TSRA Ranger, a DAFF/AQIS officer, council office staff, and participants in the My Pathway employment program. The joint CSIRO and TSRA project team provided downscaled climate change and sea level rise projections, ecosystem services modeling and other scientific information, which was integrated with local community members' knowledge. The workshop was held on 22-23 January at the Mabuiag Community Hall on Mabuiag Island, Torres Strait.

The workshop was structured into five sessions, and each addressed a specific question and delivered the following outcomes:

**Session 1: What are the drivers of change for livelihoods on Mabuiag?** Working groups listed 67 drivers, 52 of which were short term (less than 10 years) and 15 long term (more than 10 years). These were grouped into themes, and participants voted on the two most important themes. Social and cultural change in Mabuiag received the highest number of votes, followed by economic factors (e.g. local employment, cost of living).

**Session 2: What are the desired and possible futures for the Mabuiag community?**

Participants developed three desired and possible visions for the Mabuiag community in 2100. The first group's vision was:

*Community strong in culture; Sustainable industries and control of management and change; Spirituality and interconnectedness to each person's culture and tradition; To be able to comprehend the fast lane living and grasp the global way of life; Willing to experience the future, whether in the physical or the spiritual; We envision a future with educational aspirations that best feeds our people and to have a sustainable, compassionate and responsible life; We pronounce that this vision recognises the interconnectedness of all who come visit us.*

The second group's vision was:

*We would like Mabuiag to become culturally motivated (be leaders for tomorrow); Have healthy lifestyles; Creative and vibrant about community events; Make use of natural resources; Last of all to have wisdom, knowledge and understanding, peace, love and harmony.*

The third (women's) group's vision was:

*Still identify as 'g'oemulgal' in 2100 and speak own language; Would still like to have an island (prevent erosion); More population – birthing; Migration back; Good infrastructure - Need commercial airstrip (extend); Resort (but some opposition to tourism); Well planned housing developments; Seawall; New roads to other parts of island; More small businesses; Community owned enterprises; A learning centre to run courses/education for community (TAFE, uni, block, spiritual, culture); Early childhood centre (day care); Art centre; Direct export seafood factory/business; Protect our reefs from outsiders and look after environment (so we still have fish available for our children); Teach indigenous languages – have our own independent bilingual school; Solar energy for community, windmills; Own health and dental services (not QLD owned). We make our own decisions for ourselves.*

A matrix of four possible future scenarios was created from better or worse extremes of Mabuiag culture and social/economic/political drivers, which included extreme or less extreme climate change and sea level rise. Participants created narratives and drew pictures for each scenario for 2100. These ranged from the 'Best Case' **Kozan (Sharing & Equality)** (strong Mabuiag culture, good housing, jobs, services, local decision-making, a strong sustainable global economy, and less extreme climate change of 2°C and 0.5 m sea level rise), to the 'Business as Usual' **Wati Danalaig (Bad Life)** scenario (weak Mabuiag culture, poor housing, few jobs, poor services, no local decision-making, a carbon intensive economy and extreme climate change of 4°C and one metre sea level rise). "Intermediate" scenarios **Kedha Nay (What if?)** and **Kayin Besai (New Mabuiag)** fell in between the best and worst cases. Key thresholds identified, when irreversible changes may occur, were the construction of hotels on Mabuiag, loss of Mabuiag language and culture, coral bleaching, and the construction of sea walls. All were predicted to occur by 2060.

### **Session 3: What impact will the "Business as Usual" future have on human well-being?**

An ecosystem goods and services (EGS) model was developed for Mabuiag. This projected the impacts of drivers of change on EGS and human well-being by 2030 under the 'Business as Usual' **Wati Danalaig** scenario. The most important EGS categories for Mabuiag livelihoods, in order, are rock lobster, reef fish, fresh water, dugong, coastal finfish and green turtles. Participants estimated that local EGS contribute 49% of their health, food security and cultural needs, compared to 51% from external income. Impacts on EGS by 2030 were all negative, although these were offset by some positive impacts due to temperature and rainfall increases. Of the five most important EGS, the most impacted was green turtles, followed by coastal finfish. The model showed that impacts would be caused primarily by climate change, but



almost as much by increased exploitation due to population growth, especially for coastal finfish. Sea level rise was predicted to impact somewhat on terrestrial EGS such as garden food production.

**Session 4: What is the resilience of the Mabuiag community today?** Using nine predetermined indicators of general resilience, participants developed a resilience profile for the Mabuiag community. Food and freshwater self-sufficiency, and language and culture scored relatively high (4 or more on a scale of 1 to 5). Working well together to address challenges, innovation and creativity, good leadership, the ability of the community to organise and make decisions quickly, ability to learn, and networks and partnerships beyond Mabuiag scored medium (3-4). Disaster preparedness and financial capacity scored relatively low (below 3).

**Session 5: What are the priority adaptation strategies to build a resilient Mabuiag community?** Based on the EGS and human well-being impacts for 2030 and the resilience profile, participants designed adaptation strategies for livelihoods to steer them away from the “Business as Usual” *Wati Danalaig* scenario and towards the Mabuiag visions. Three working groups identified thirty strategies. Twelve strategies addressed both EGS impacts and resilience issues.

Working Group 1:

1. Create economy (community enterprise, small business, local markets)
2. Funeral funds (benevolent funds)
3. Educate about budgeting
4. Seek funding
5. Create infrastructure to attract business
6. Crayfish enterprise for community
7. Create lending programs for community (low interest)
8. Create local foundations
9. Create scholarships so information about financial systems comes back to community

Working Group 2:

1. Disaster response training (e.g. drills)
2. Youth activities and engagement
3. Seek support from funding agencies to assist community with grants and submissions
4. Address tenure as a bigger issue of Mabuiag
5. Create more jobs/identify jobs to increase skills in community
6. Investigate options for seawalls
7. Increase turtle hatching success

Working Group 3:

Turtle Management:

1. Education programs
2. Regional coordination
3. Controlled incubation
4. Turtle sanctuary

Disaster Preparation:

1. Education
2. Multi-purpose infrastructure e.g. community hall that is also cyclone shelter (financial benefit too)
3. Capacity building for community (organisational)
4. Communication hub in community for disasters

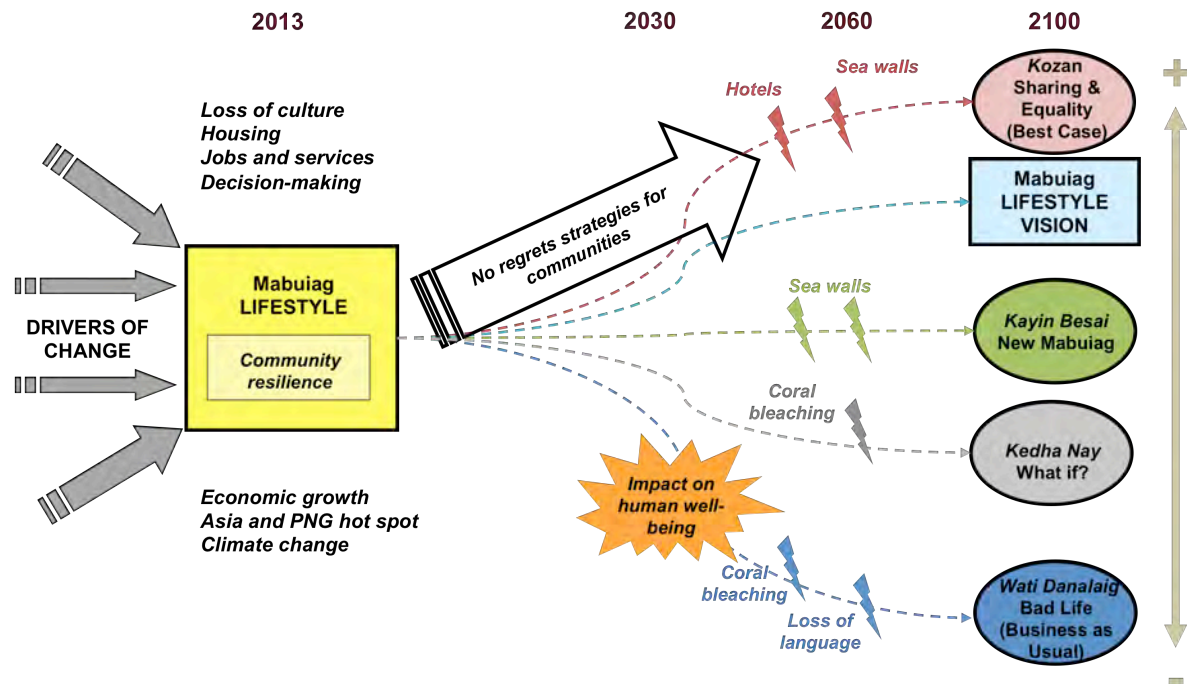
5. Regular drills
6. Need mobile coverage
7. Alarm system
8. Local disaster fund
9. Satellite emergency phones
10. Move houses back from storm surge risk areas

Strategies were cross-checked with the other potential future scenarios (i.e. *Kozan*, *Kedha Nay*, *Kayin Besa*) to determine whether they would be mal-adaptive if these scenarios eventuated. Working Group 1's strategy to create an economy risked being mal-adaptive if it clashed with local culture or created conflict related to increased wealth. Group 3's strategy of controlled turtle incubation and of moving houses back from areas at highest risk from storm surge risked being mal-adaptive if climate change impacts were not significant. All other strategies were 'no regrets' and would be beneficial for livelihoods under any future change.

**Workshop evaluation:** A questionnaire survey carried out before and after the workshop examined how participants' perceptions had changed. In response to the open-ended question "what is the greatest challenge that Mabuiag will face in the future?", changes related to climate were the most frequently (24% of responses) named before, but changes related to climate and the economy were the most frequently (22% each) named after the workshop. To the multiple-choice question "is Mabuiag resilient to future change?", 37% answered 'yes' before, while 50% answered "yes" after the workshop. For the statement "Mabuiag is ready to cope with climate change", 12% disagreed, 69% agreed, and 19% were neutral before the workshop. After the workshop this changed to 17% disagreeing, 67% agreeing, and 16% being neutral. Most participants (84%) felt that the workshop had either "increased my understanding of future change and how Mabuiag can adapt" or "made me think differently about the future". There was only one respondent unsure of the workshop's impact.

**Next steps:** The perceptions of the Mabuiag workshop participants presented in this report will be combined through integration and policy evaluation workshops later in 2014 with those of other case study communities, and government stakeholders.

## Scenario planning workshop process



Summary of the workshop process and results for all sessions. Lightning symbols represent thresholds identified for each scenario.

# 1. Introduction

## 1.1 Project background

The Torres Strait (Fig. 1) is a region of rich natural and cultural values, with tight linkages between its environmental assets, ecosystem services and the livelihoods of communities. The Torres Strait Treaty between Australia and Papua New Guinea explicitly aims to protect Indigenous communities' livelihoods on both sides of the border, and improve them through sustainable economic development. As Australia's northern border with Papua New Guinea (PNG), however, the region is potentially under increasing pressure from PNG population growth, extractive development and exploitation and pollution of shared Torres Strait marine and seabed resources. Global drivers such as peak oil, shipping traffic and climate change will also have complex impacts on environmental assets. This uncertain future will present challenges for maintaining resilient Torres Strait communities, but may also provide opportunities for sustainable economic development (e.g. tourism, aquaculture, sustainable fisheries).

Because of the rapid and increasing rate of change and uncertainty, it is important to discuss predictions of potential changes and plan proactively rather than respond reactively. This requires the design of 'no regrets' strategies which bring benefits under any conditions of future change, and which are flexible and therefore less likely to be 'mal-adaptive'.

Through participatory scenario planning and resilience analysis with Torres Strait communities and stakeholders, informed by integrated ecosystem service and climate modeling, this project aims to explore potential future scenarios for a spread of communities throughout the region, identify 'no regrets' strategies to protect livelihoods and achieve sustainable economic development. This will respond in part to the 2010 Senate Foreign Affairs, Defence and Trade Committee Inquiry, which recommended an analysis of the vulnerability of the Torres Strait to climate change and other future pressures. The project outputs will support the delivery of ongoing TSRA, DoE and DFAT initiatives promoting climate adaptation, alternative livelihoods, food security and economic development in the region, including:

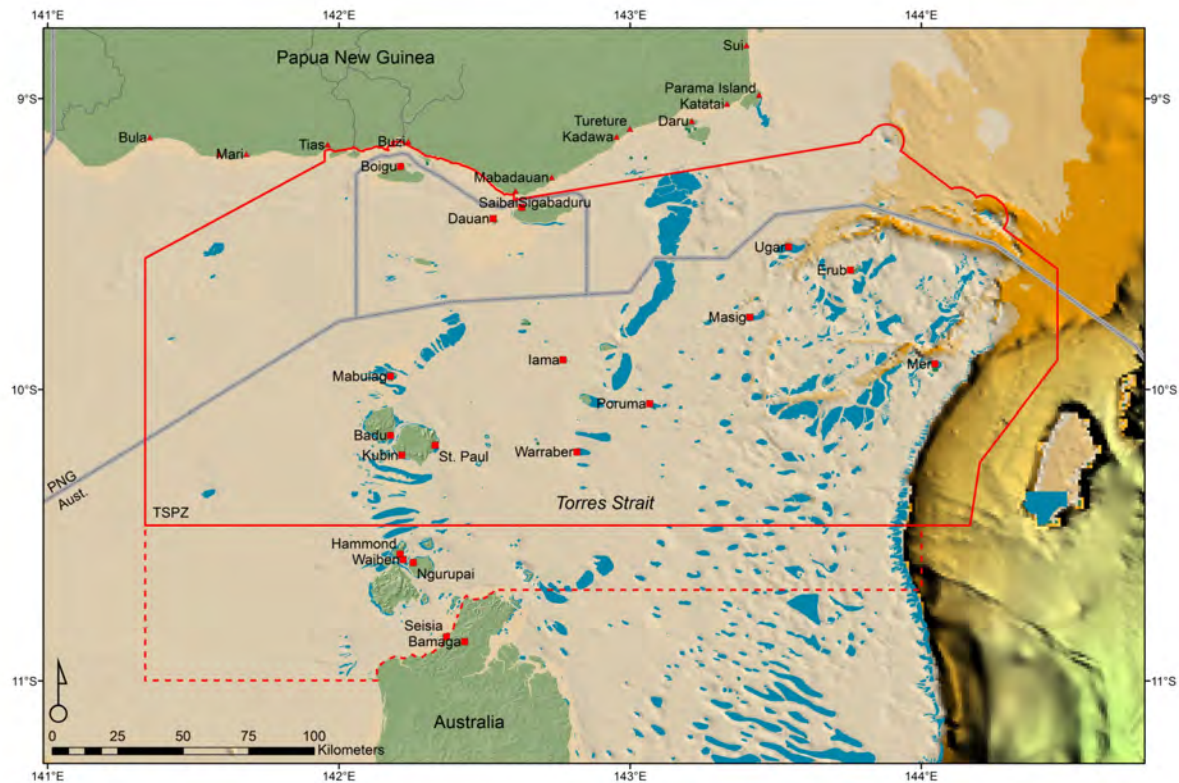
- The TSRA's community adaptation plans under the Torres Strait Climate Change Strategy;
- The Torres Strait Treaty's Joint Advisory Committee and Environmental Management Committee objectives of achieving food security and alternative livelihoods in the Western Province, PNG;
- The Torres Strait and Northern Peninsula Regional Plan;
- The TSRA's Sustainable Land Use Plans;
- The Torres Strait Integrated Service Delivery Framework

In July 2011-December 2014 the project's outcomes and impacts will be to:

1. Provide information to communities and regional stakeholders to advise strategic decision-making, including the Torres Strait Treaty
2. Identify 'no regrets' adaptation strategies
3. Provide suggested mechanisms to increase the capacity for communities and stakeholders to avoid mal-adaptive strategies
4. Support the development of TSRA community-based adaptation planning

The project addresses five research questions:

1. What are possible future changes in the Torres Strait?
2. How will they affect communities and their livelihoods?
3. Which communities are most likely to be impacted by changes?
4. What is their capacity to adapt?
5. What are the priority 'no regrets' strategies that will build communities' resilience and capacity to adapt?



**Figure 1.** The Torres Strait region, showing Mabuia Island, reefs, international boundaries, the Torres Strait Protected Zone (TSPZ) and Australian and PNG Treaty communities. The 14 Australian communities within the TSPZ are the focus of this study.

## 1.2 Mabuia Island

Mabuia (or Mabuayag) is located in the western group of islands in the Torres Strait, approximately 70km north of Thursday Island and 20km north of Badu Island (Fig. 1). Mabuia is a submerged remnant of the Great Dividing Range, consisting of steep hills that are mainly comprised of red granite, reaching a peak elevation of 263m. The island is about 4km long by 3.5km wide across its widest point, covering an area of 626ha.

Vegetation consists of rock pavement and shrubs interspersed with vine thicket, dense grassland and wetlands with some large fringing mangroves, and supports diverse fauna. There is a small network of watercourses that flow intermittently on Mabuia. Freshwater is scarce and the main water source, a weir, runs dry in the latter half of the year. The main community is located along an 1100m section of a 2km long section of southwest-facing beach. Due to the island's steepness, the village is located no more than 10m above sea level generally on sandy beach flats.

Mabuiag's population in 2012 was approximately 292 people, living in about 55 houses. In 2001 the population was 240. Infrastructure on the island includes an airstrip, paved roads in the main village and reticulated sewage. It has a Council building, community hall, primary school and health centre plus an IBIS supermarket store. It is serviced by a barge from Horn Island weekly, and by charter flights. The island has no reliable mobile phone coverage.

The Mabuiag Sustainable Land Use Plan Part 2 (RPS 2010) identified the following pressing issues for the island:

- Land issues, including development along the southern coastline and in areas identified as being erosion-prone, an intermittent water supply, potential acid sulphate soils and bushfire risk.
- Infrastructure issues, including upgrading the water plant when population reaches 370 people, waste disposal and dump site, electricity and alternative energy capacity and the lack of mobile phone coverage.
- Population issues, namely projected population growth and changes to the population profile (a doubling of the 65+ age group in the next 20 years and fewer young people).
- Housing issues, including vacant lots below the designated storm tide level.
- Growth issues related to housing and landfill capacity.



**Figure 2.** Satellite image of Mabuiag Island (from TSRA).

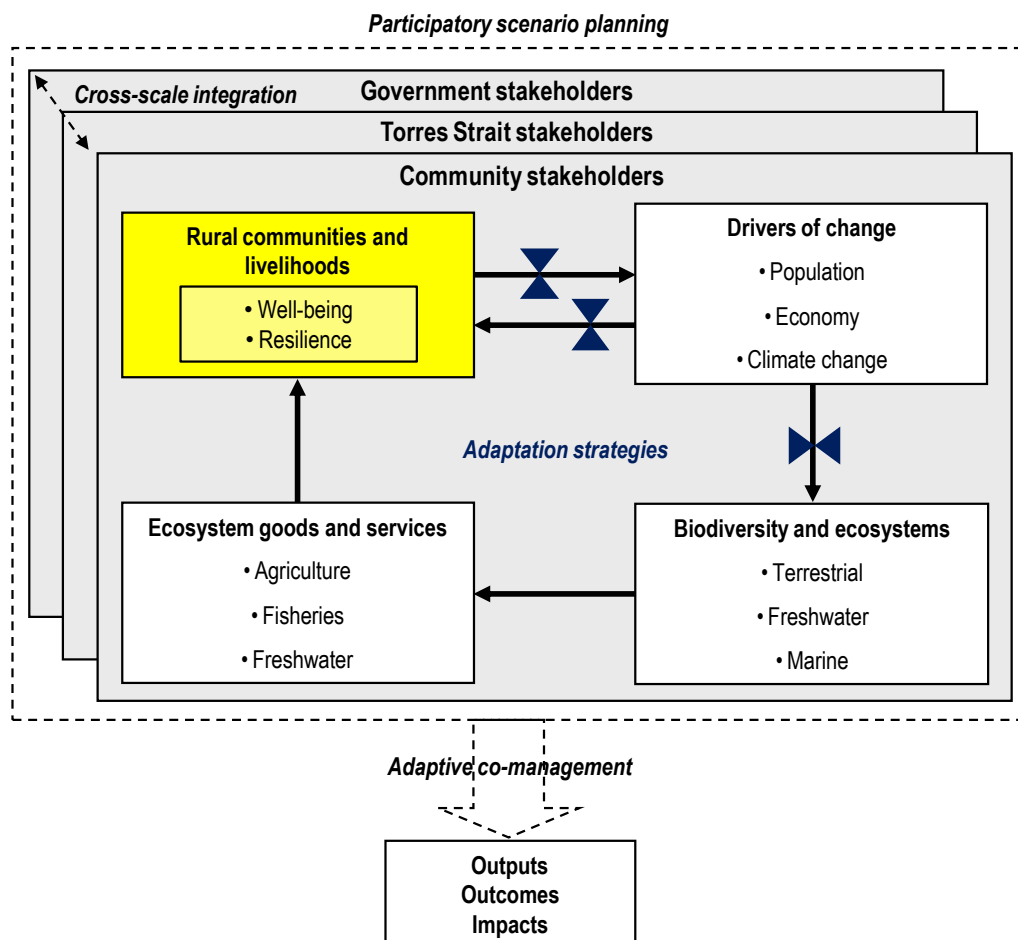
## 2. Methodology

This project applies participatory scenario planning with government and community stakeholders. This approach aims to enable stakeholders to express their different perceptions of



livelihoods, the system dynamics determining their characteristics and their possible development trajectories. Workshops held at the regional and community level identify adaptation strategies which stakeholders believe will reduce perceived negative impacts of drivers of change on human well-being, thus, reducing livelihoods' vulnerability and building communities' resilience and adaptive capacity for future change (Fig. 3). Subsequent workshops integrate the strategies identified by all stakeholders, allowing comparison between stakeholders' perspectives, and an assessment of whether the strategies have been implemented by policies and programs. If the strategies have not been implemented, barriers to implementation are identified. This social learning process creates 'adaptive co-management', whereby new knowledge, partnerships and adaptive capacity are generated amongst all stakeholders to improve livelihoods.

In July 2011-December 2014 the project is carrying out a series of workshops. This report describes a scenario planning process which investigated Mabuiag Island community's challenges and opportunities, and adaptation strategies required to improve their livelihoods. Outputs of the workshop were an analysis of the drivers influencing livelihoods, a community vision for the future, potential future scenarios, valuation of ecosystem goods and services, a resilience self-assessment carried out by participants, and 'no regrets' adaptation strategies to build community resilience. In 2014, these will be integrated with regional stakeholders' perceptions that were elicited through a workshop held in Cairns in October 2012 (Butler et al. 2012a).



**Figure 3.** Conceptual diagram of the the system dynamics influencing communities and their livelihoods, stakeholder levels and adaptation strategies. The research process of participatory scenario planning, cross-stakeholder integration and adaptive co-management are indicated by dashed lines.

### 3. Mabuiag Island scenario planning

#### 3.1 Community consent and invitations

A key step in planning the workshop was to secure TSRA Board approval to engage with communities. This was achieved in March 2013 when the project team presented the project plan to a Board meeting on Thursday Island. In July and August 2013 community workshops were held on Masig (Butler et al. 2013), and Erub (Bohensky et al. 2014). Following these workshops, the Mabuiag community was approached to hold a workshop, for which approval was received and a date set.

Having enthusiastically participated in the previous workshops, Masig Councillor Fraser Nai joined the team as a community champion and facilitator and, together with John Rainbird and Vic McGrath (TSRA Land and Sea Management Unit), arranged invitations for community members and an advertisement on the island. Nineteen people participated, including the PBC Chair and Senior TSRA Ranger, a DAFF/AQIS officer, council office staff, and participants in the My Pathway program. Of these, nine were women and ten were men (Table 1).



Workshop participants, CSIRO and TSRA team members

**Table 1.** Workshop participants and their affiliations

	<b>Name</b>	<b>Affiliation</b>
1	Flora Warrior	TO, Lot 90, Mabuiag Island
2	William Misi	Lot 60, Mabuiag Island
3	Lency Bani	My Pathway
4	Father Barsa Banu	Pastor
5	Marissa Whap	My Pathway



6	Anau Gizu	TO, My Pathway
7	Father Frank Whap	Mabuiag Island Council
8	Kelsie Whap-Repu	My Pathway
9	Terrence Whap	Senior Ranger, TSRA
10	Eccles Tamwoy	My Pathway
11	Jack Fell	My Pathway
12	David Gizu	Mabuiag Island
13	Delisia Ware	My Pathway
14	Holly Banasa	Mabuiag Island
15	Rita Kebisu	My Pathway
16	Cygnnet Repu	DAFF/AQIS
17	Maryann Whap	Mabuiag Island
18	Meroma Fell	Mabuiag Island
19	Nwbuma Yellub	Youth

### 3.2 Workshop process

The workshop was held over two days on 22<sup>nd</sup> and 23<sup>rd</sup> January 2014 at the Mabuiag Community Hall, Mabuiag Island. The workshop was entitled 'Mabuiag Yesterday, Today and Tomorrow'. Workshop facilitation was led by Vic McGrath (TSRA), James Butler and Erin Bohensky (CSIRO), supported by Councillor Nai, John Rainbird (TSRA) and Tim Skewes (CSIRO). Posters summarising presentations were displayed around the meeting room throughout the workshop.

The objectives of the workshop were to:

1. Discuss future challenges and opportunities for the Mabuiag community
2. Identify important strategies to build the resilience of the community

Following local cultural protocols, at the start of the workshop Father Barsa Banu led with a prayer. Participants were then asked to give their verbal consent for the project team to apply and publish the materials and results of the workshop, and to take photographic and video material. All participants agreed. Key terms and concepts were discussed with the participants to ensure a common understanding of terminology (Table 2).

**Table 2.** Terms and definitions used in the workshop

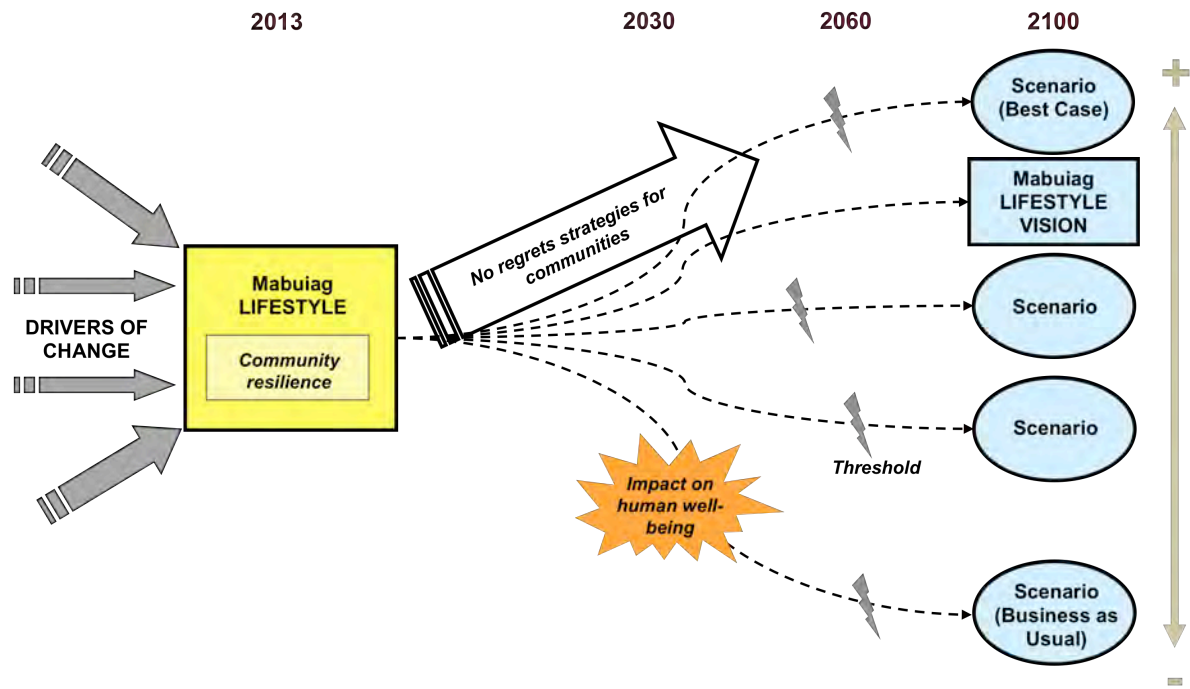
Term	Definition	Reference
Livelihoods	The capabilities, assets (including both material and social resources) and activities required for a means of living	Chambers and Conway 1992
Human well-being	The basic needs of people to live a healthy life: income, food security, health, social cohesion, freedom of choice	Millennium Ecosystem Assessment 2005
Driver of change	Any natural or human-induced factor that directly or indirectly causes a change in the system of interest, plus institutional and governance issues that mediate livelihood outcomes	Millennium Ecosystem Assessment 2005; DfID 2004
Ecosystem goods and services	Those goods and services which are provided by ecosystems and actually and directly valued and consumed by people	Wallace 2007; Fisher et al. 2009; Kent and Dorward 2012

Resilience	The capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks and therefore identity	Walker et al. 2005
Threshold	A tipping point where sudden and possibly irreversible change occurs in a system	Walker et al. 2005
Adaptive capacity	The potential for actors to make changes that increase resilience, reducing the chance of the system losing its ability to provide its desirable function, or transforming the system altogether	Chapin et al. 2006
Vulnerability	The degree that a system will be impacted by change, mediated by adaptive capacity	IPCC 2007
Adaptation strategies	Adjustment in ecological, social or economic systems in response to actual or expected change and their effects or impacts	Smit and Wandel 2006
'No regrets' strategies	Adaptation strategies which yield benefits under any future conditions of change	Hallegatte 2009
Mal-adaptation	Adaptation strategies which result in the system becoming more vulnerable to change	Hallegatte 2009

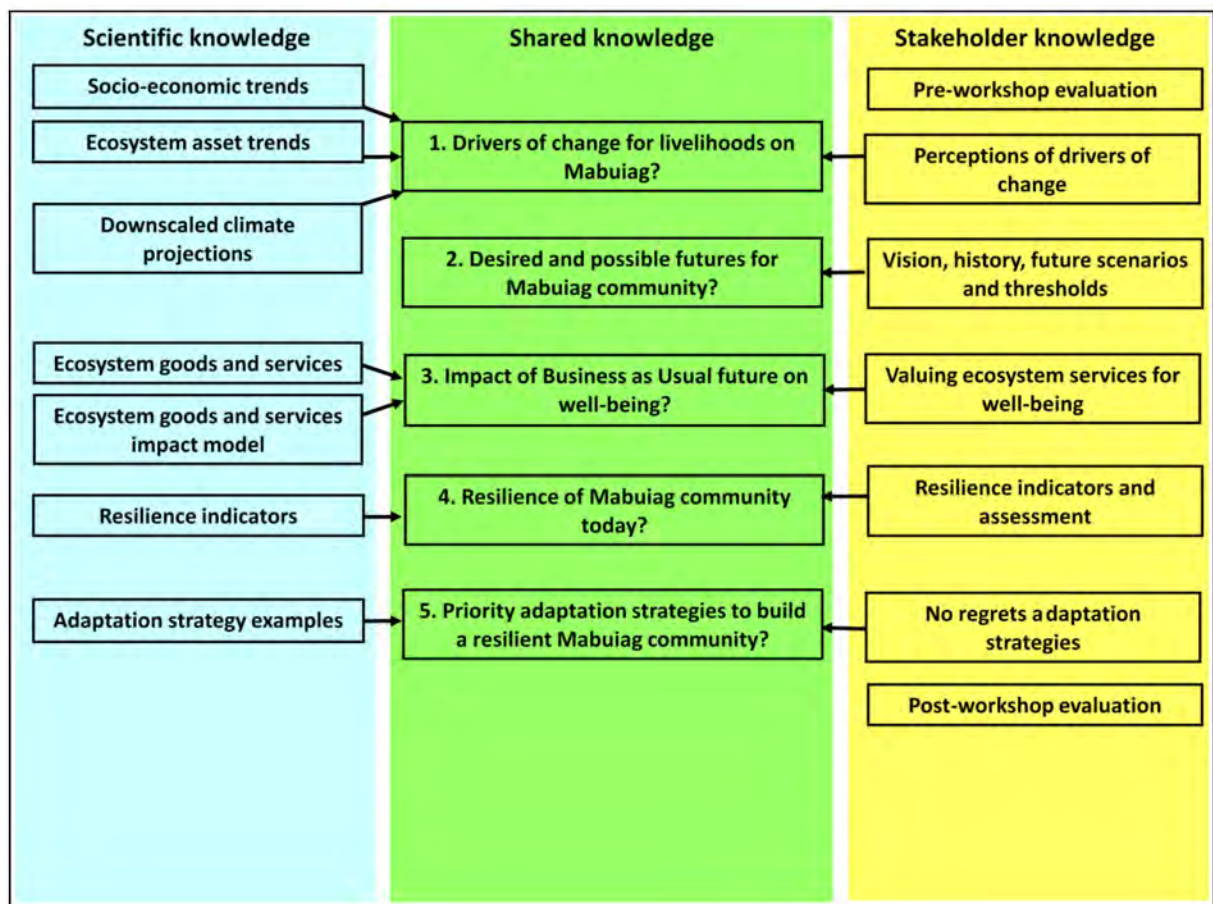
The workshop process was explained to the participants using Fig. 4. Five steps are taken:

1. The drivers of change for livelihoods today and in the future are identified.
2. The desired future vision for livelihoods in 2100 is agreed in terms of human well-being. Then, based on plausible variations in the drivers of change, four future scenarios are created and compared to the desired vision. Thresholds in drivers are identified where sudden and possible irreversible change occurs. Elders also draw a timeline of the history of the island and key events and dates.
3. The impacts on ecosystem goods and services and human well-being are modelled for 2030 using the 'Business as Usual' scenario. 2030 is investigated because impacts of drivers are more predictable in the shorter-term than in the long-term, and any human responses are less likely to have taken great effect.
4. The current resilience and vulnerability of the community to cope with the 'Business as Usual' scenario is assessed.
5. Based on the potential impacts on well-being and current vulnerabilities, appropriate adaptation strategies are designed to build community resilience. These are compared against the scenarios identified in Step 2 to check whether they would be compatible or 'mal-adaptive' for any other futures that could eventuate. In this way 'no regrets' strategies are agreed which could steer livelihoods towards the desired future vision.

To follow this process, the workshop was structured into five sessions, and each addressed a specific question (Figs. 4 and 5; Appendix I). The structure was designed to encourage the integration of scientific information from other project activities with stakeholders' knowledge to generate shared knowledge. An evaluation questionnaire was also carried out at the beginning and end of the workshop to assess how participants' perceptions may have changed.



**Figure 4.** Diagram of the workshop process. Numbers refer to the workshop steps and sessions.

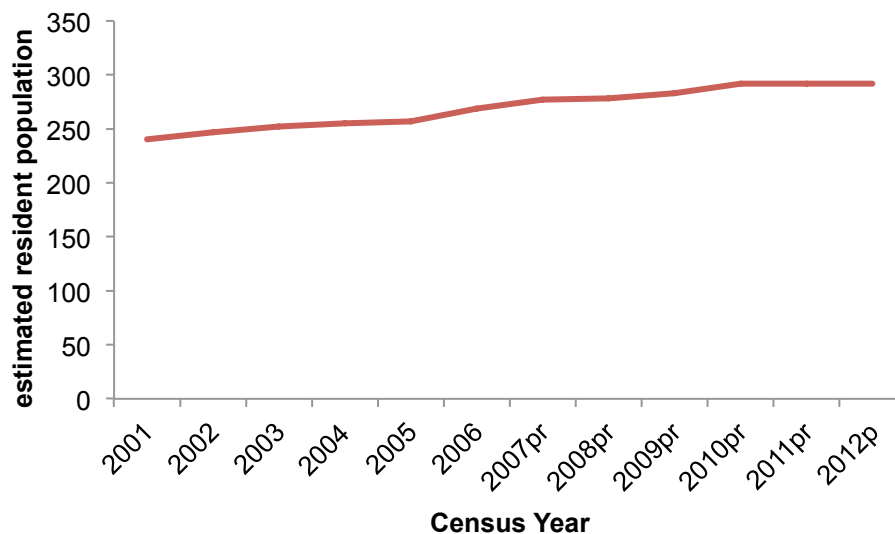


**Figure 5.** Workshop structure and sessions, showing the process of knowledge integration

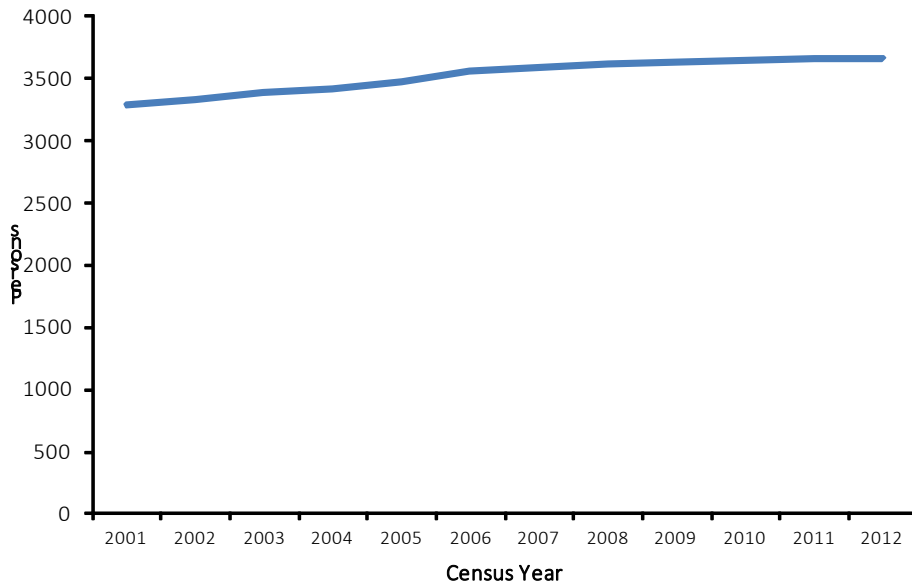
## 4. Workshop results

### 4.1 Session 1: What are the drivers of change for livelihoods on Mabuiag?

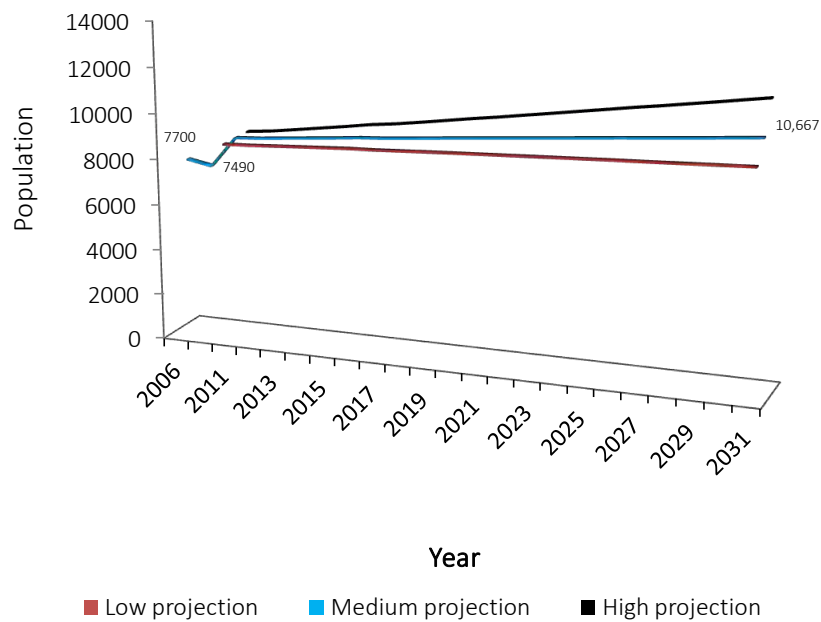
Session 1 began with CSIRO and TSRA team members presenting information on the current and projected trends in likely drivers of change for Torres Strait and Mabuiag livelihoods. This started with an analysis of global issues (e.g. financial crises, technology, disease epidemics, growth of the Asian economy). Information on the Torres Strait economy, increasing shipping, health and cultural trends was then presented, plus recent population trends for Mabuiag (Fig. 6) and the Torres Strait (Fig. 7), projected population growth for the Torres Strait (Fig. 8) and PNG's Western Province (Fig. 9), and planned resource development in Western Province (Fig. 10). Current climate patterns, climate change projections downscaled to 8 km from the IPCC A2 'high' emissions scenario (Fig. 11, Table 3) using the CSIRO Conformal Cubic Atmospheric Model (CCAM; McGregor and Dix 2008), and sea level inundation risk for Mabuiag were presented by John Rainbird (Fig. 12). This was followed by a summary of current knowledge on the status and trends of key species and ecosystem assets, collated from current NERP scientific studies and other past research projects. For example, the size of nesting female green turtles has shown a steady decline since 1976 (Fig. 13), suggesting that the population is becoming vulnerable because smaller turtles lay fewer eggs.



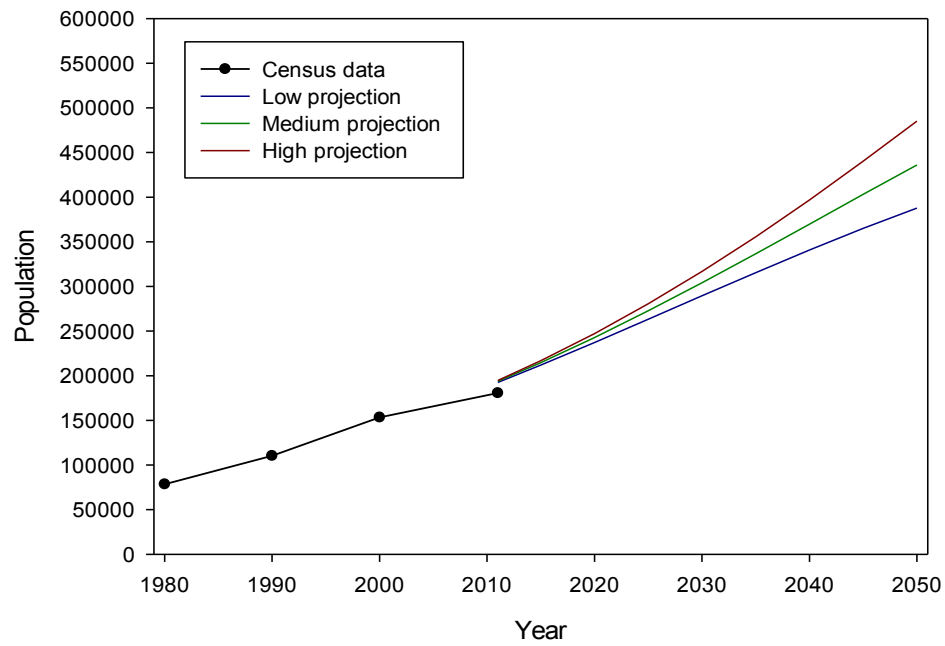
**Figure 6.** Population census data for Mabuiag Island, 2001- 2012. There are currently approximately 292 people resident on the island. (Source: Australian Bureau of Statistics)



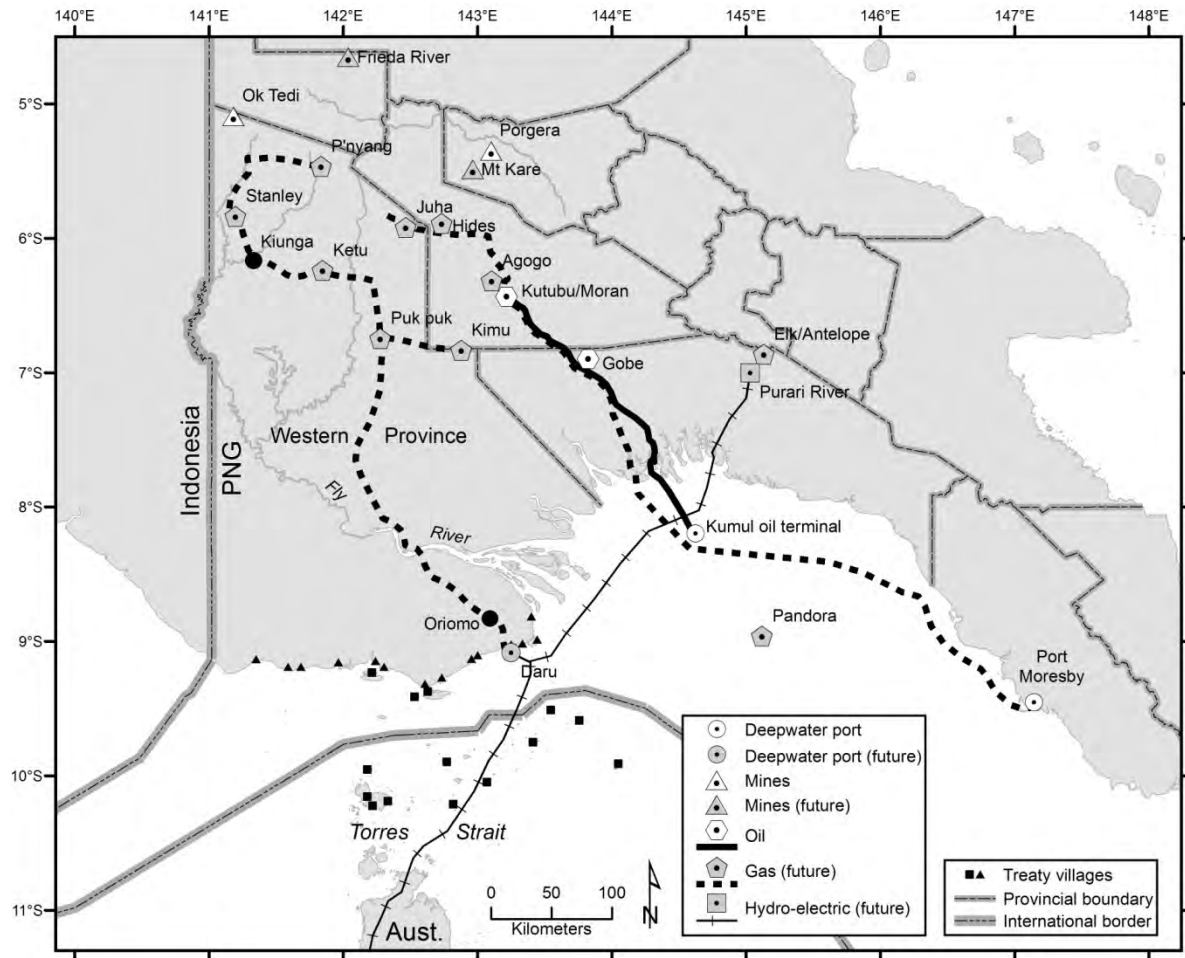
**Figure 7.** Population census data for the TSPZ with the inclusion of Hammond Island, 2001- 2012. Numbers have increased gradually from 3,250 to 3,600. (Source: Australian Bureau of Statistics)



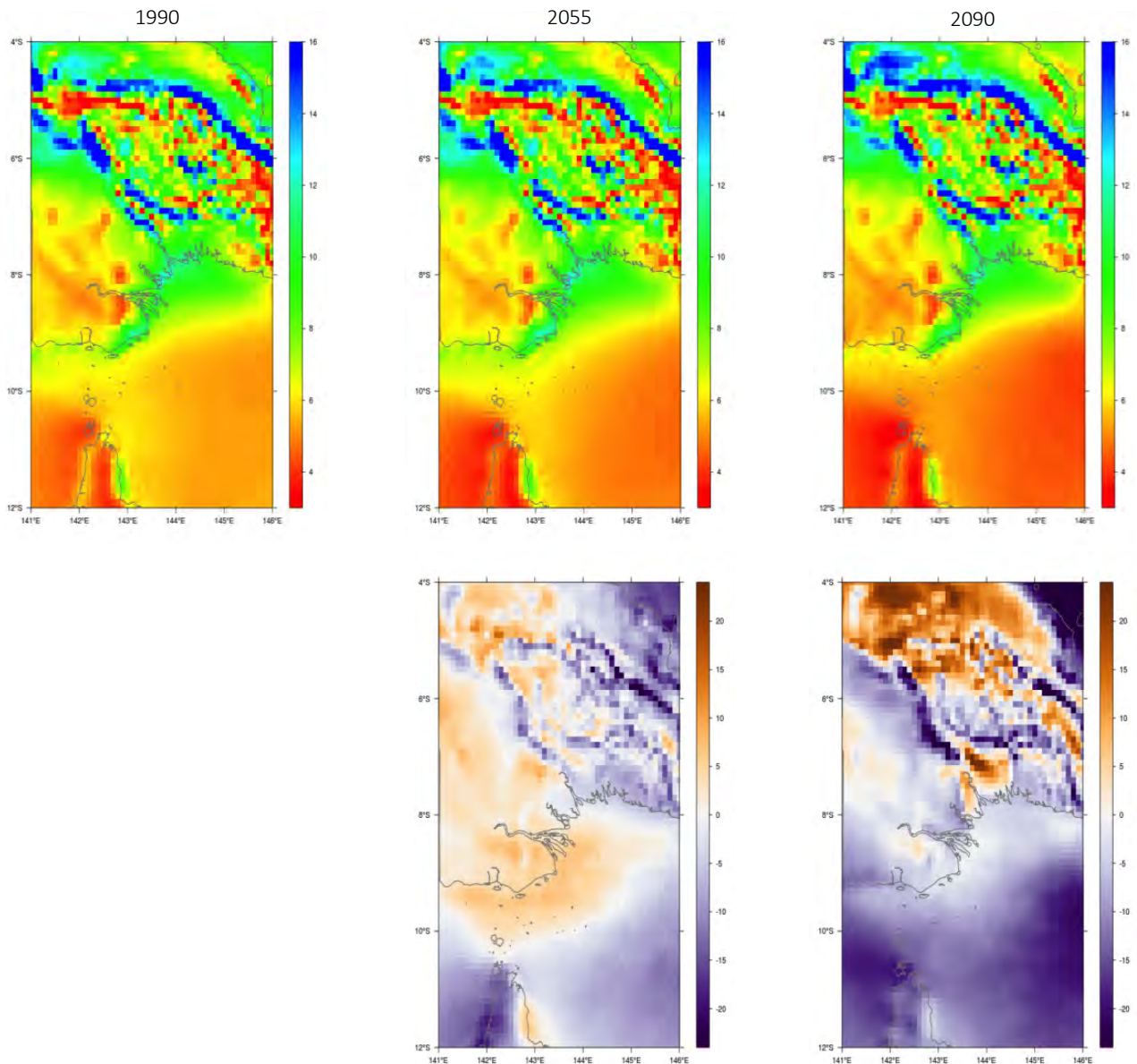
**Figure 8.** Population census data for the Torres Strait Indigenous Region for 2006 and 2011, and low, medium and high projections until 2031. Note that as well as the 14 TSPZ communities, in 2011 this statistical region included Thursday Island, Horn Island and Hammond Island. Although there was a decline from 7,700 in 2006 to 7,490 in 2011, medium projections indicate a population increase to 10,667 in 2031, at an annual average growth rate of 0.91%. For full details see Butler et al. (2012b).



**Figure 9.** Population census data for Western Province, PNG in 1980-2011, and projected increases between 2012 and 2050 at low, medium and high projections. The average annual growth rate in 2000-2011 was 1.5%. At medium projections, the population may at least double from 180,000 to 420,000 by 2050. For full details see Butler et al. (2012b).



**Figure 10.** Summary of current and proposed resource development projects in PNG neighbouring the Torres Strait. For full details see Butler et al. (2012b).

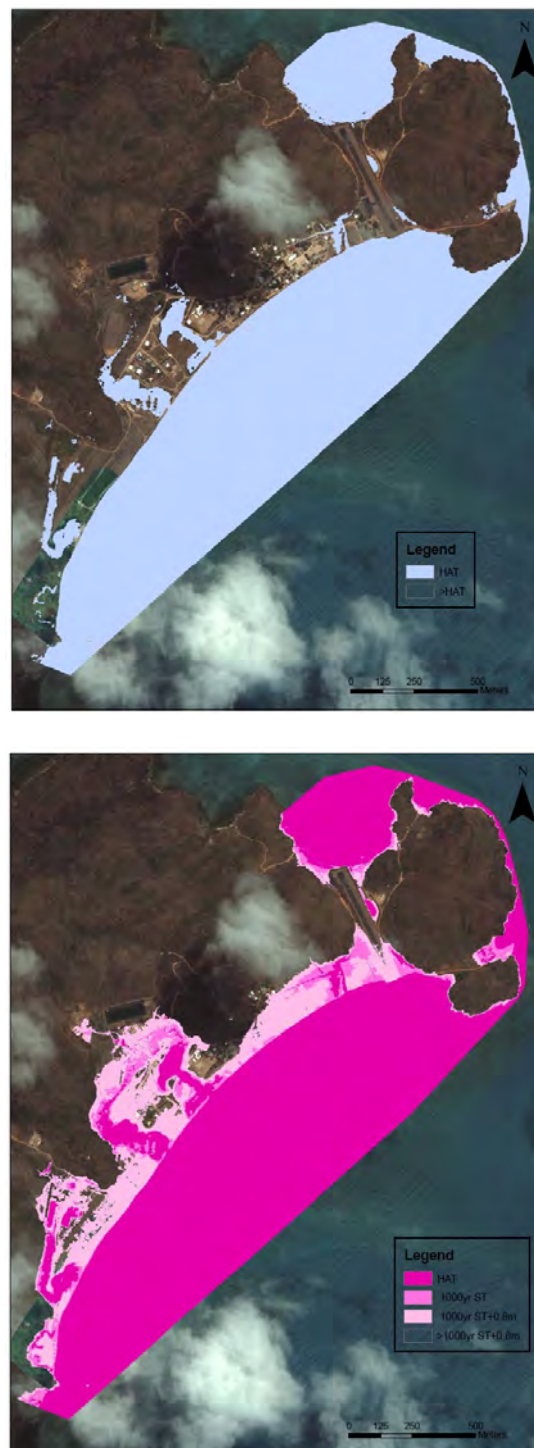


**Figure 11.** Annual mean rainfall rate ( $\text{mm day}^{-1}$ , top row) and changes relative to 1990 (bottom row) in the Torres Strait region under the IPCC A2 emissions scenario, downscaled to 8 km using CCAM. For full details see Katzfey et al. (2012).

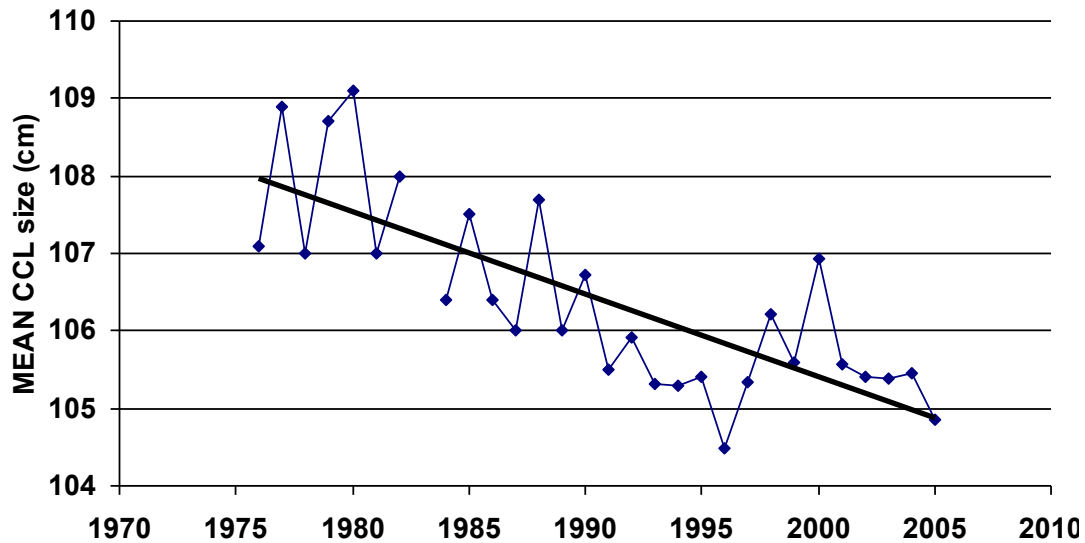
**Table 3.** Summary of changes in climate parameters for the Torres Strait from 1990 levels under the IPCC A2 emissions scenario, averaged from downscaled CCAM data across the region. For full details see Katzfey et al. (2012).

A2 scenario	2055	2090
Temperature ( $^{\circ}\text{C}$ )	<b>+1.3</b>	<b>+2.5</b>
Apparent temperature ( $^{\circ}\text{C}$ )	<b>+2.2</b>	<b>+4.8</b>
Rainfall (%)	<b>+3.4</b>	<b>-2.9</b>
Relative humidity (% humidity)	<b>+0.5</b>	<b>+0.6</b>
Wind speed (%)	<b>-2.2</b>	<b>-3.5</b>





**Figure 12.** Inundation risk for Mabuiag Island under current Highest Astronomical Tide (HAT) (top) and HAT with 1000 year return period storm tide and 0.8 m sea level rise (bottom). (Source: Kevin Parnell, James Cook University).



**Figure 13.** Trend in curved carapace length (CCL) of nesting female green turtles at Raine Island, 1976-2005 (Source: Colin Limpus, Queensland Environmental Protection Agency)

Following these presentations, workshop participants were divided into four groups to discuss their perceptions of the current and imminent drivers of change for the Mabuiag community and their livelihoods. Each group wrote down their selected drivers on sticky note paper, and placed a total of 67 on a large whiteboard. Through discussion these were clustered into themes, and into short term (10 years or less) or long-term (10 years or more) drivers. After clustering, each participant was given two votes and asked to select the two most important drivers of change, using stickers. The votes were then totalled to identify the two most important themes of drivers (Table 4).



Workshop participants voting for the most important drivers of change. Photo: Tim Skewes.

**Table 4.** Drivers of change for Mabuiag Island identified and grouped into themes by participants. The two most important themes selected by voting were 1) Mabuiag society and culture and 2) larger-scale social/political/economic drivers. Drivers that received votes are in bold.

Theme (total votes)	Short term (<10 years) drivers (votes)	Long term (>10 years) drivers (votes)
Society & culture 27 (14 votes)	<b>Loss of culture (5)</b>	Overcrowding
	Lack of housing	People leaving the island
	Loss of people	Health status (sick person moves to Cairns and whole family moves)
	<b>Loss of language (1)</b>	Health is presently neutral (depends on which aspect of health)
	Loss of tradition	<b>Increasing Church fellowships (1)</b>
	<b>Culture maintained (3)</b>	Decrease of population
	<b>Houses need to be upgraded (2)</b>	
	Increasing/improved spirituality	
	Spiritual well-being	
	<b>Preservation of hymns, languages and songs (2)</b>	
	Obstacles to housing	
	Socializing	
	Families moving to mainland	
	Education (added later, when prompted)	
Economics 14 (5 votes)	<b>More jobs in the community (3)</b>	PNG and Indonesia becoming hotspot
	<b>Food prices gone up (1)</b>	Shipping increase
	Shipping increase	Money exchange with PNG people
	More roads	Higher pays
	Lack of services	Economic hotspots
	<b>Low income (1)</b>	Less oil (petrol)
Technology 7 (2 votes)	<b>Technology (1)</b>	
	Need more communication in the community	
	Internet access	
	<b>Mobile coverage (1)</b>	
	No mobile reception	
Politics 7 (1 vote)	<b>Local people taking lead (1)</b>	
	Proper community decision-making	
	Lack of youth in decision making	
	Investment and government fund for infrastructure	
	Chiefs and TOs need recognizing	
	Political decision making	
Natural resources 5 (0 votes)	Government	
	Overhunting for dugong	
	Decline in number of dugong and turtle	
	Extension of dam for water supply	
Climate change 7 (2 votes)	Loss of seafood	
	<b>Erosion (2)</b>	Extreme dry seasons
		High sea level

## **4.2 Session 2: What are the desired and possible futures for the Mabuiag community?**

### **4.2.1 Desired future vision for Mabuiag Island community**

Session 2 began with a discussion to develop statements about the desired future vision for Mabuiag Island's community in 2100. Participants developed three lifestyle visions for the Mabuiag community in 2100. The first group's vision was:

*Community strong in culture; Sustainable industries and control of management and change; Spirituality and interconnectedness to each culture and tradition; To be able to comprehend the fast lane living and grasp the global way of life; Willing to experience the future, whether in the physical or the spiritual; We envision a future with educational aspirations that best feeds our people and to have a sustainable, compassionate and responsible life; We pronounce that this vision recognises the interconnectedness of all who come visit us.*

The second group's vision was:

*We would like Mabuiag to become culturally motivated (be leaders for tomorrow), have healthy lifestyles; Creative and vibrant about community events; Make use of natural resources; Last of all to have wisdom, knowledge and understanding, peace, love and harmony.*

The third (women's) group's vision was:

*Still identify as 'g'oemulgal' in 2100 and speak own language; Would still like to have an island (prevent erosion); More population – birthing; migration back; Good infrastructure - Need commercial airstrip (extend); Resort (but some opposition to tourism); Well planned housing developments; Seawall; new roads to other parts of island; more small businesses; Community owned enterprises; A learning centre to run courses/education for community (TAFE, uni, block, spiritual, culture); Early childhood centre (day care); Art centre; Direct export seafood factory/business; Protect our reefs from outsiders and look after environment (so we still have fish available for our children); Teach indigenous languages – have our own independent bilingual school; Solar energy for community, windmills; Own health and dental services (not QLD owned). We make our own decisions for ourselves.*

### **4.2.2 Mabuiag historical timeline**

To describe life on Mabuiag in the past a timeline was developed from local knowledge of people's experiences and customs that were common place on the island. The timeline was provided by Terrence Whap with the help of Vic McGrath and Fiona Morseu. Key events were:

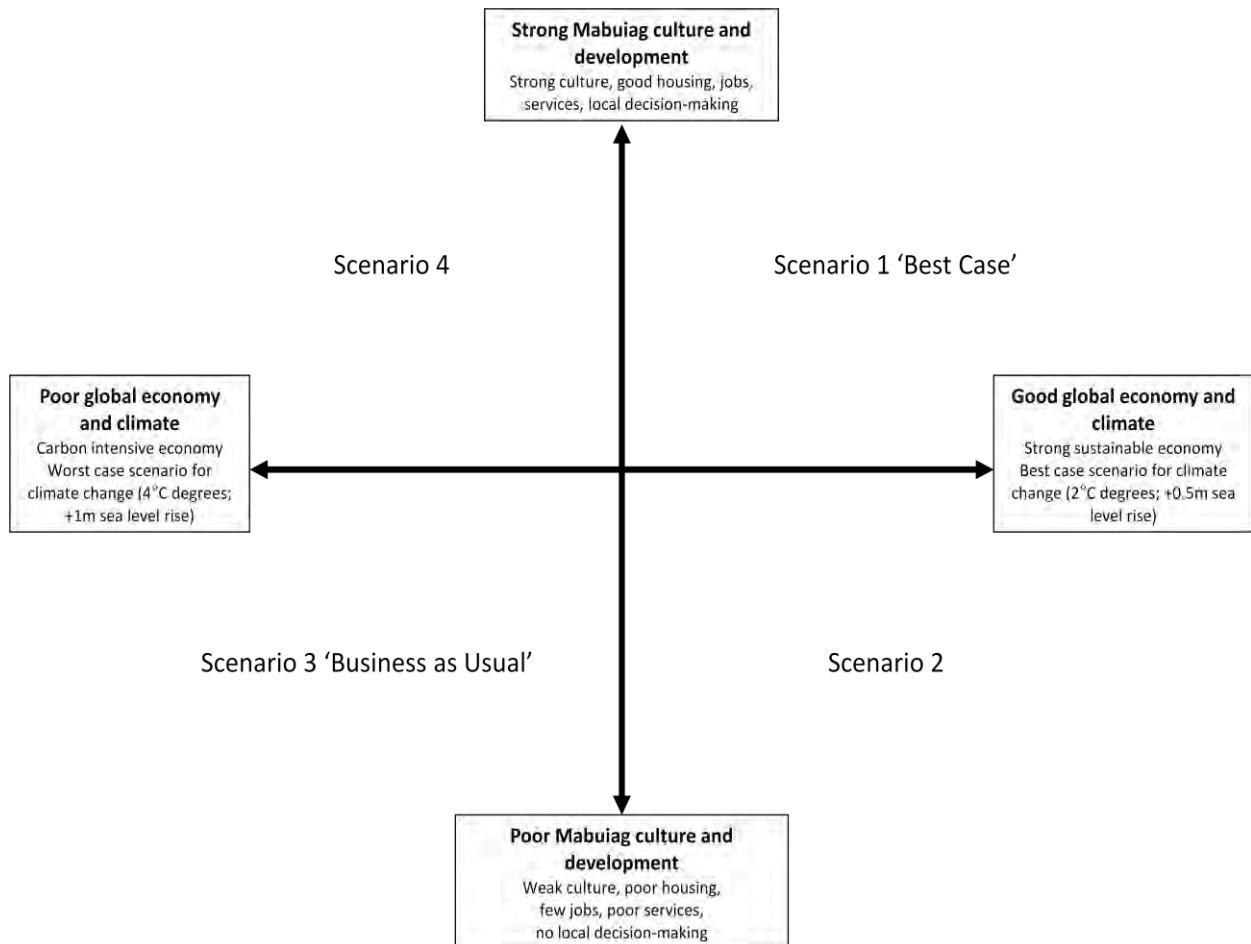
- Mabuiag originally run by local Chiefs: the dominating, overarching clan group was Wagadagam Clan. All the other clans that currently exist and came to form were established from Wagadagam. The island was run by Wagadagam Clan prior to the Coming of the Light in 1871.

- Coming of the Light/Christianity 1871: Missionaries landed on Mabuiag. Mothers Union and Girls' friendly society started in the 1960s.
- First school on the island: People start to speak more English and less Kalaw lagaw Ya (KLY) with the first school college run by Mr McGuire and was established straight after the Coming of the Light. The college taught students like Getano Lui Snr and George Mye who became leaders in the Torres Strait. The new state school was built on Mabuiag in 1983/1984.
- Pearling industry: The pearling industry started before the Coming of the Light. Mabuiag was the first island to go into this industry. South Sea Islanders dominated the pearling industry which saw islanders come from the central and near western islands to join Mabuiag.
- The war years: During the war years there was little travel by the locals who remained on the island as they were scared from passing by planes. The battle of the Coral Sea during 1937 – 39/40 saw some local men recruited in the army and go to war. During this time some American and Australian soldiers were posted on Mabuiag.
- Mabuiag people get to vote: The 1967 referendum in Australia was followed by Mabuiag Islanders voting. However, local people were voting for local Councillors since 1930 which was followed by the first councillors' meeting held at Masig in 1937.
- Commercial crayfishing begins: Commercial cray fishing began at Mabuiag in the early 1970s. Prior to that, locals were diving for crayfish for general/personal consumption at home, feasting etc.
- First phone booth installed: In 1979/1980 the first phone booth was installed at Mabuiag Island by Telecom, linking Mabuiag with the outside world.
- Building of airstrip: The old airstrip was established by manpower in the early to mid 1950s. The new air strip was then constructed in 1979/1980.
- Dimple Bani initiated as Chief of Mabuiag: Dimple Bani was made chief of Wagadagam at a traditional ceremony in 2006.
- New Health Centre built: The new Health centre was built in the late 1990s (1998), supplementing the old MAP (Medical Aid Post) established in the early 1950s.
- Native Title: Native Title was granted to Mabuiag in 2003.

#### **4.2.3 Future scenarios for Mabuiag Island**

Using the two most important themes of drivers from Session 1 (culture and social-economic-political), two intersecting lines (axes) were drawn with different extremes of each driver. These axes were described in broad terms as Mabuiag culture (strong versus weak) and social-economic-political conditions (which included housing, jobs, services, extent of local decision-making, and the sustainability of the global economy; Fig. 14). The global social-economic-political conditions also had influence on the extent of climate change and sea level rise.

These axes created a matrix of four different future scenarios for Mabuiag, which combined better or worse levels of the drivers. Workshop participants were divided into four working groups, one for each scenario. Participants developed a narrative of Mabuiag livelihoods in 2100 for their assigned scenario, drew a picture, and identified any potential thresholds of change and the likely year that these would be encountered (Figs. 15–18). Fig. 19 shows the final matrix of scenarios relative to the drivers of change.



**Figure 14.** The matrix of four future Mabuiag Island scenarios created by combining better or worse levels of the two most important driver themes, Mabuiag culture and social-economic-political factors (which included climate change)





Workshop participants drawing a scenario picture and creating a narrative. Photo: Tim Skewes.



Figure 15. Scenario 1, Kozan (Sharing and equality) (Best Case)

### Verbatim narrative for Scenario 1, Kozan (Sharing and equality)

"We've got strong culture, or cultural maintenance, preservation and conservation and everything, carrying out what they've been taught. In the middle there they got indigenous and non-indigenous. Our scenario is based on Kozan. In this case it means sharing and equality. We share everything. Community, as of now, from now onwards. You've got houses that have been moved to high sites from climate change and sea level rising and we've got towers rising at the back there. We've got hotels on the island, we've got tourism, we've got resource contracts and

businesses going on. So we've got it made here on the island. But if you can notice this red line here; that's a sea wall and the blue is the water. And, it's gone over the sea wall. The sea wall was not made according to the calculations of the surveyors. That's happening for us now. The sea walls break and sink down. So, we live a good life but we still have disadvantages and obstacles. Down here we've got local decision-making, we've got the elders sitting and, again, not only indigenous but non-indigenous as well. We've got the presentation to the government and the government is now sitting and lobbying and then we've got our goals. Between this one [local decision-making] and jobs and services we've got mechanics, builders, plumbers, receptionists. But we've got more people and fewer jobs. More job vacancies and less funding. You've got more government awareness and less cultural awareness, so you've got 'down hill' cultural values. You've got more high school leavers coming back. All that's happening, but we've still got goals. Because number one is the best case scenario we just thought that Kozan would be more about sharing culture with others, we're sharing our knowledge."

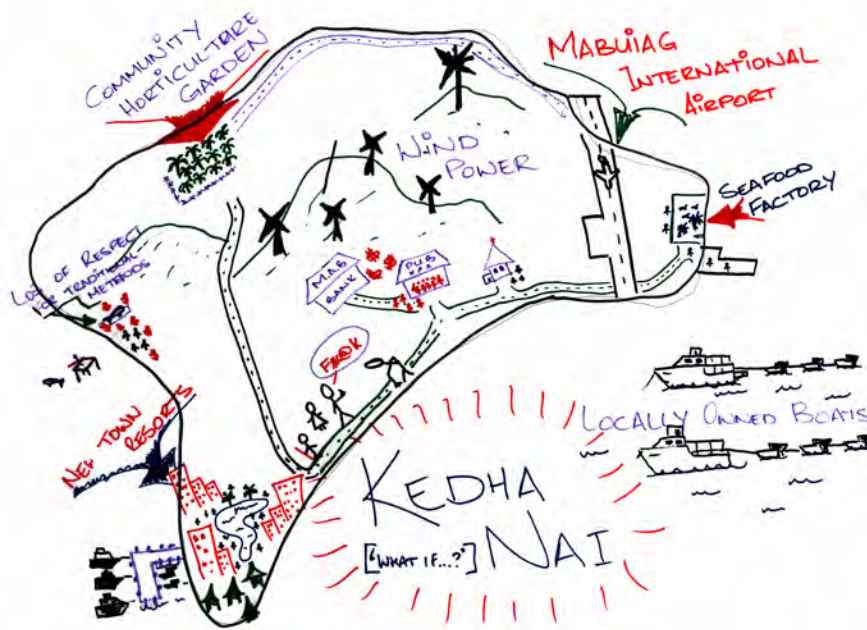


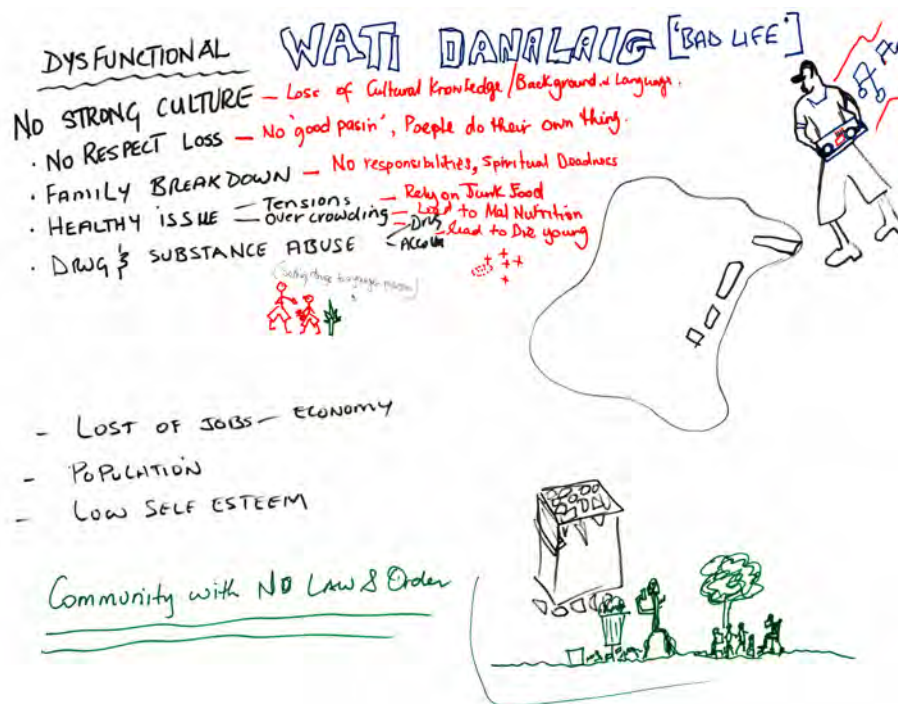
Figure 16. Scenario 2, Kedha Nai (What if?)

### Verbatim narrative for Scenario 2, Kedha Nai (What if?)

"First off we've got strong economy. Because of that you have locally owned boats with their own business: fish factory development, seafood factory development for island. We extend the runway. We have international airport where a plane can fly straight to here, with our product can fly straight to Indonesia, straight to the Asian market. Also, because we're going green on the island we got wind turbines everywhere to save energy because with peak oil, cost of fuel go up, so we try and go to all them kind of environmentally sustainable power sources. Also, at the back we have a big horticulture garden that will sustain island, kai-kai (food), where you don't depend on shipments to come in. You have your own fruit and veggies: living on that. Then at the end we got a resort: because of money and the economy people wanting to spend money and come and see and do different things. Also, you got all boats, all cruises and them things will be in there, down that end. But, on the downside, also, because the economy, the culture will be bad for the island. We got pub, after hour time, We got church there next to the pub...you got the police and the lawyer, but you look across from the pub: because everyone



has money, but not enough of the culture. Where people come from bank straight to the pub with their money. This one here, you see an old man, elder, and young people don't have respect no more for their elders, your community: because no culture. Up the back here, we got man catching dugong. We got a loss of respect for traditional methods of hunting and fishing and gathering. Some people catch a dugong and chuck away, no respect. That decay from now until 2050, 2070, around that time. That's this scenario. That's what's going to happen. People don't mind, they got disco. Community today say turn that thing down, people want to sleep. That's the type of change we are going to see because of the loss of culture. Because people are sustainable money wise, but the other side is selfishness is come in, people only think about themselves and not others. It's called 'Kedha Nai'. This is how it's going to turn out, but it makes you think about the other, especially the social, cultural side."

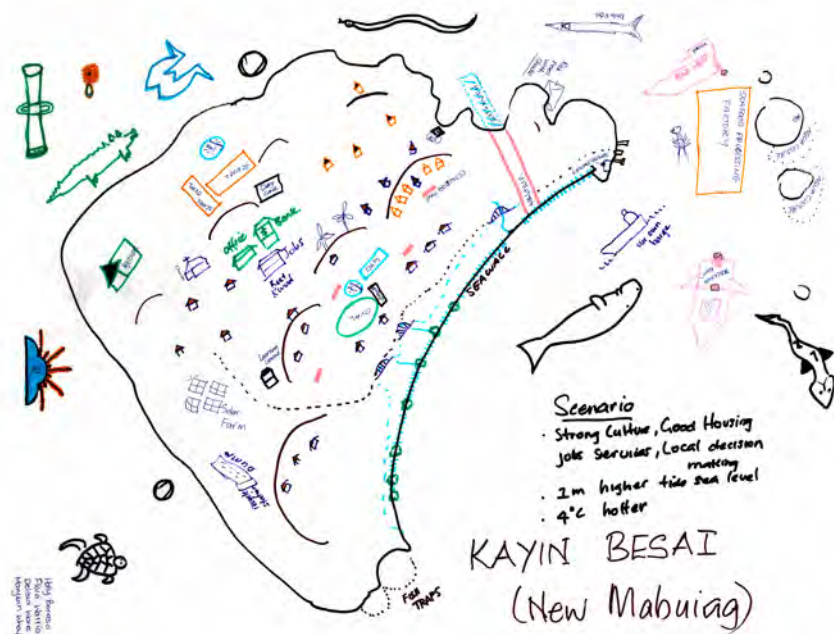


**Figure 17.** Scenario 3, Business as usual (wati Danalaig)

### Verbatim narrative for Scenario 3, Wati Danalaig (Bad Life)

"This one is called 'Wati danalaig', which means 'bad life', hopeless life, no happiness involved: Business as usual. If we don't look after the community, 80, 90 years down the track, taking all these things into consideration, because we've lost our culture, loss of knowledge, language. That's a big loss and that's a loss of identity for us, loss of community. People tend to do things their own way. The elders keep to themselves. There could be family breakdown. People went to work away and people stay here with families. It's putting added pressure on other families causing issues of overcrowding, tensions between families. People aren't taking responsibility and also the community is spiritually dead. Kids get bored so drug and substance abuse; sniffing petrol, alcohol. So it will affect our economy with loss of jobs. People don't want to work, visitors don't want to come into the community. The population goes flat because no jobs in the community. They could be out on the streets or the other side of the island. Big impact on the population and also low self esteem. There's a bin with rubbish and someone drinking, sniffing and people keep getting together and drinking, sniffing too. It's not a good picture for visitors.

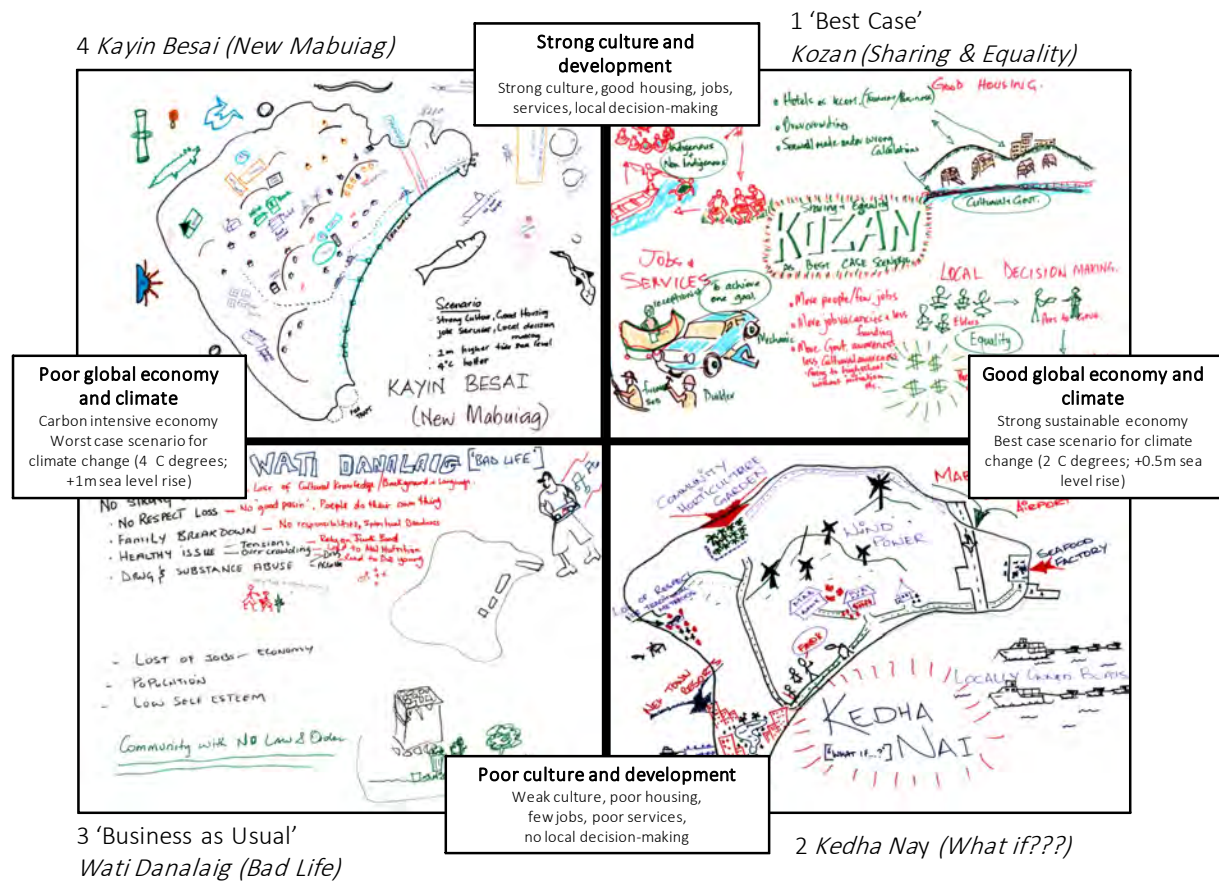
The community's dirty, rubbish everywhere. And this here is someone sitting in a wheelchair and that's what could happen down the track. And, this one here [picture of the man with stereo]...if we have somebody, cultural thing. We don't get to see people wearing traditional headdress, but instead wearing a hat and they are carrying music. In 50 years' time people will dance differently."



**Figure 18.** Scenario 4, Kayin Besai (New Mabuiag)

#### **Verbatim narrative for Scenario 4, Kayin Besai (New Mabuiag)**

"Ours is called 'Kayin Besai', so we're looking ahead. Our scenario is that we have strong culture, good housing, good jobs and services and local decision-making, but we got one metre high sea level and 4 degrees hotter temperature. Strong culture; everything is good locally, but globally climate change and lots of other things. The first obvious thing with climate change we had to move the houses back because we've pretty much lost the beach. And the church had to be moved back further inland at the back of the island and we have to start building on hills and a lot of other places. So a lot of the business hub, like offices and things like that, need to be moved to another location. Perhaps the school needs to move to the back. We have to start building bridges just to get across roads. We are going to have a lot more assets because a lot more people are going to have good boats...a lot more ladies in boats. A seafood factory, we'll have aquaculture to make use of the small islands and probably have our own shipping at that stage. If we have a good economy, we'll probably have our own shipping. All the rest is on culture: you're keeping those things alive...everybody making decision at community level. It's cultural decision-making for everybody. That's to bring back the cultural part. Everything you see we make decisions for ourselves. We've got sea wall in there, but that's just to stop erosion, it's not to stop the water. We can't really dam the creeks because fish have to breed in creeks, but plenty more trees-mangroves to stop the erosion. Nobody wanted to live on Mabuiag so we built a small island for ourselves, we built a small island."



**Figure 19.** The four scenarios within the matrix of drivers for Mabuiag Island



Workshop participants presenting the narrative for the Business as Usual Wati Danalaig (Bad Life) scenario. Photo: John Rainbird.

### **4.3 Session 3: What impact will the Business as Usual future have on human well-being?**

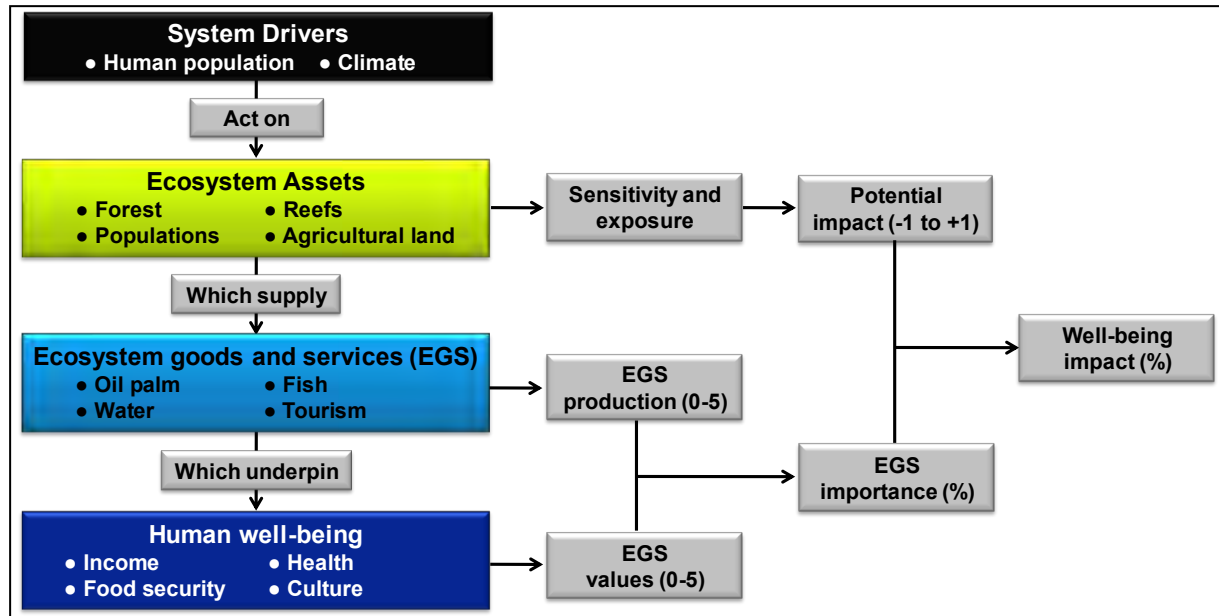
This session explored the potential impacts of the Business as Usual *Wati Danalaig (Bad Life)* scenario on the natural resource base supporting the Mabuiag community's livelihoods. This was feasible using three sources of quantitative data. First, the extreme climate change predicted by the Business as Usual scenario had been modeled using CCAM, which is based on the high IPCC A2 global emissions projections. Second, sea level rise projections have been made in studies done for the TSRA. Third, population projections were available for the Torres Strait region, which assumes continuing net growth, and thus mirrors the Business as Usual scenario. Impacts were only investigated for 2030 because climate and human population projections are likely to be more realistic in the short term, and any human responses are less likely to have taken effect.

The potential impacts on human well-being were examined using the semi-quantitative ADWIM (Asset-Drivers-Well-being-Interaction-Model; Fig. 20). First, a preliminary list of the ecosystem goods and services (EGS) that support livelihoods in each Torres Strait community was made by TSRA collaborators. During the workshop participants refined the list for Mabuiag and estimated the 'production' (i.e. the relative volume produced or exploited) of each EGS for Mabuiag, scored from 0-5. They also ranked the relative value (0-5) of each EGS in terms of four indicators of well-being: income, food security, health and culture. Combining this with the 'production' information gave the relative importance of each EGS for the Mabuiag community (Fig. 21).

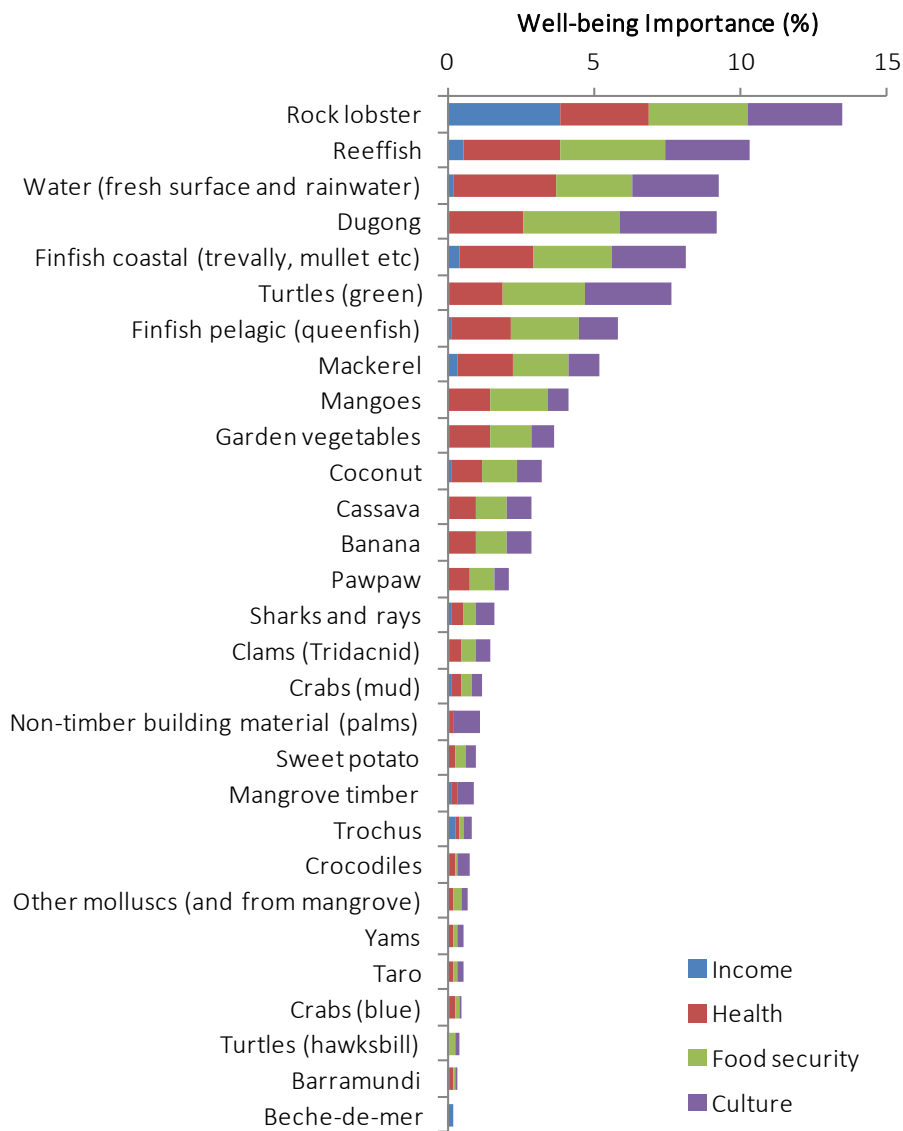
The most important EGS was rock lobster, which contributed highly for all four indicators of well-being, and was the highest contributor for income (Fig. 22). Reef fish, freshwater, dugong, coastal finfish, and green turtles were the next most important EGS, and of these only freshwater was not a marine-derived EGS. Mangoes and garden vegetables were the most important terrestrial EGS.

Participants from Mabuiag were also asked to score the relative contribution of EGS to their overall well-being, relative to income derived from formal employment, remittances and government support. This showed that local EGS contributed 49%, and external income 51% (Fig. 23). The highest importance of local EGS was for culture, while external income contributed more to food security and health.

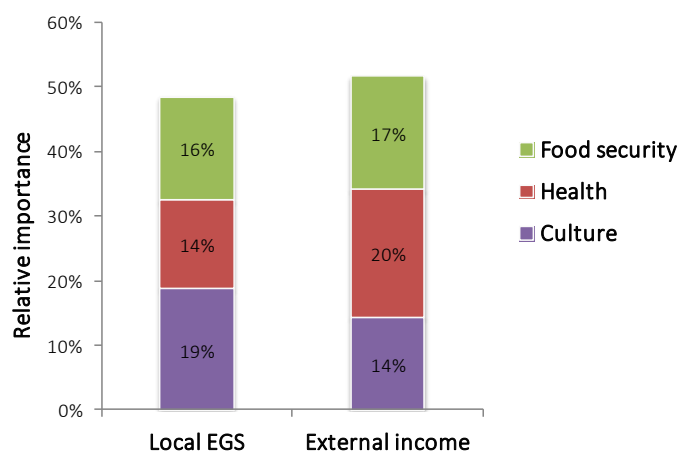




**Figure 20.** The ADWIM model (see Skewes et al. 2011, 2012) used to estimate the importance of EGS, and the impact on human well-being from the Business as Usual *Wati Danalaig (Bad Life)* scenario



**Figure 21.** The 31 ecosystem goods and services identified by the Mabuiag Island community, and their relative importance (total bar) and contributions to income, health, food security and culture (colours)



**Figure 22.** The relative contribution of local EGS to food security, health and culture relative to external income for the Mabuiag Island community, as reported by eight local participants





Workshop participant valuing EGS for Mabuiag Island. Photo: Erin Bohensky.

By applying the downscaled climate and human population growth projections for 2030 for Mabuiag (Table 5) the resulting impacts on ecosystem assets, EGS and well-being were estimated. Results showed that overall impacts on well-being in 2030 were likely to be negative for all EGS, although these were off-set by some positive impacts due to temperature and rainfall increases linked to climate change (Fig. 23). The most impacted EGS were turtles and reef fish, followed by coastal finfish, and was caused primarily by climate change, but also by increased exploitation due to population growth in the Mabuiag human population, especially for coastal finfish. For the terrestrial EGS (e.g. coconuts, yams, taro), sea level rise was the primary impacting factor due to loss of land.

When well-being impacts were aggregated for all EGS, the negative impacts increased with time (Fig. 24). Overall, in 2030 negative human population impacts exceeded climate change impacts, some of which were offset by some positive effects of temperature and rainfall increases. By 2060, human population impacts and sea level rise roughly doubled, and the only positive effects were related to rainfall. By 2100 negative impacts were approximately three to four times their 2030 levels, and the greatest of these impacts was sea level rise due to potentially extreme climate change effects.

**Table 5.** Projected changes in climate and human population under the Business as Usual scenario for each Torres Strait island, including Mabuiag, which were applied in ADWIM.

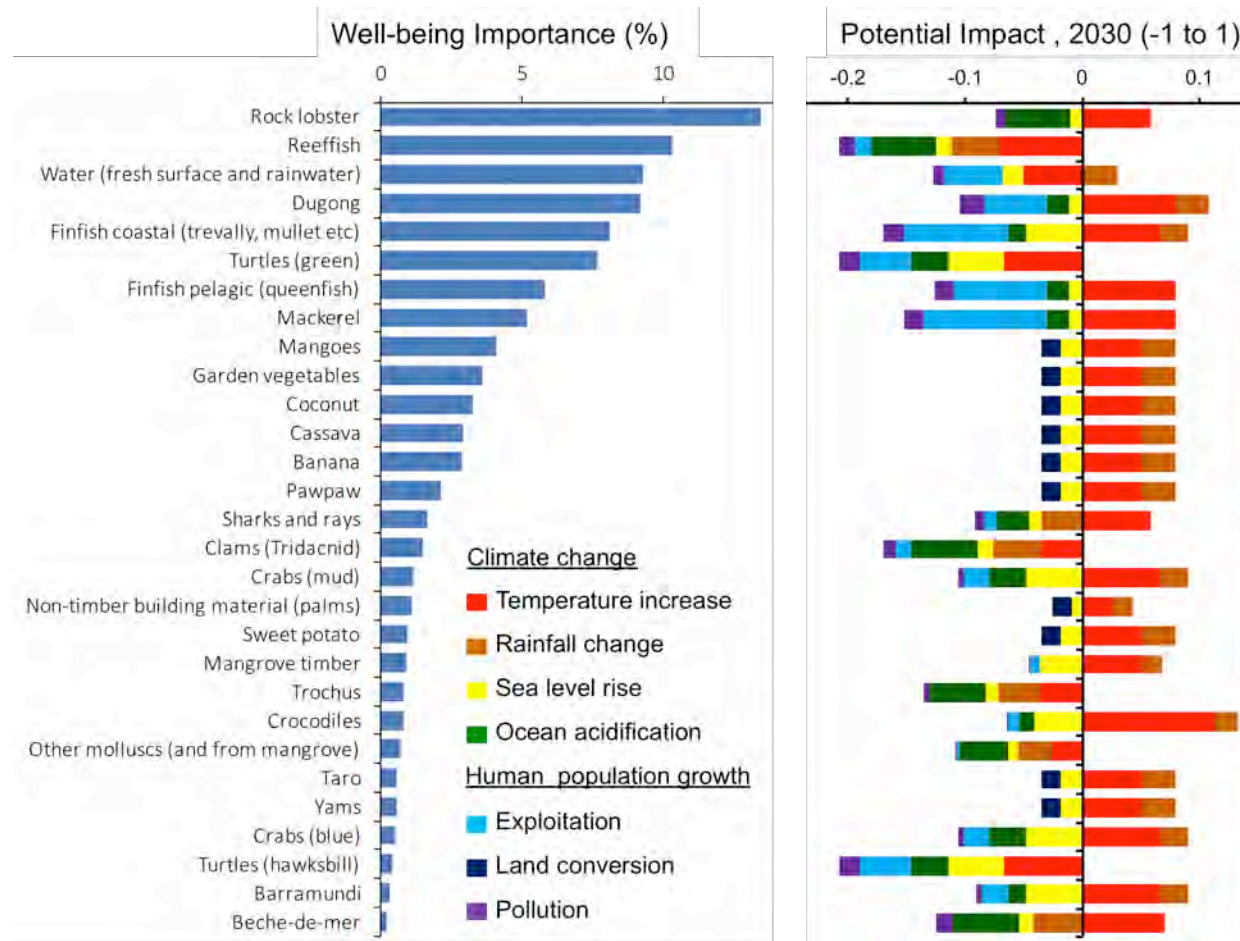
Drivers and threats	Year	Badu	Boigu	Dauan	Erub	Yam	Kubin	Mabuiag	Masig	Mer	Poruma	Saibai	St Paul	Ugar	Warraber
Change in average annual rainfall (%)	2030	1.1	2.8	3.2	2.7	2.4	1.1	1.7	2.5	1.6	2.3	3.3	1.2	3.2	1.5
	2055	2.1	5.3	6.2	5.1	4.6	2.1	3.2	4.8	3.1	4.3	6.3	2.3	6.1	2.9
	2090	-7.0	1.0	1.1	0.2	-3.0	-7.0	-5.8	-1.1	-1.6	-2.4	1.5	-6.5	1.4	-4.2
Air temperature change (deg C)	2030	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2055	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	2090	2.3	2.6	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.3	2.3	2.3
Population (persons) [note 1]	2010	915	284	164	365	340	228	276	330	545	194	394	266	85	288
	2030	1104	343	198	440	410	275	333	398	658	234	475	321	103	347
	2055	1282	398	230	511	476	319	387	462	764	272	552	373	119	404
	2100	1489	462	267	594	553	371	449	537	887	316	641	433	138	469
Density, land (people per km2)	2000	9.0	3.9	44.1	61.1	197.0	1.3	43.2	203.6	127.2	521.8	3.8	1.6	229.3	389.7
	2030	10.9	4.7	53.2	73.7	237.7	1.6	52.2	245.6	153.4	629.5	4.6	1.9	276.6	470.1
	2055	12.6	5.5	61.8	85.6	276.1	1.9	60.6	285.2	178.2	731.1	5.4	2.2	321.3	546.0
	2100	14.7	6.4	71.7	99.5	320.6	2.2	70.4	331.2	206.9	849.1	6.2	2.5	373.1	634.1
Density, sea (people per km2) [note 2]	2000	0.40	0.18	0.08	0.14	0.13	0.10	0.11	0.12	0.21	0.07	0.21	0.11	0.03	0.11
	2030	0.48	0.22	0.09	0.17	0.15	0.12	0.14	0.15	0.26	0.09	0.25	0.14	0.04	0.13
	2055	0.55	0.25	0.11	0.20	0.18	0.14	0.16	0.17	0.30	0.10	0.29	0.16	0.04	0.15
	2100	0.64	0.29	0.13	0.23	0.21	0.16	0.19	0.20	0.35	0.12	0.34	0.18	0.05	0.17
Density, reef (people per km2) [note 3]	2000	4.1	342.7	9.7	1.4	2.4	1.0	1.7	2.4	1.9	1.0	26.9	1.1	0.6	3.5
	2030	5.0	413.5	11.7	1.7	2.9	1.2	2.0	2.9	2.3	1.3	32.4	1.3	0.8	4.2
	2055	5.8	480.2	13.6	2.0	3.4	1.4	2.3	3.4	2.7	1.5	37.7	1.5	0.9	4.9
	2100	6.7	557.7	15.8	2.3	4.0	1.6	2.7	4.0	3.1	1.7	43.7	1.8	1.1	5.7

**Notes:**

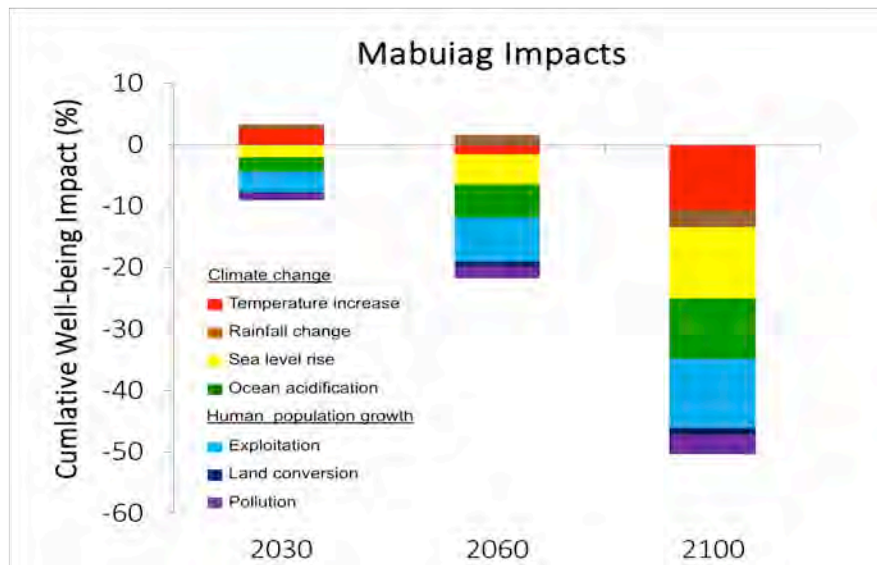
1. Population growth was assumed to be 0.99% p.a. until 2030, and then 0.5% p.a. after 2030, based on Queensland Government projections. While there has been variation in population growth amongst the islands since 2000 (e.g. from -1.89% p.a. for Yorke Island to +3.37 % p.a. for Saibai Island), it was assumed that all the islands will experience the same population growth rate over the next 100 years. (Source: Queensland Government Population Projections, 2011 edition, and QRSIS database maintained by the Office of Economic and Statistical Research).
2. Density of people per km<sup>2</sup> of sea was calculated from an assumed marine area of 30 km radius around each island.
3. Density of people per km<sup>2</sup> of reef was calculated from the area of reef within each islands marine area.

In ADWIM, sea level rise was factored (relative to 2000) for Mabuiag Island to be 0.24 m by 2030, 0.49 m by 2060 and 1.00 m by 2100 (Source: John Rainbird, TSRA). This was used to assess exposure for the marine and coastal EGS. Exposure of terrestrial EGS is also influenced by the proportion of land at risk of inundation. We therefore assumed an estimated inundation for Mabuiag Island of 40% of current landmass by 2100, using visual estimates of percent inundation from maps supplied by the TSRA.

In ADWIM, ocean acidification was factored as a change in the aragonite saturation coefficient (relative to 2000) of -0.31 by 2030, -0.71 by 2060, and -1.31 by 2100. This was applied to all islands (Source: Pacific Climate Change Science Program, 2011).



**Figure 23.** The relative contributions of climate change and population-derived impacts on human well-being for Mabuiag Island EGS in 2030 under the Business as Usual *Wati Danalaig (Bad Life)* scenario.



**Figure 24.** The cumulative impacts on well-being for all EGS in Mabuiag in 2030, 2060 and 2100 under the Business as Usual *Wati Danalaig (Bad Life)* scenario.

#### 4.4 Session 4: What is the resilience of the Mabuiag community today?

This session began with a discussion about the concept of community resilience. It was described in terms of five key characteristics illustrated on a poster (Fig. 26):

- Bouncing back
- Flexibility
- Overcoming challenges through perseverance
- Connectedness and unity
- Keep learning

Because there have been no marked environmental or socio-economic shocks to Mabuiag in recent times, the discussion focussed on the general resilience of the community, rather than resilience to specific challenges. The TSRA-CSIRO team presented nine indicators of general resilience, and each was discussed in turn. Then, participants were asked to score how the Mabuiag community was performing on each, and give the reasons for their scores, to create a resilience profile (Table 6).

Participants felt that the community scored highly in terms of food and water self-sufficiency, and language and culture (4 or more on a scale of 1 to 5). This was attributed to having “resources from the sea, native foods, rainwater tanks, “backyard gardens” and for the latter, “effort people put into maintaining culture – ties into spirituality” and “programs for cultural maintenance”. Working well together to address challenges, innovation and creativity, good leadership, the ability of the community to organise and make decisions quickly, ability to learn, and networks and partnerships beyond Mabuiag all scored medium (3-4), and it was generally agreed that there was room for improvement in these areas. Disaster preparedness and financial capacity scored relatively low (below 3). Reasons for the low score for disaster preparedness included: “Need more training, need more community awareness, not a lot of disaster



experience” and for financial capacity “lack of human resources for people to get financial support”, people rely on income support because no labour market, getting loans from the bank difficult without jobs. People only have enough money to live week to week, no savings (so can’t plan for future contingencies like disasters).”



**Figure 25.** The poster used in the workshop to explain concepts of community resilience

**Table 6.** Workshop participants' scoring of Mabuiag community's resilience against 10 indicators, with explanations given by the 3 groups. (Note: Not all groups gave a score in all categories).

Resilience indicator	Score (1-5 where 1 is lowest); group scores and average	Why?
1. Disaster preparedness	3, 2, 3 (2.67)	Gr 1: SES, disaster management on the ground, can access the network. Need more training. Need more community awareness. Not a lot of disaster experience. Gr 2: No training. Gr3: Have generators and backup systems/supplies but people not very aware.
2. Financial capacity	2, 3, 2 (2.33)	Gr1: Financial capacity includes income support and government support. In terms of government support: lack of human resources for people to get financial support. Gr2: Can generate resources / access cash through lobster fishery, people sharing. Gr3: People rely on income support because no labour market, getting loans from the bank difficult without jobs. People only have enough money to live week to week, no savings (so can't plan for future contingencies like disasters etc.). There are examples from other places (e.g. Masig, Pacific communities) that Mabuiag can look to (e.g. insurance, space capacity)
3. Food and water self-sufficiency	4, 4, 4 (4)	Have resources from the sea, native foods, rainwater tanks, backyard gardens
4. Work well together to address challenges	3,2,4,3 (3)	Gr 1: divided between 2 and 3; 2 because most people don't come to meetings Gr 2: 4: good communication across community but based on assumption that you don't need everyone to get things done
5. Innovation and creativity	4,3 ,3, 2 (3)	Gr 1: 4: Creative people are there; also 3 Gr 2: 3: Lots of creative people and thinking but not necessarily the ability or tools to harness their power and put into action Gr 3: 2: Only a few people drive ideas in the community and others follow
6. Good leadership	3, 4, 4 (3.67)	Gr 1: self organisation in community, push comes from within, but need for more motivation Gr 2: good range of leaders (including NGOs, spiritual leaders, women) Gr 3: good spread through community (Chiefs, inspiration in primary school, youth, spiritual leaders, women)
7. Ability of community to organise and make decisions quickly	3.5, 4,3 (3.5)	Gr 2: people come together quickly, structure and process enables people to make things happen Gr 3: depends on situation but people can do it, strong leaders
8. Ability to learn	3, 3.5, 3.5 (3.33)	Gr 1: making same mistakes (e.g. shed being blown down by Northwest winds) Gr 3: willingness to learn
9. Networks and partnerships beyond Mabuiag	3, 4, 3 (3.33)	Gr 1: community organisations have knowledge, confidence Gr 2: compared with other communities, we are one of the most studied in TS – good networks with institutions, have done a lot of things Gr 3: networks through families (marriages) across TS, and with institutions (research and others)
10. Language and culture	5, 5, 4 (4.67)	Gr 1: have retained the culture, culture is unique, language is still there Gr 2: effort people put into maintaining culture – ties into spirituality Gr 3: programs for cultural maintenance



## 4.5 Session 5: What are priority adaptation strategies to build a resilient Mabuiag community?

### 4.5.1 Adaptation strategies

In this session the results of the overall potential impacts in 2030 of the “Business as Usual” *Wati Danalaig (Bad Life)* scenario on EGS and human well-being for Mabuiag were combined with the community’s resilience profile to design adaptation strategies. The facilitators explained that adaptation strategies could be focussed on either impacts of change on EGS (e.g. declining rainfall and coral bleaching) or resilience issues (e.g. poor leadership) or both, and generic examples were given. Participants were then divided into three working groups. Each group was provided with the graphs of EGS and projected impacts in 2030 (Fig. 23), and the resilience assessment (Table 6). From this information, they listed strategies in descending order of priority. For each strategy they also listed the following information:

- The impacted EGS and the threats causing that impact
- Alternative strategies which take advantage of underutilised EGS
- The resilience scores requiring improvement
- The resources and stakeholders required to implement the strategy

By comparing the strategy against the other three possible future scenarios (i.e. *Kozan, Kedha Nay, Kayin Besai*), the working groups also assessed whether the strategy risked being mal-adaptive if any of these alternative futures eventuated. If not, the strategies were considered to be ‘no regrets’.



Workshop participants designing adaptation strategies based on EGS impacts and resilience profile. Photo: Erin Bohensky

Working Group 1 presented nine strategies which addressed the resilience indicator of financial capacity (Table 7), the highest priority of which was to create an economy (e.g. community enterprise, small business, local markets). Working Group 2 considered that a disaster drill was a

priority to increase disaster preparedness (Table 8), followed by increasing youth activities and engagement. Working Group 3 divided strategies into those related to turtle management, and those related to disaster preparation (Table 9).

Of these 30 strategies, 12 addressed both EGS and resilience issues. All strategies required the involvement of at least the community, and some required partnerships with as many as seven stakeholders to implement them. Three strategies risked being mal-adaptive under future conditions other than the “Business as Usual” *Wati Danalaig (Bad Life)* scenario. For example, Working Group 1’s strategy of creating a local economy was considered to have potential to cause conflict with Mabuiag culture and create conflict over wealth. Two strategies were considered potentially maladaptive if projected impacts of sea level rise did not materialize. All other strategies were considered ‘no regrets’.

#### **4.5.2 Results and next steps**

Fig. 26 illustrates the overall process and results of the workshop sessions. Thirty ‘no regrets’ adaptation strategies were identified for Mabuiag based on the community’s most important EGS, projected impacts by 2030 for the “Business as Usual” *Wati Danalaig (Bad Life)* scenario, and the community’s resilience profile today. Strategies aim to build the community’s resilience and steer livelihoods towards the visions for Mabuiag Island. Several thresholds were identified which, if passed, could alter the identity of Mabuiag Island and not be easily reversed, such as the building of large hotels.

In addition to this report, which will be made available to the community, the perceptions of the Mabuiag workshop participants presented here will be combined through integration and policy evaluation workshops in 2014 with those of other case study communities, and government stakeholders.

**Table 7.** Adaptation strategies identified by Working Group 1, in descending order of importance

<b>Adaptation strategy</b>	<b>Impacted EGS and threats addressed, or EGS alternatives</b>	<b>Resilience issue addressed</b>	<b>Stakeholders required to implement strategy</b>	<b>Scenario 1 Kozan (<i>best case</i>) Risk of mal-adaptation?</b>	<b>Scenario 2 Kedha Nay Risk of mal-adaptation?</b>	<b>Scenario 4 Kayin Besai Risk of mal-adaptation?</b>
1. Create economy (community enterprise, small business, local markets)	• None specified	• Financial capacity	• CEA, Community, banks, TSRA, TSIRC, NGOs, Office of Fair Trading	<ul style="list-style-type: none"> <li>• Could be a clash with strong local culture</li> <li>• There can be conflicts with wealth</li> </ul>	<ul style="list-style-type: none"> <li>• Could be conflict with culture</li> </ul>	<ul style="list-style-type: none"> <li>• Could be conflict with culture</li> </ul>
2. Funeral funds (benevolent funds)	• None specified	• Financial capacity	• Community	No	No	No
3. Education about budgeting	• None specified	• Financial capacity	• Mura Kosker	No	No	No
4. Seek funding	• None specified	• Financial capacity	• NGOs, foundations, TSRA, philanthropic organisations	No	No	No
5. Create infrastructure to attract business	• None specified	• Financial capacity	• Above plus My Pathways for participants	No	No	No
6. Crayfish enterprise for community	• None specified	• Financial capacity	• Community, TSRA	No	No	No
7. Create lending programs for community (low interest)	• None specified	• Financial capacity	• Community	No	No	No
8. Create local foundations	• None specified	• Financial capacity	• Community, TSRA	No	No	No
9. Create scholarships so information about financial systems comes back to community	• None specified	• Financial capacity	• Community	No	No	No

**Table 8.** Adaptation strategies identified by Working Group 2, in descending order of importance

<b>Adaptation strategy</b>	<b>Impacted EGS and threats addressed, or EGS alternatives</b>	<b>Resilience issue addressed</b>	<b>Stakeholders required to implement strategy</b>	<b>Scenario 1 <i>Kozan</i> Risk of mal-adaptation?</b>	<b>Scenario 2 <i>Kedha Nay</i> Risk of mal-adaptation?</b>	<b>Scenario 4 <i>Kayin Besai</i> Risk of mal-adaptation?</b>
1. Disaster drill	• None specified	• Disaster preparedness	• SES, Local government, Disaster Management department	No	No	No
2. Youth activities and engagement	• None specified	• Work well together to address challenges; good leadership; innovation and creativity; ability of community to organise and make decisions quickly	• PBC, Council, Sports and Recreation, TSRA, Health	No	No	No
3. Seek support from funding agencies to assist community with grants and submissions	• None specified	• Financial capacity	• TSRA, grantwriting workshops, consultants	No	No	No
4. Addressing tenure as a bigger issue of Mabuiag	• None specified	• Work well together to address challenges; good leadership; ability of community to organise and make decisions quickly	• PBC, TOs, Council, TSRA, government	No	No	No
5. Create more jobs/identify jobs to increase skills in community	• None specified	• Work well together to address challenges; innovation and creativity; ability of community to organise and make decisions quickly	• TSIRC, TSRA, PBC, community leaders	No	No	No
6. Investigate options for seawalls	• Grow trees	• Engage coastal engineer; community to support (Work well together to address challenges)	• TSRA, local government, PBC	No	No	No
7. Increase turtle hatching success	• Turtles	• Protect nesting areas; support rangers (Networks and partnerships beyond Mabuiag)	• Rangers, TOs, Landcare, external consultants	No	No	No

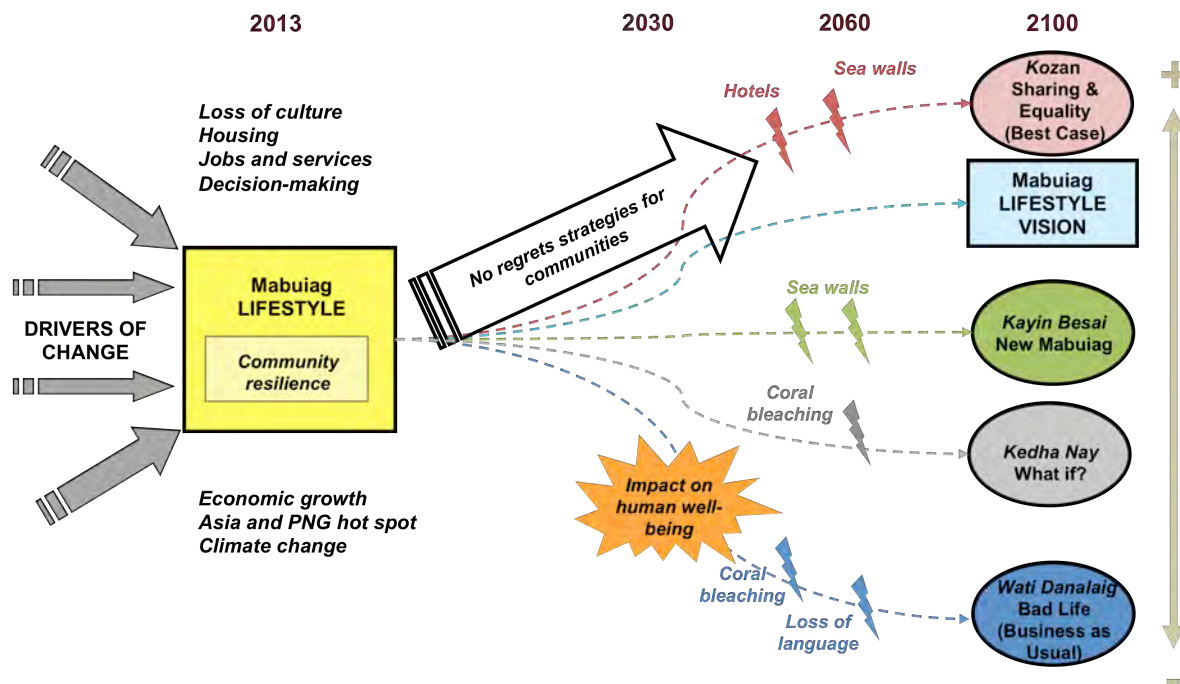
**Table 9.** Adaptation strategies identified by Working Group 3, in descending order of importance

Adaptation strategy	Impacted EGS and threats addressed, or EGS alternatives	Resilience issue addressed	Stakeholders required to implement strategy	Scenario 1 Kozan Risk of mal-adaptation?	Scenario 2 Kedha Nay Risk of mal-adaptation?	Scenario 4 Kayin Besai Risk of mal-adaptation?
<i>Turtle Management</i>	• Turtles	• Food self-sufficiency				
1. Education programs			• Education system (Tagai), public meetings, ranger program, fishers' association, Native Title PBC	No	No	No
2. Regional coordination			• TSRA, TSIRC, institutions, Govt (State and Federal)	No	No	No
3. Controlled incubation			• Science community	Maybe, if temperature increase is not significant	Maybe, if temperature increase is not significant	No
4. Turtle sanctuary			• Native Title	No	No	No
<i>Disaster preparation</i>	• Water	• Disaster preparedness (cyclones, storm surge, king tide)	• Community, TSIRC, SES, Rural Fire, AMSA, BOM, Torres Shire (e.g. regional and local community approach)	No	No	No
1. Education						
2. Multi-purpose infrastructure e.g. community hall that is also cyclone shelter (financial benefit too)			• TSRA, TSIRC, Government	No	No	No
3. Capacity building for community (organisational )			• Community organisations, TSIRC, SES, Rural Fire, AMSA, BOM, Torres Shire	No	No	No

4. Communication hub in community for disasters			<ul style="list-style-type: none"> <li>Local police, local divisional office, TSIRC, SES, Rural Fire (Coordination)</li> </ul>	No	No	No
5. Regular drills			<ul style="list-style-type: none"> <li>Local police, local divisional office of TSIRC, SES, Rural Fire (Coordination), community</li> </ul>	No	No	No
6. Need mobile phone coverage			<ul style="list-style-type: none"> <li>Political representatives</li> </ul>	No	No	No
7. Alarm/warning system			<ul style="list-style-type: none"> <li>Local police, local divisional office, TSIRC, SES, Rural Fire (Coordination), community</li> </ul>	No	No	No
8. Local disaster fund			<ul style="list-style-type: none"> <li>Community</li> </ul>	No	No	No
9. Satellite emergency phones access			<ul style="list-style-type: none"> <li>TSIRC (Each divisional office has one)</li> </ul>	No	No	No
10. Move houses back from storm surge risk areas			<ul style="list-style-type: none"> <li>Not specified</li> </ul>	Maybe, if sea level rise is not sufficient to impact houses	Maybe, if sea level rise is not sufficient to impact houses	No



## Scenario planning workshop process

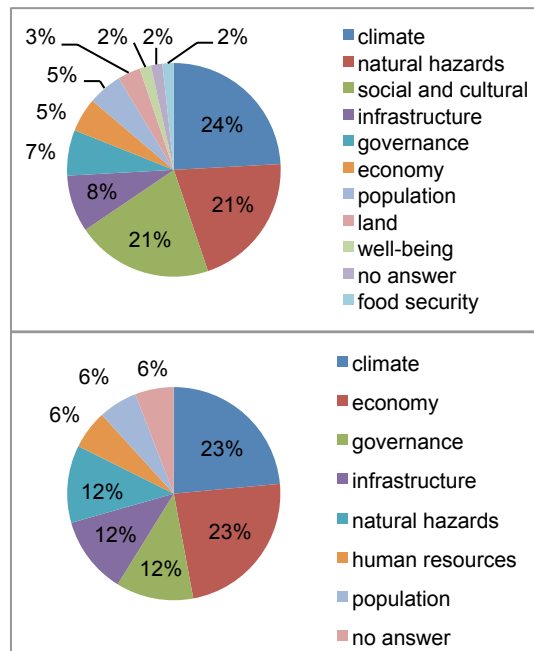


**Figure 26.** Summary of the workshop process and results for all sessions. Lightning symbols represent thresholds identified for each scenario.

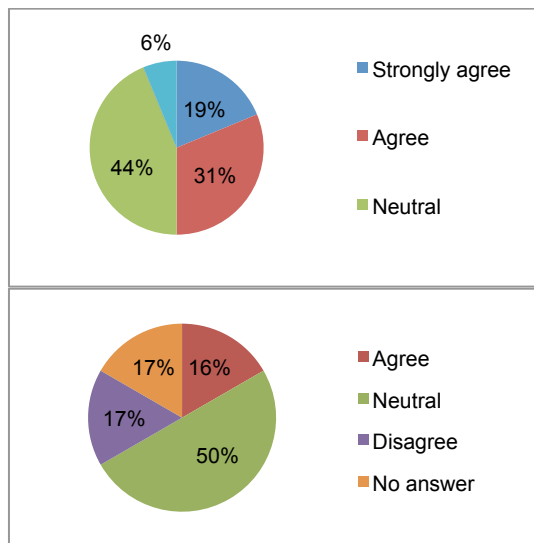
## 5. Workshop evaluation

A questionnaire survey carried out before and after the workshop examined how participants' perceptions changed during the workshop process. For the open-ended question "what is the greatest challenge that Mabuiag will face in the future?", changes related to climate were the most frequently (24% of responses) named before, but changes related to climate and the economy were the most frequently (22% each) named after the workshop (Fig. 27). For the multiple-choice question "is Mabuiag resilient to future change?", 37% answered 'yes' before, while 50% did after the workshop. For the statement "Mabuiag is ready to cope with climate change", 12% disagreed before the workshop, 69% agreed, and 19% were neutral. This changed to 17% disagreeing, 67% agreeing, and 16% neutral after the workshop (Fig. 28).

After the workshop participants also selected from a range of optional answers about the impact the workshop had on them (Table 10). Most participants felt that the workshop had either "increased my understanding of future change and how Mabuiag can adapt" (4 of 6). One participant said that it "made me think differently about the future". Only one respondent was unsure of the workshop's impact. No participants selected the options that the workshop: "made me confused", "made me lose interest" or "had no impact on me". These results, whilst based on a small number of individuals, indicate that the workshop process had changed participants' perceptions of challenges facing Mabuiag, the community's resilience and their views of the future.



**Figure 27.** Participants' responses to the question "what is the greatest challenge that Mabuiag will face in the future?" Top: before (n=16); Bottom: after (n=6) the workshop.



**Figure 28.** Participants' responses to the statement "Mabuiag is ready to cope with climate change". Top: before (n=16); Bottom: after (n=6) the workshop.

**Table 10.** Participants' perceptions of how the workshop impacted on them.

Response	Responses (%)
1. Increased my understanding of future change and how Mabuiag can adapt	4 (67%)
2. Made me think differently about the future	1 (17%)
3. Will make me do something differently about the future	1 (17%)
4. Made me confused	0
5. Made me lose interest	0
6. Had no impact on me	0

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## Appendix I: Workshop agenda

### NERP Tropical Ecosystems Hub **Building Resilient Communities for Torres Strait Futures**

Mabuiag Yesterday, Today and Tomorrow Workshop

Wednesday 22nd – Thursday 23rd January 2014

Mabuiag Island

#### Workshop objectives:

1. Discuss future challenges and opportunities for the Mabuiag community
2. Identify important strategies to build the resilience of the community

#### **SUMMARY OF WORKSHOP ACTIVITIES**

##### **DAY 1: Wednesday 22<sup>nd</sup> January**

- 9:00 Welcome, introductions and start
- Session 1: What are the drivers of change for livelihoods on Mabuiag?
- Session 2: What are the desired and possible futures for the Mabuiag community?
- 5:00 Finish

##### **DAY 2: Thursday 23<sup>rd</sup> January**

- 9:00 Start
- Session 3: What impact will the Business as Usual future have on well-being?
- Session 4: What is the resilience of the Mabuiag community today?
- Session 5: What are the priority adaptation strategies to build a resilient Mabuiag community?
- 5:00 Summary, next steps and finish

## WORKSHOP PROGRAM

### DAY 1: Wednesday 22<sup>nd</sup> January

8:30 - 9:00	Participants sign in, evaluation questionnaire distributed to participants on arrival
9:00	Opening address and prayer
9:15 – 9:45	Evaluations collected, introduction and consents: Vic McGrath, Cr. Fraser Nai, James Butler, Erin Bohensky (facilitators)
9:45 – 10:30	<b>Session 1: What are the drivers of change for livelihoods on Mabuiag?</b>

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Discussion	45 mins	Where is Mabuiag at the moment? What are the issues and problems? What are its strengths and weaknesses? What is well-being?	Vic McGrath	General discussion – capture ideas and keywords on butcher's paper	Shared understanding of local issues and concepts used in the workshop, Mabuiag's issues, strengths and weaknesses

10:30 – 10:45 Morning tea

10:45 – 12:30 **Session 1 continued**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Presentation	15 mins	Drivers of change and global futures	Erin Bohensky	Powerpoint, poster	Awareness of drivers
Presentation	15 mins	Climate change and sea level rise	John Rainbird	Powerpoint, poster	Awareness of climate change
Presentation	15 mins	Torres Strait and PNG population and economic trends, shipping	Tim Skewes	Powerpoint, poster	Awareness of trends



Introduction	10 mins	Describe session on drivers	James Butler		
Four working groups identify drivers	40 mins	List drivers of change differentiated as short and long term	Working groups facilitated by CSIRO-TSRA team	Cards for each group and white board	Drivers grouped by themes on board and split as short and long term issues
Voting	10 mins	Rank drivers by importance	James Butler	White board and stickers	Ranked groups of drivers

12:30 – 1:30              Lunch

1:30 – 4:00              **Session 2: What are the desired and possible futures for the Mabuiag community?**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Elders historical timeline and stories (done concurrently)	30 mins	Where has Mabuiag come from, how has it changed and what caused these changes?	Vic McGrath	Time-line picture of Mabuiag's history	Time-line picture of Mabuiag
Four separate working groups for women, men (done concurrently)	15 mins	Future vision for Mabuiag community	Fraser Nai	Flip charts	Statements of desired future for the community
Presentation (done concurrently)	15 mins	Introduce scenario planning, select and describe two most important drivers	Erin Bohensky	Central flip chart to explain 2x2 matrix and describe drivers	
Four mixed working groups	1.5 hours	Describe and present scenarios with narratives	Four working groups, facilitated by CSIRO-	Flip chart and pens for each group	Narrative and pictures for each scenario, one working

develop and present scenario narratives		and pictures for 2100 including thresholds	TSRA		group per scenario
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4:00 – 4:30              Tea

4:30 – 5:00              **Session 3: What impact will the Business as Usual futures have on well-being?**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Group discussion	30 mins	Review of ecosystem goods and services (EGS) for Mabuiag	Tim Skewes	Refined EGS list and valuation	List and valuation of EGS for Mabuiag (potentially modified)
Recap of Day 1	15 mins	Review of day and preview of Day 2; remind people of starting time	Vic McGrath		

## DAY 2: Thursday 23<sup>rd</sup> January

9:00 – 9:30              **Review Day 1**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Review Day 1 Preview Day 2	30 mins	Review of drivers, desired future and preview Day 2	Erin Bohensky	All posters, flip charts from Day 1, working groups scenarios grouped on walls	

9:30 – 10:30      **Session 3 continued**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Presentation of EGS results and impacts in 2030	1 hour	EGS results and impacts in 2030 under Business as Usual scenario	Tim Skewes	EGS results	

## 10:30 – 11:00      Tea

11:00 – 1:00      **Session 4: What is the resilience of the Mabuia community today?**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Discussion	1 hour	What is resilience? What is vulnerability?	John Rainbird	Examples of previous challenges for Mabuia	
Assessment of community resilience and vulnerability	1 hour	Community ranking of resilience indicators	John Rainbird	Word table	Heat map of indicators and community scoring

## 1:00 – 2:00      Lunch

2:00 – 4:00      **Session 5: What are priority adaptation strategies to build a resilient Mabuia community?**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Four working groups – women and men separate	1 hour	Adaptation strategies required	Working groups, facilitated by TSRA-CSIRO	Butcher's paper, printed graphs of EGS impacts, resilience indicators and scores	'No regrets' adaptation strategies listed by each group

Presentation of strategies	1 hour	Presentation of strategies by groups	Working group representatives	Butcher's paper result sheets for each group	Adaptation strategies discussed
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4:00 – 4:30                      Working tea and evaluation questionnaire

4:30 – 5:00                      **Conclusions and next steps**

Activity	Activity time	Subject	Presenter	Materials, aids etc.	Outputs
Discussion	30 minutes	Conclusions and next steps	James Butler	Central flip chart	Workshop evaluation, next steps agreed