



Can protected areas reduce risk?



# The ecosystem service value of protected areas for cyclone protection in Queensland, Australia

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[www.csiro.au](http://www.csiro.au)

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# Overview

## Australian case study

- Where: Wet Tropics, CCRC, Queensland, Aust.
- What: Cyclones e.g. Tropical Cyclone Yasi
- When: Time of the year effected by cyclones, frequency
- Who: is effected e.g. industries?

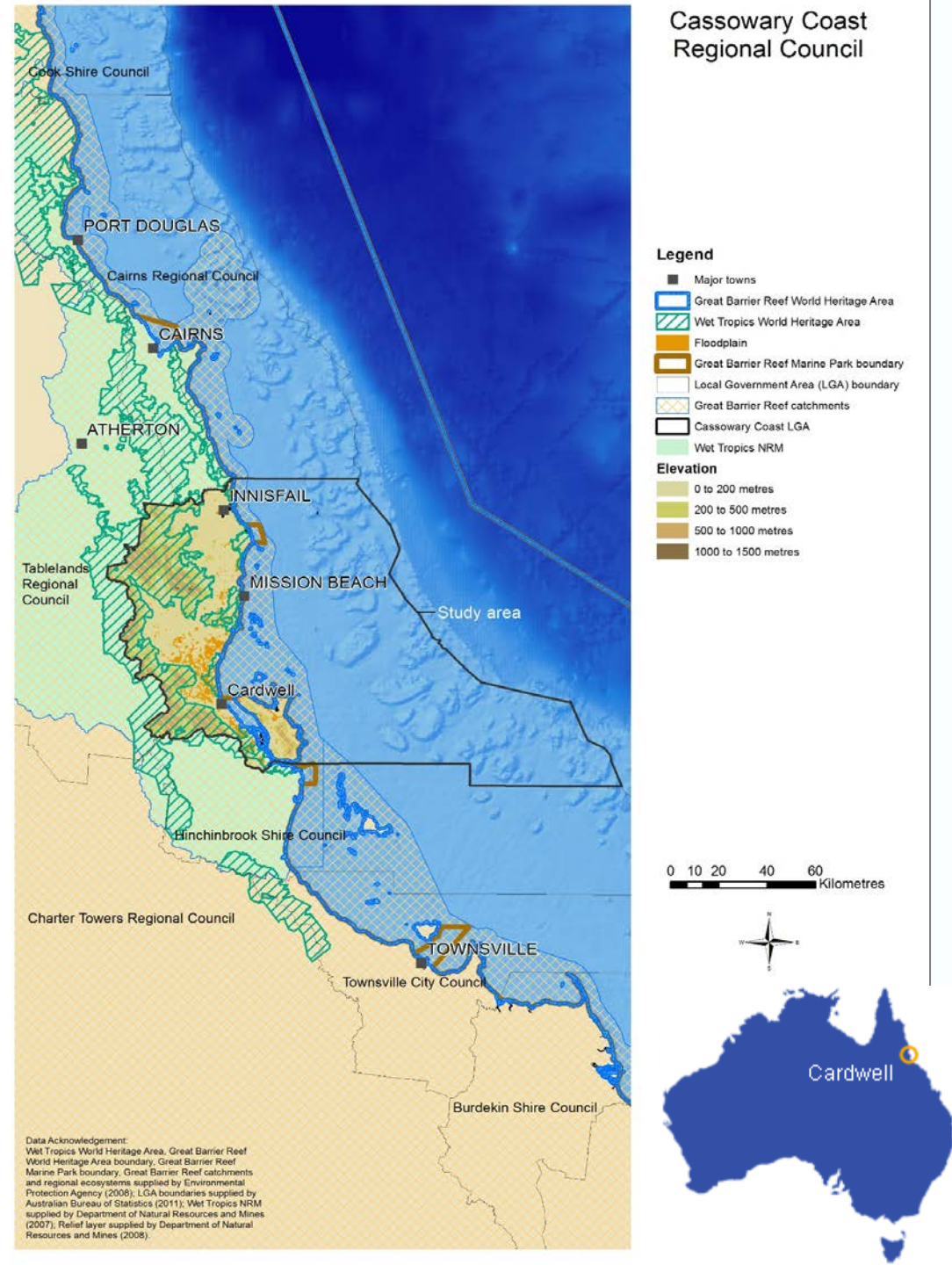
## How do protected areas reduce risk?

1. How protected areas reduce damage from cyclones
2. Economic benefits of protected areas
3. Other benefits - social - effects human wellbeing

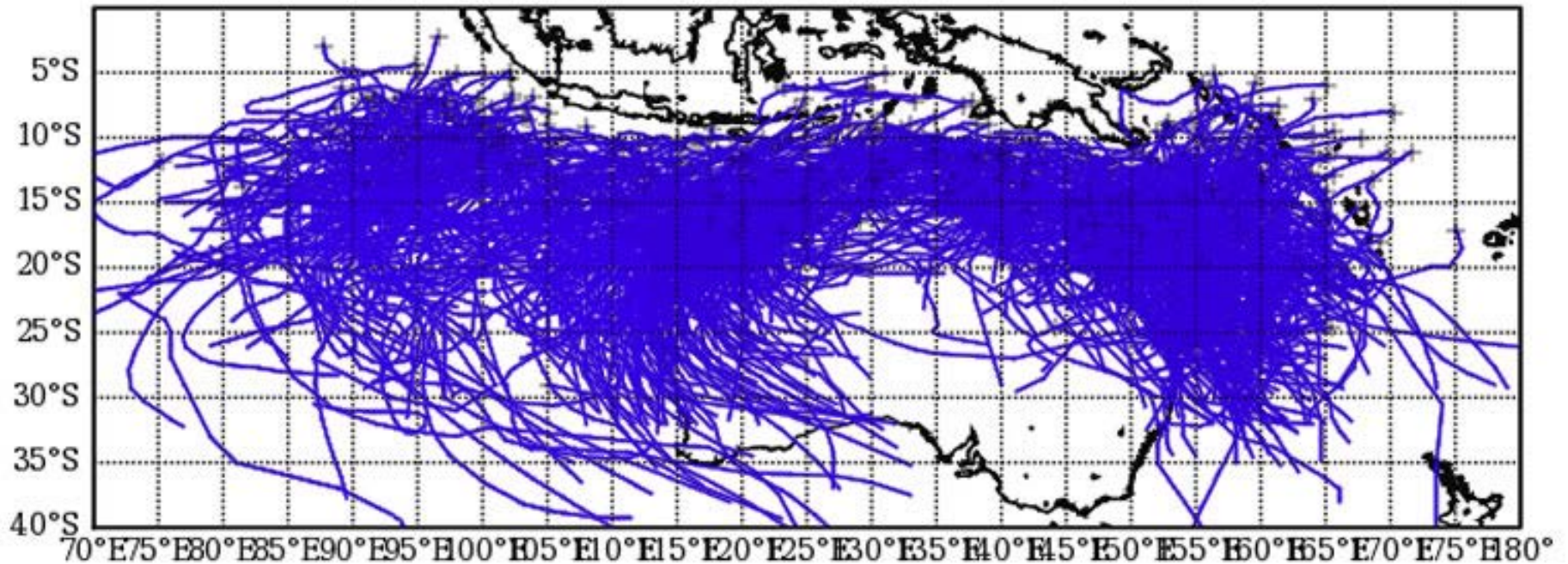


# Australian Case study area

- Wet Tropics WHA and Great Barrier Reef WHA
  - Cassowary Coast Regional Council
    - Cardwell



## Cyclone Tracks in Australia: 1907 - 2005

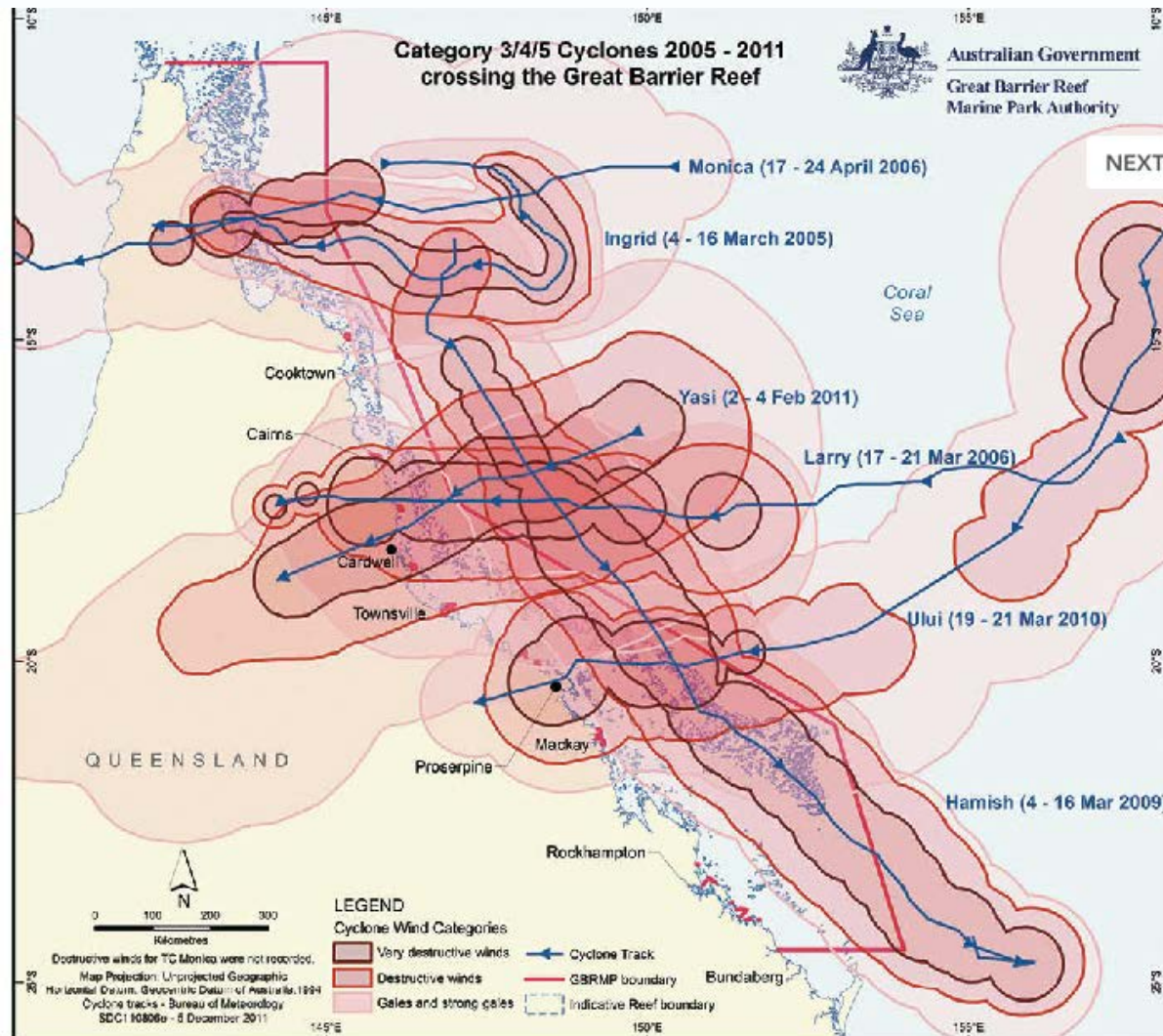


In an average season, about 10 tropical cyclones develop over Australian waters, of which six cross the coast, mostly over northwest Australia and northeast Queensland.

## Global Storm Tracks 1980 - 2006



# Cat 3/4/5 Cyclones 2005-2011 crossing the Great Barrier Reef

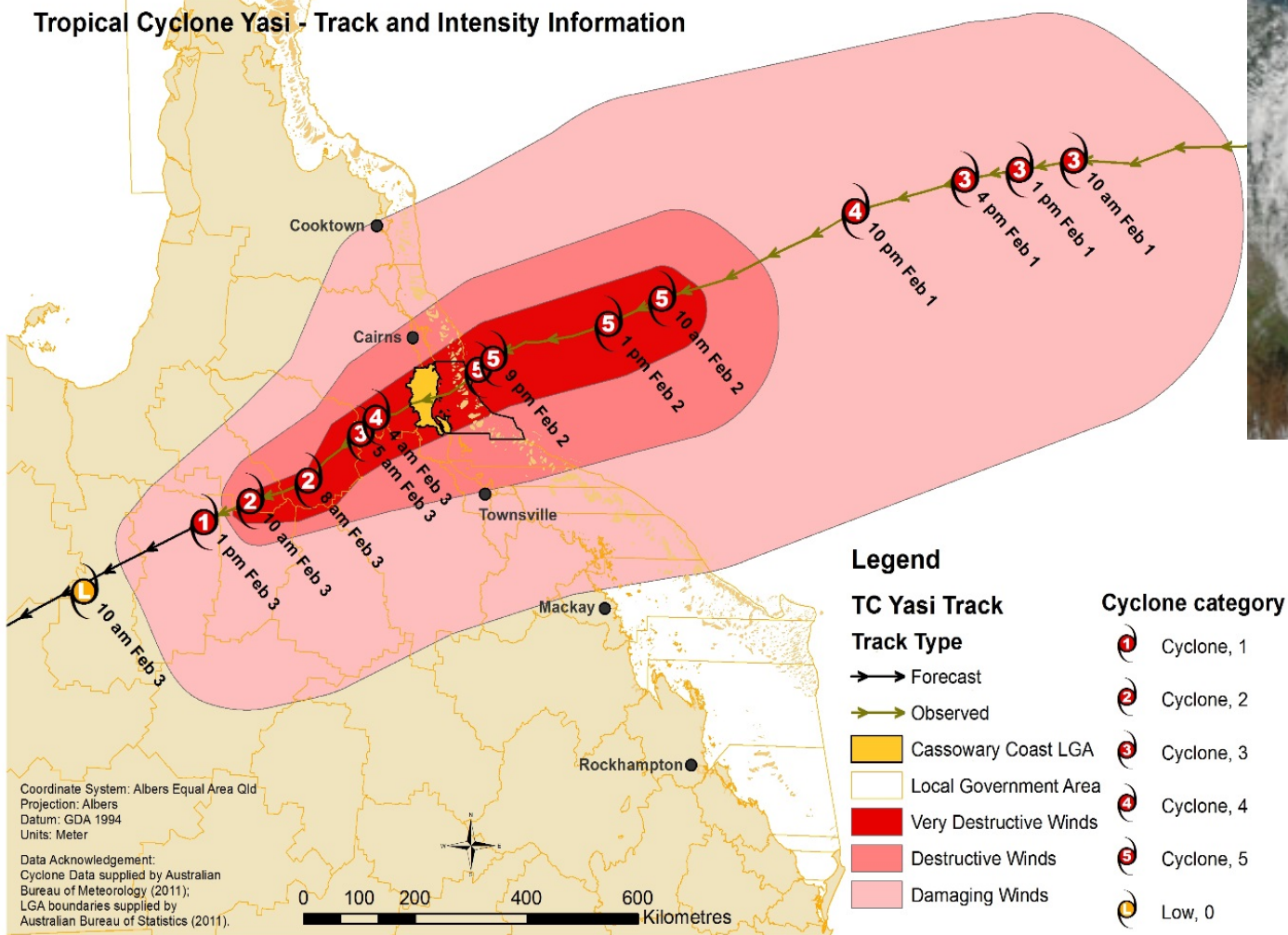


Extent of the Great Barrier Reef impacted by Category 4 or 5 cyclones in the six year period 2005-2011. Map: courtesy of the Spatial Data Centre, Great Barrier Reef Marine Park Authority.

CLOSE X

# Cyclone Yasi, 2011

Tropical Cyclone Yasi - Track and Intensity Information





# Tropical Cyclone Yasi – damage to Tourism



Dunk Island Resort prior



Dunk Island Resort post TC Yasi



Dunk Island Resort owner Peter Bond next to the pool.

Dunk Island 2014



Dunk Island resort was severely damaged by Cyclone Yasi nearly three years ago and still bears the visible scars of that event.



# Tropical Cyclone Yasi - industry



Many Reef tourism businesses lost operating days due to damage to infrastructure including vessels, berthing facilities, jetties, and shore-based facilities.



## Agriculture



# Damage to National Parks

*"Cyclone Yasi really battered some of our national parks, especially the islands and coastal areas close to the eye. Some of our no-anchoring and zoning markers which have concrete anchors weighing hundreds of kilograms, were found several kilometres from their normal spot. We were worried about the impact on walking tracks, day use facilities and camp grounds on the islands. These are important to local communities and tourism operators, so we have tried to get these cleared and available for use again as quickly as we can."*

**Richard Quincey**

Regional Manager

Queensland Parks and Wildlife Service





# Damage to vegetation, restricting access to national parks etc





# Damage to coral, dune erosion, disturbance to wildlife



Cyclones can have direct effects such as bird mortality, as well as indirect effects such as reduced nesting success.

# Example – Cardwell



Cardwell foreshore restoration  
reconstruction will be completed

Photograph 40: The 5.33 metre storm surge during TC Yasi, 3 February 2011, damaged the Cardwell esplanade and deposited sand and debris above HAT (Source: News Limited).



# Cyclone damage - infrastructure





# Cyclone damage - infrastructure



## BUILDING DAMAGE

- 1 Negligible
  - 2 Missile to cladding/window
  - 3 Loss of half roof sheeting
  - 4 Loss of all roof sheeting
  - 5 Loss of roof structure
  - 6 Loss of half walls
  - 7 Loss of all walls
- Contour interval 5m

500 m

06-405-2

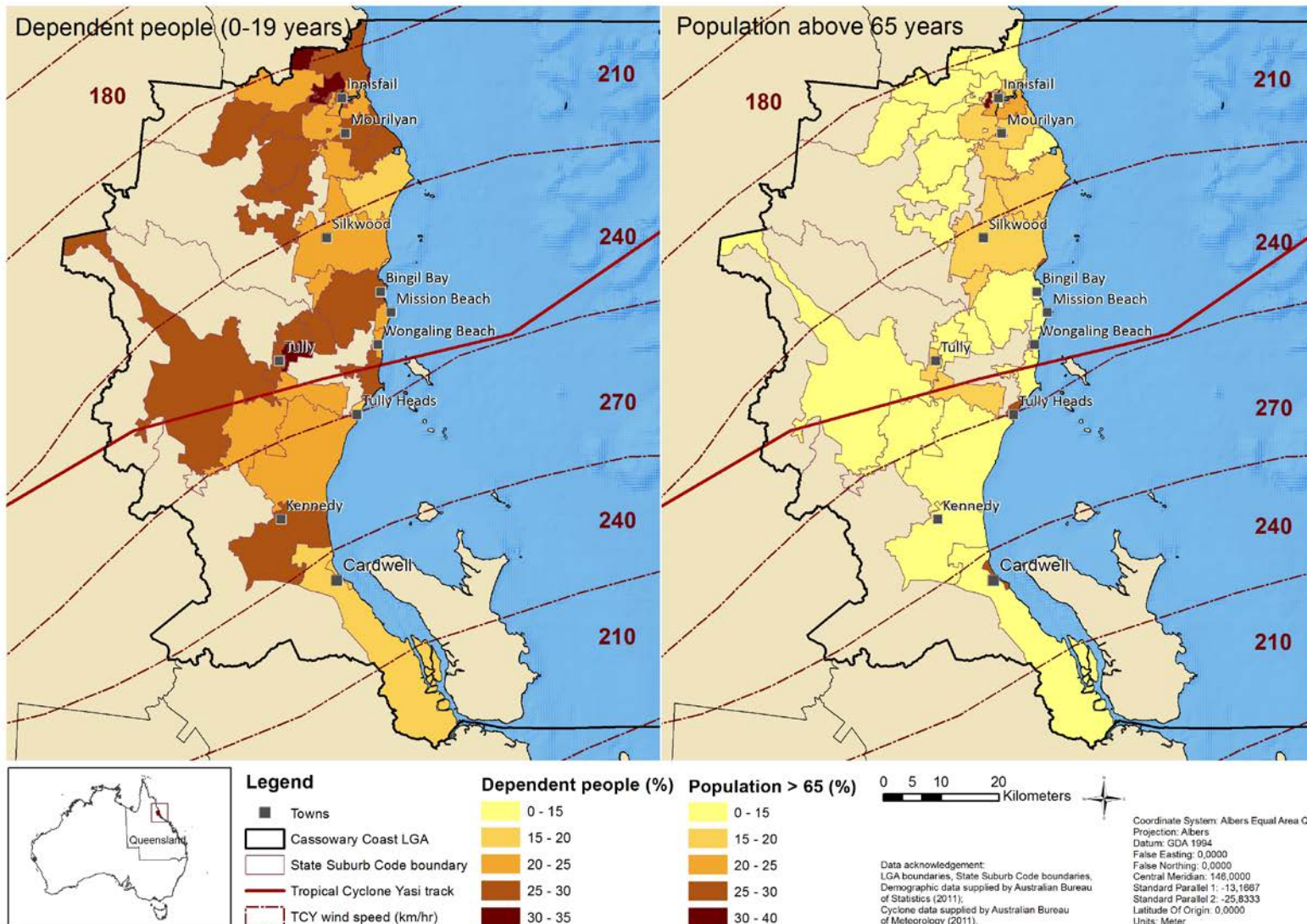




# Secondary effects – storm surges, flooding, inundation, flood plumes (reef)

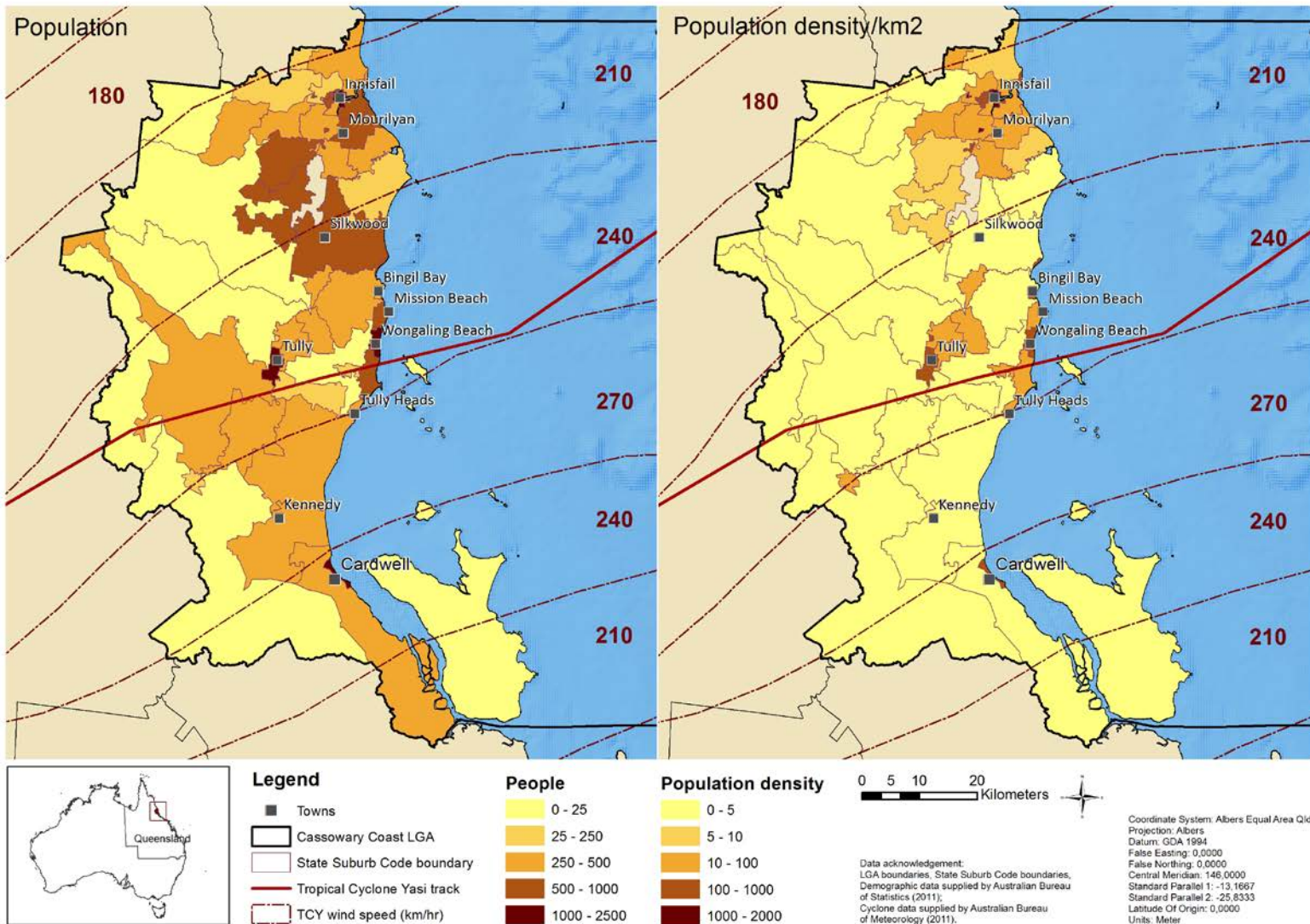


# Population affected by Cyclone Yasi





# Population affected by Cyclone Yasi



# How do protected areas reduce risk?





# How protected areas provide protection?

- **Wetlands** are vital to Australia. They protect our shores from wave action, reduce the impacts of floods, absorb pollutants and provide critical habitat for animals and plants. Australia currently has [64 Ramsar wetlands](#) and more than [900 nationally important wetlands](#).
- **Coastline/dunes** protect our shores from wave action, stabilise vegetation.



# How protected areas provide protection?

- **Mangroves** protect our shores from wave action, stabilise vegetation.



- **Inland protected areas/remnant vegetation** protect infrastructure, buffer.



# Economic benefits ...

- A loss of 1 ha of wetland in the model corresponded to an average \$33,000 (median = \$5,000) increase in storm damage from specific storms.
- Taking into account the annual probability of hits by hurricanes of varying intensities, the annual value of coastal wetlands ranged from \$250 to \$51,000/ha/yr, with a mean of \$8,240/ha/yr (median = \$3,230/ha/yr)
- Coastal wetlands in the US were estimated to currently provide \$23.2 Billion/yr in storm protection services.

**From:** Costanza, R., O. Pérez-Maqueo, M. L. Martinez, P. Sutton, S. J. Anderson, and K. Mulder. 2008. The value of coastal wetlands for hurricane protection. *Ambio* 37:241-248.

# Economic Reasons for Conserving Wild Nature

**Costs** of expanding and maintaining the current global reserve network to one covering 15% of the terrestrial biosphere and 30% of the marine biosphere = **\$US 45 Billion/yr**

**Benefits** (Net value\* of ecosystem services from the global reserve network) = **\$US 4,400-5,200 Billion/yr**

\*Net value is the difference between the value of services in a “wild” state and the value in the most likely human-dominated alternative

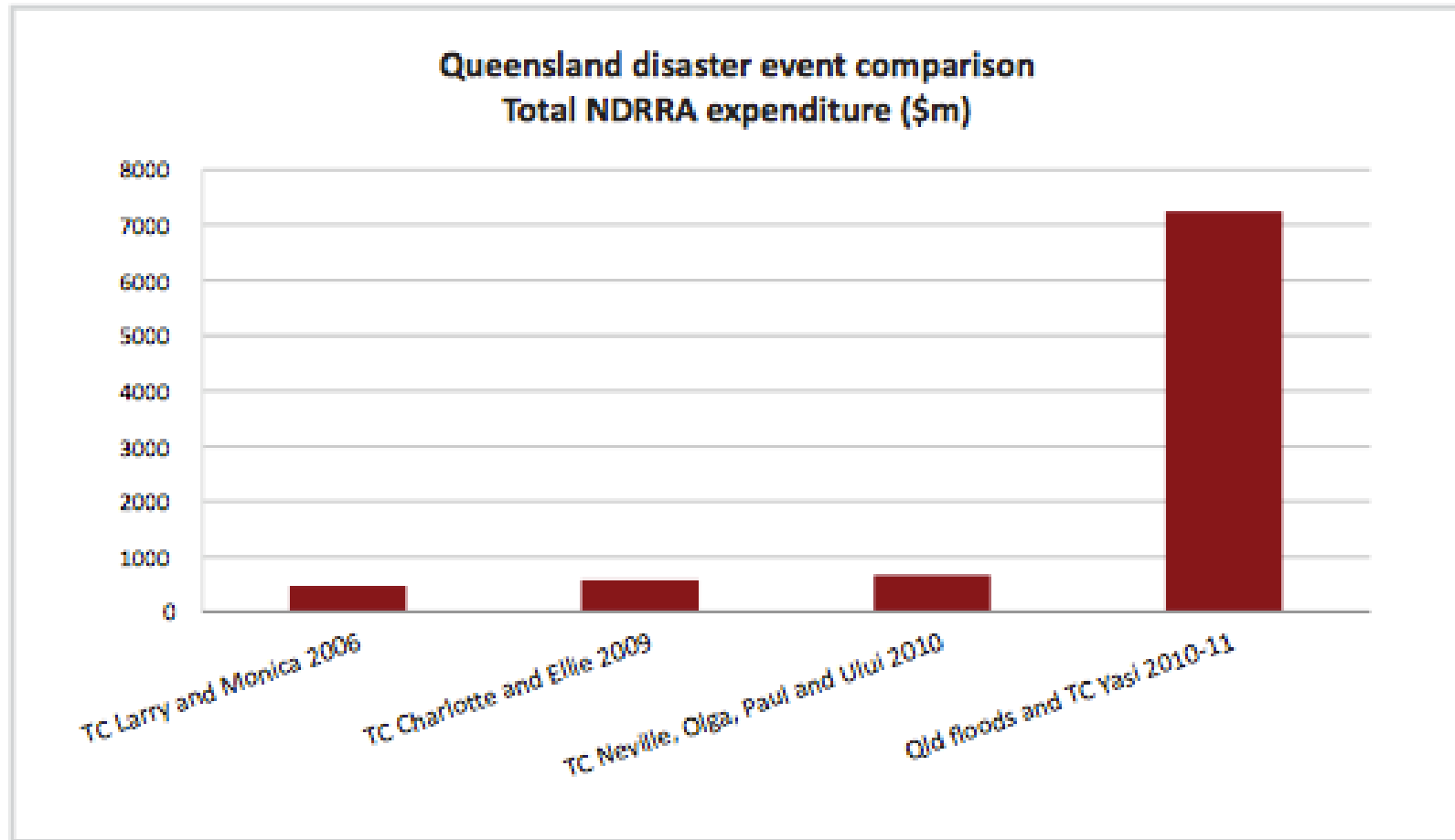
**Benefit/Cost Ratio = 100:1**

(**From:** Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and R. K. Turner 2002. Economic reasons for conserving wild nature. *Science* 297: 950-953)



# Economic ...

- Reduced repair bill/damage costs associated with clean up and rebuilding of new infrastructure



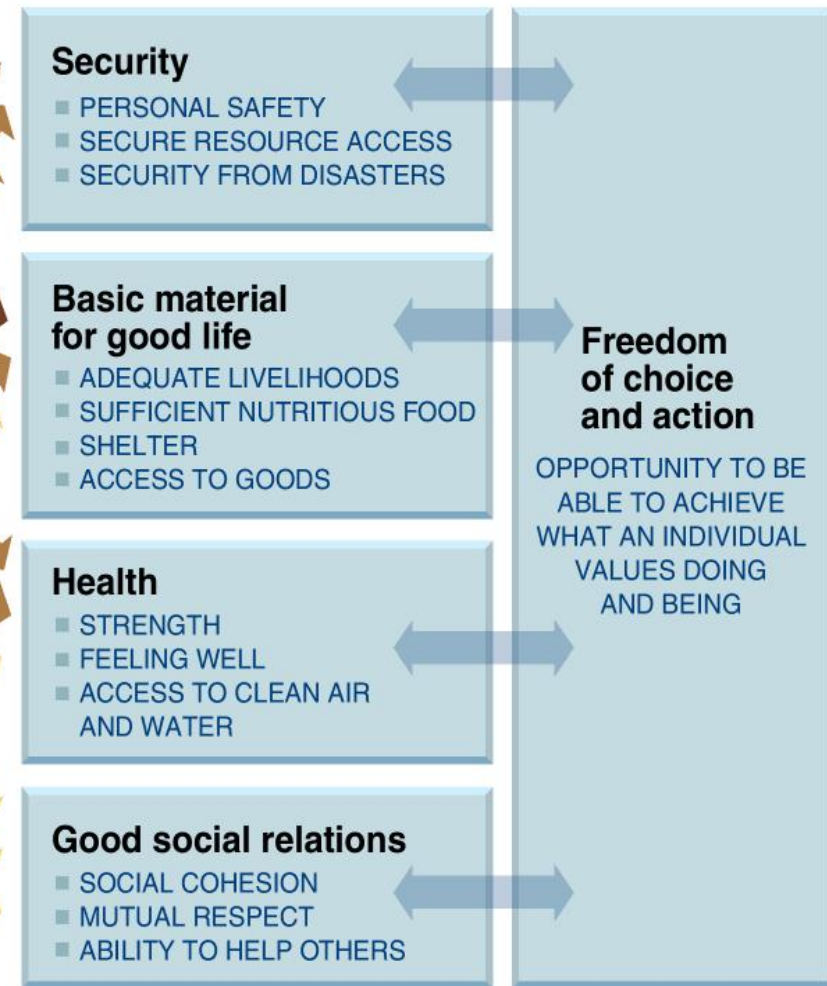
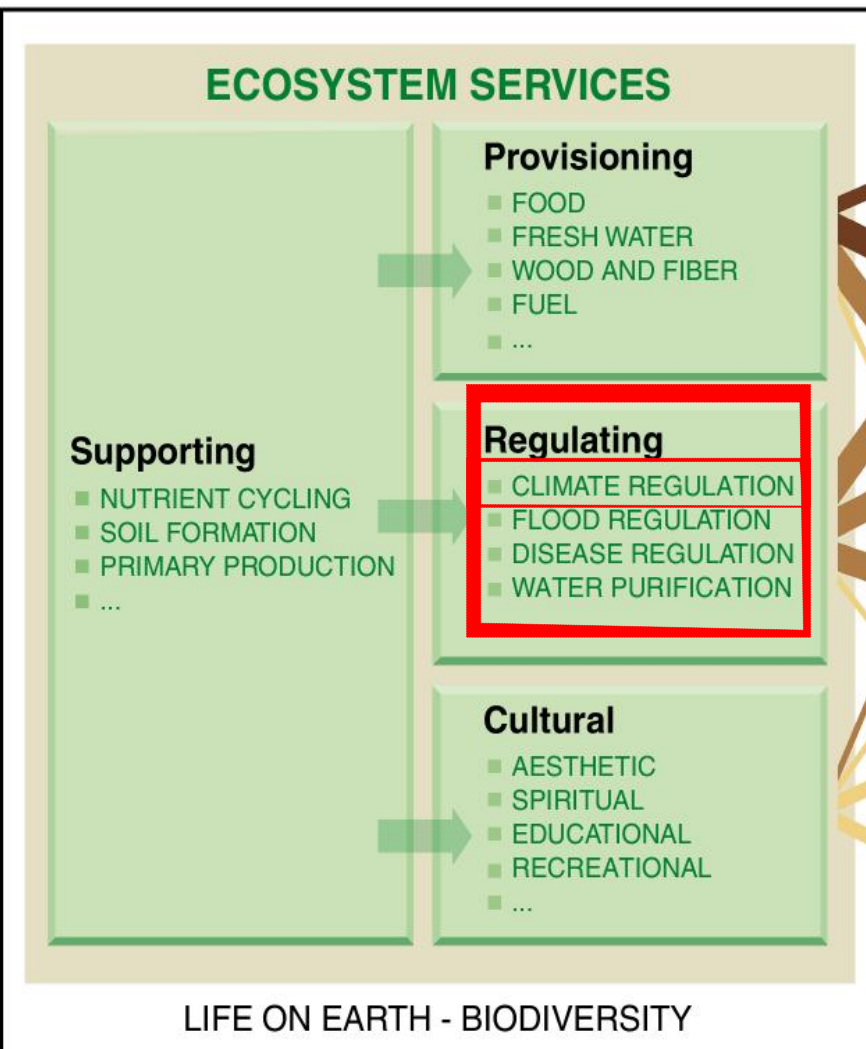
# Economic ...

- Loss of tourism \$ to tourism industry, Qld and Australian economy and associated employment
- GBR tourism contributes \$5.2 billion annually to Australia's economy and provides 64,000 FTE jobs<sup>1</sup>
- Est. two million visitors each year to the Wet Tropics
- Domestic travelers account for more than 80% of visitors to Queensland
- The gross economic value of tourism directly generated by the Wet Tropics World Heritage Area (without flow on effects) was valued at \$426 million (21.8% in the region)<sup>2</sup>

<sup>1</sup>Access Economics, 2013; <sup>2</sup>Prideaux et al. 2007



# CONSTITUENTS OF WELL-BEING



Source: Millennium Ecosystem Assessment

**ARROW'S COLOR**  
Potential for mediation by socioeconomic factors

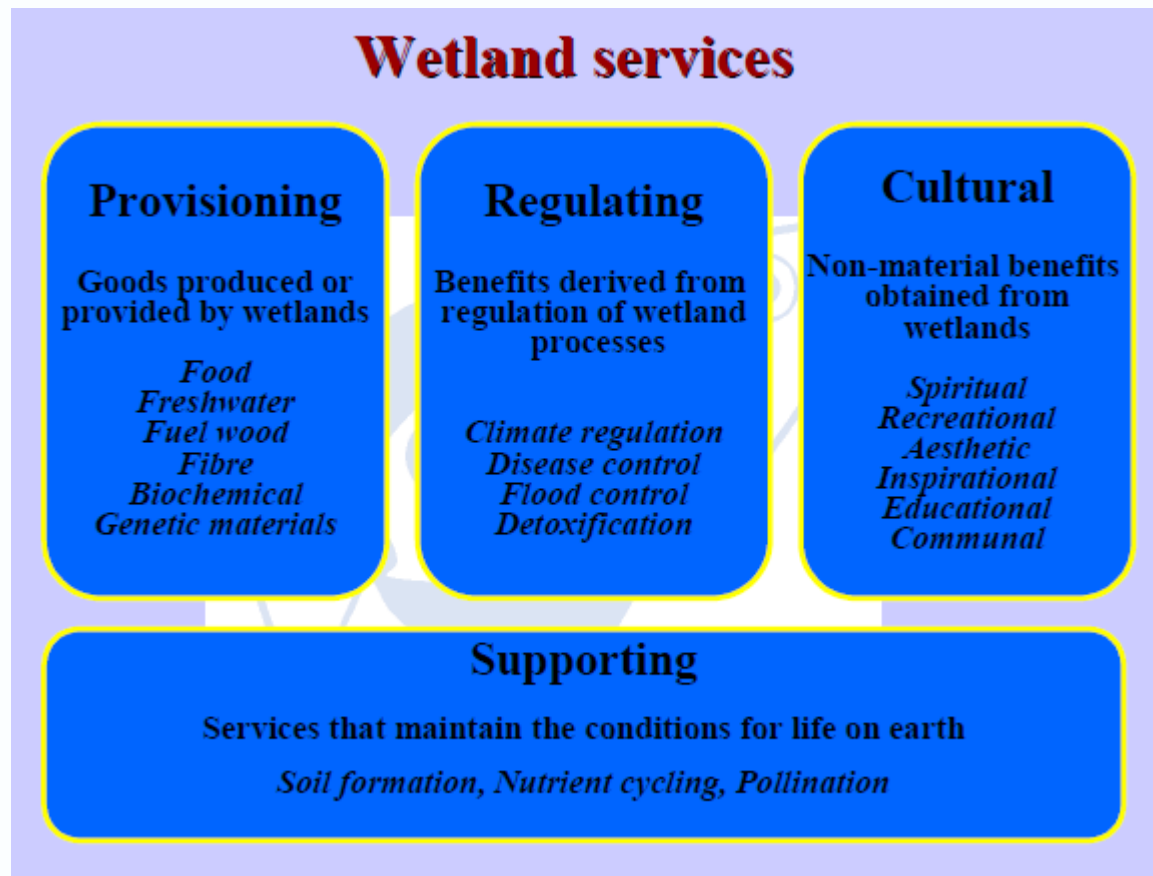
- Low
- Medium
- High

**ARROW'S WIDTH**  
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong

## ES and Well-being

# Other ES benefits







# THANK YOU

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