

Rapid assessment for monitoring heritage sites of international significance

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The Problem....

*Financial & human resources are constrained,
reporting is required,*

so how do we go about monitoring?

K'gari-Fraser Island: World Heritage....

Criterion viii

- outstanding examples of stages in the earth's history

Criterion viii

- superlative natural phenomena

Criterion ix

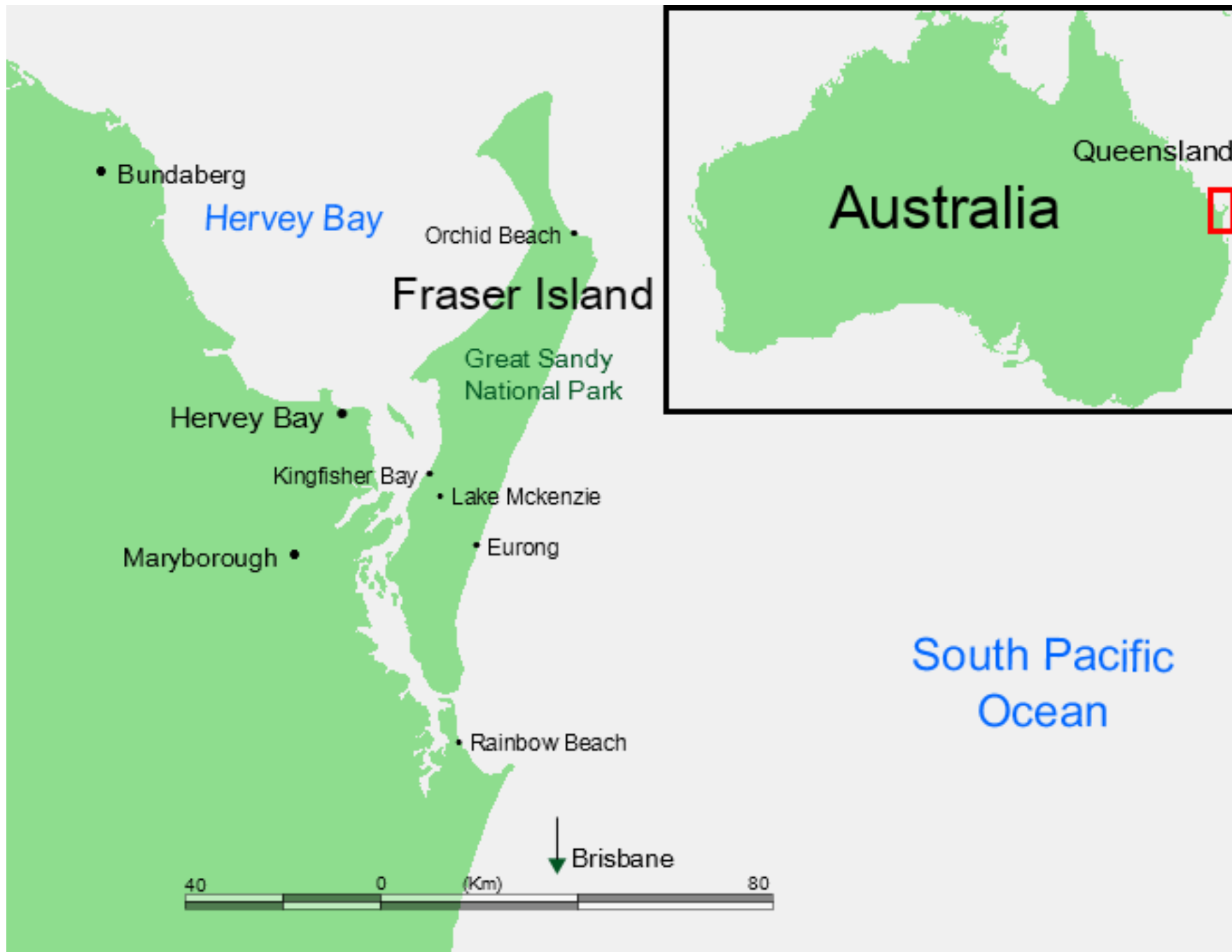
- outstanding examples of ongoing evolution.

'Fraser Island (Kgari) ***the world's largest sand island*** is an outstanding example of ***complex dune formations*** evolving from a unique interaction of coastal successional vegetation, hydrological and geomorphological systems. The island contains close to ***half the world's known freshwater dune lakes***. It is an area of ***exceptional natural beauty***, with spectacular ***tall rainforests*** and sandy beaches, wallum heath, tidal wetlands, and ***diverse terrestrial and aquatic fauna*** including acid frogs, shorebirds, dugong, turtle and whales' (DSEWPAC 2011).

World Heritage evaluation:

to meet Australia's international obligations will require:

- **legislative and governance arrangements** to meet Australia's obligations to world heritage;
- **identification of threatening processes** and **rehabilitation** of threatened sites; and
- **protection and conservation of values**, and,
- **communication** to generate support of world heritage values.



122 km long,
184,000 ha,
Inscription: 1992
Current WH status:
Of concern

Biophysical values

Dune systems

- World's largest sand island
- 250 kms of clear sandy beaches
- Long uninterrupted sweeps of ocean beach
- Coloured sand cliffs
- Zonation and succession of plant communities according to salinity, water table, age and nutrient status of dune sands, exposure and fire frequency

Water, lakes and wetlands

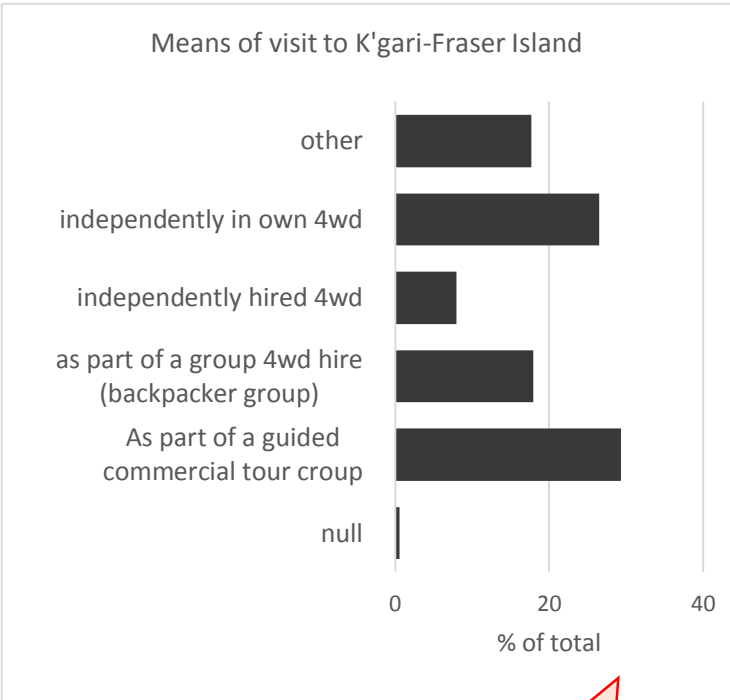
- Perched freshwater dune lakes
- Largest unconfined aquifer on a sand island
- Dynamic relationship between sand mass, aquifer hydrology and lakes
- Patterned fens and rare invertebrates
- Threatened acid frogs

Rainforest

- Tall rainforest (up to 50 m) on sandy dunes
- Refugia for relict and disjunct populations in closed forest



Current experiences....



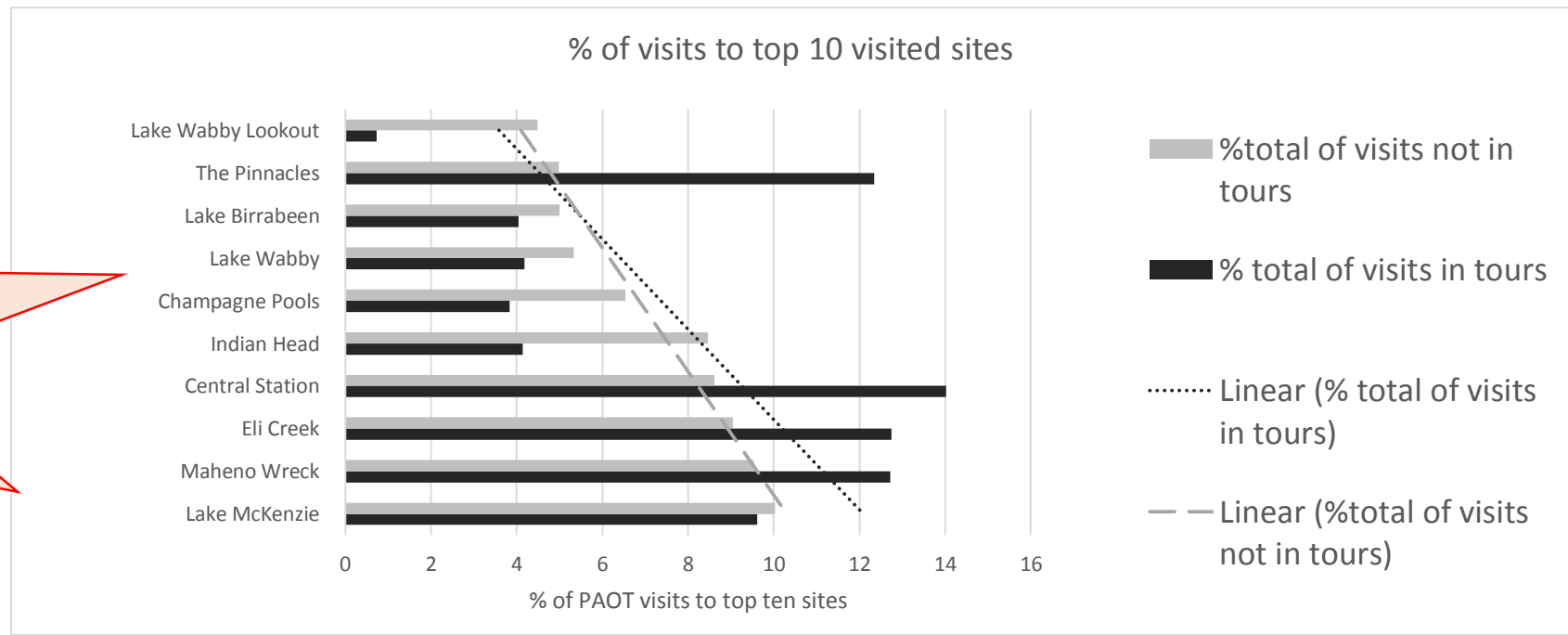
-visitor numbers: 200,000 listing 1992, 340,000 in 2002, now **500 000 p/a**

-Australian-resident independent visitors **income to island: \$191.4 m p/a**

-income to Lake McKenzie: \$31.8 m p/a

-BUT annual economic income through national park tourism in Queensland=more than five times **investment by State gov** in national parks

**CRUISE SHIPS....
JUST
ANNOUNCED
THIS WEEK**



Impacts and issues



More impacts & issues



HABITUATION
FIRE
LOGGING IMPACT
GARBAGE
WEEDS
DISTURBED BIRDS
CRUSHED CRABS
STORM EVENTS



Pressures

On World Heritage Values:

- Limited application of biophysical knowledge due to **lack of systematic monitoring**
- **Introduced** flora, fauna and pathogens
- Inappropriate **fire** regimes and climate related fire incidence changes
- **Global warming** and changes in weather patterns
- **Historical uses** and ecological restoration outcomes
- Travel **infrastructure** with implications for fragmentation and vector points

Of social values on World Heritage:

- Regional **growth and expansion** of tourism industries
- Increased **visitor pressure and inappropriate recreation** activities
- Expansion of **residential** areas and infrastructure within the property
- **Governance** and context management
- Changes in **social expectations** of the natural environment

Rapid monitoring: six steps

1. identifying World Heritage *management objectives* and relevant *evaluation subjects*;
2. classifying World Heritage *value assets* and *threats* to those assets;
3. *prioritising sites* for visitor and management monitoring;
4. selecting World Heritage *value-indicators* of visitor impacts;
5. developing *monitoring programs* for value-indicators; and
6. *using results* to improve future management (adaptive management) and conservation of World Heritage values

Monitoring approach and tools

WORLD HERITAGE VALUES:

- Listing values (island wide)
- Site specific values

PRESSURES on WORLD HERITAGE VALUES:

- On-site pressures
- Landscape-scale pressures

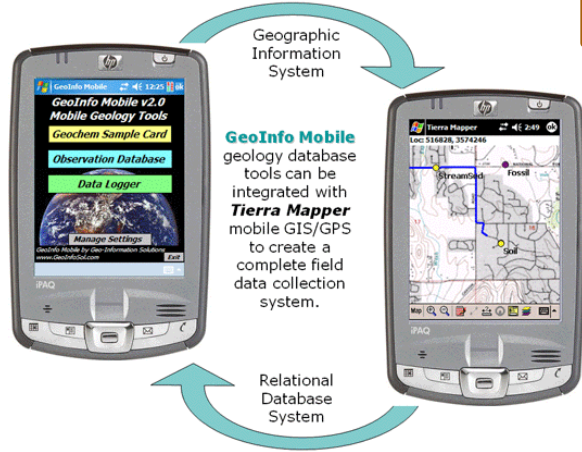
SCALE OF MONITORING

- Site
- Landscape (the Island within the region)
- Global and international

MONITORING STRATEGY:

- Site eg water quality, biodiversity, habitat, visitor impact, social values
- Landscape eg. Veg assessment, annual, five year, spatial visitor utilisation patterns
- Global eg. Climate change, global social values

Gadgets, devices and tools

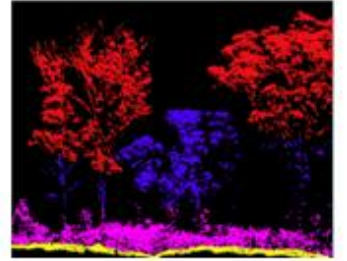
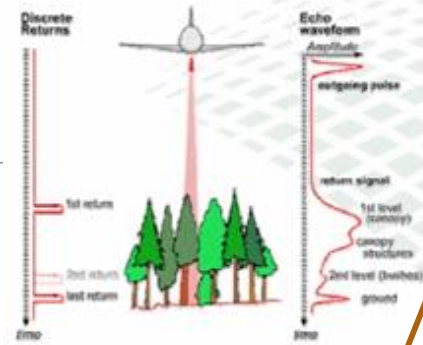


climate



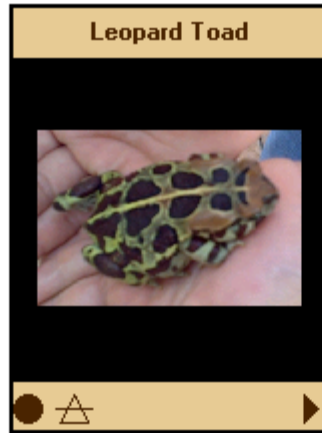
- LiDAR (Light Detection And Ranging), MODIS, LANDSAT, MSS

- DEM: ~1.2 m point-to-point
 - Canopy height
 - Canopy type & structure



Vegetation using terrestrial laser scanning

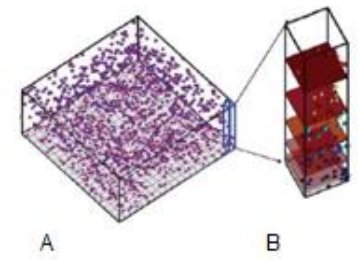
Vegetation structure through airborne laser scanning



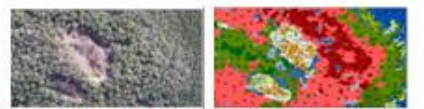
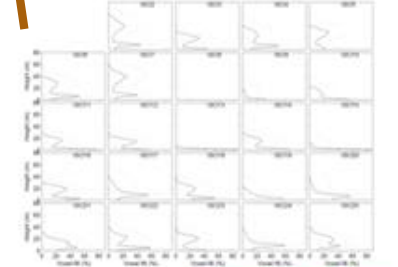
Species
Leopard Toad
Clicking Stream Frog
Cape River Frog
Sand Toad
Common Platanna
Cape Platanna

Activity
<input type="checkbox"/> Out at night
<input checked="" type="checkbox"/> Migrating to pond
<input type="checkbox"/> At pond
<input type="checkbox"/> Amplexus
<input type="checkbox"/> Migrating away from pond
<input type="checkbox"/> Burrow
<input type="checkbox"/> In Swimming Pool
<input type="checkbox"/> In Storm Water Gutter
<input type="checkbox"/> Dead

Height bins and LiDAR voxels showing A) laser cloud in 3D space and B) vertical distribution of laser points in 2D pixel of 4 x 4 m voxels



Classification performed to evaluate pixel membership in 20 classes



Schut, AGT et al. (2012). International Annals of Photogrammetry & Remote Sensing.

Conclusions

Future investment in ***managing heritage values is constrained*** by political frameworks, resourcing and unpredictable change.

A monitoring framework based on ***measurable variables*** to critically evaluate the state of heritage sites is needed.

Monitoring should include values for ***a cross section of ecological, environmental and social*** site assessment cross-referenced with World Heritage listing values for each site.

Rapid appraisal monitoring at minimum should be conducted when resources are scarce and the need is great.

Measurable and rigorous monitoring data can be collected efficiently and effectively using a ***combination of technological support and minimal ecological knowledge***.

World Heritage monitoring should ensure that ***Australia's global citizenship responsibilities*** are effectively met.