Marine Environments

Environmental Change and Management – Coral Reefs

Louise Swanson

Why coral reefs?

Lizard Island 2012

Fitzroy Island 2016

Environmental Change and Management (Australian Curriculum)

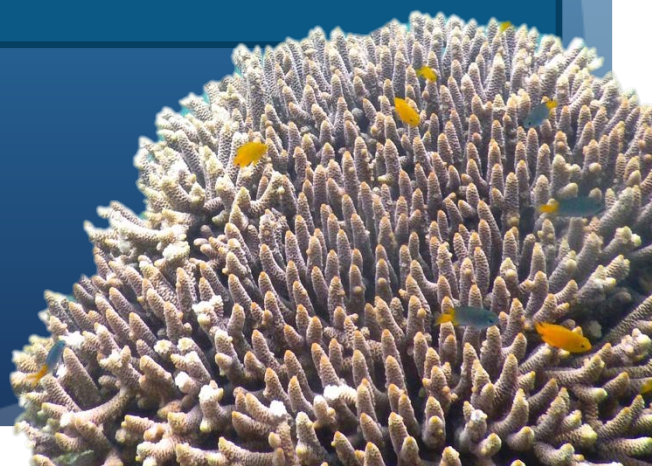
- Human-induced environmental changes that challenge sustainability
- Environmental worldviews of people and their implications for environmental management
- The Aboriginal and Torres Strait Islander Peoples' approaches to custodial responsibility and environmental management in different regions of Australia.
- The first three dot points - more general nature, use a range of examples in a range of environments, at a variety of scales.

Environmental change and management (Australian Curriculum)

- Select ONE environment as the context for study. A comparative study of examples selected from Australia and at least one other country should be included.
  - The application of systems thinking to understanding the causes and likely consequences of the environmental change being investigated
  - The application of geographical concepts and methods to the management of the environmental change being investigated
  - The application of environmental economic and social criteria in evaluating management responses to the change.

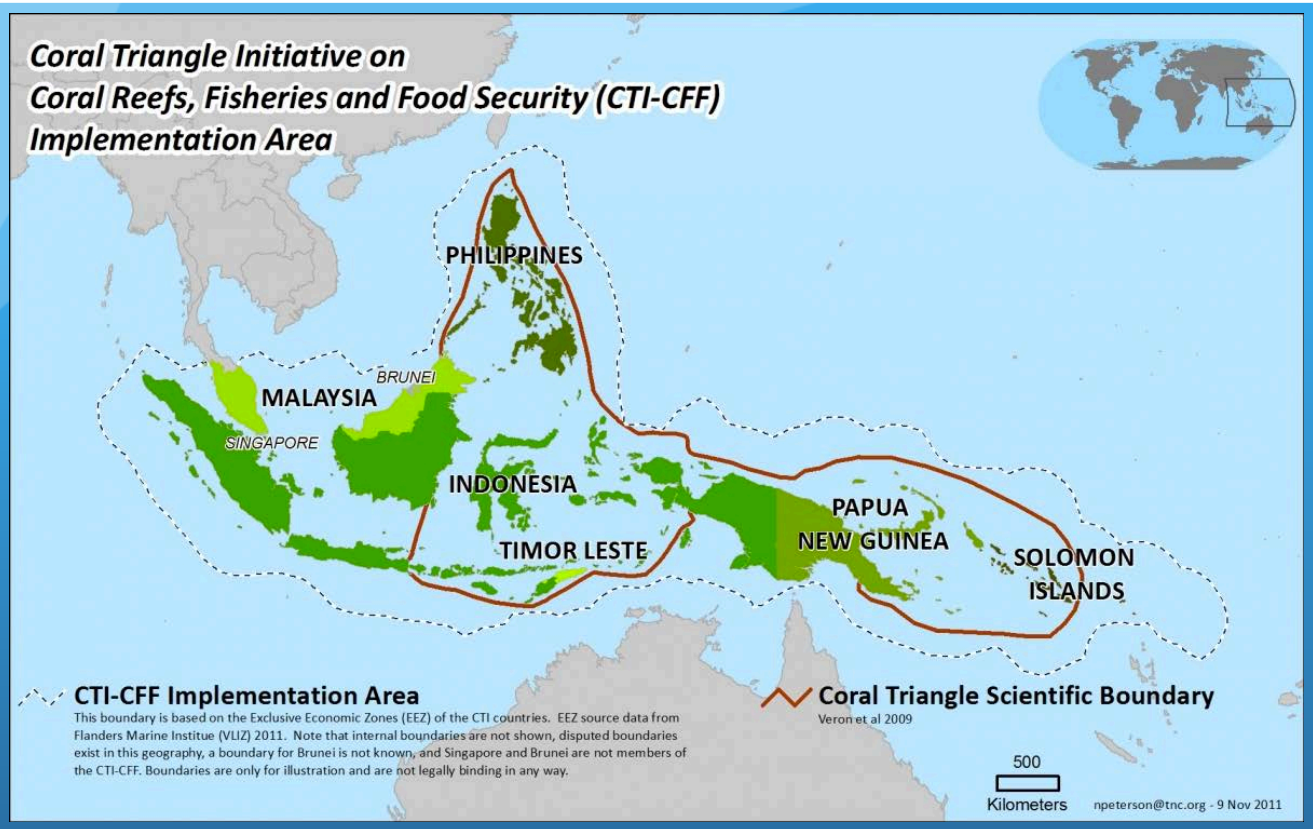
Today's presentation

- The fourth dot point:
  - requires an in depth investigation of one environment (in this case marine environments, specifically coral reefs).
  - A comparative study - Great Barrier Reef (Australia) and the Coral Triangle (Indonesia, Malaysia, the Philippines, Papua New Guinea, Timor Leste and Solomon Islands).



Case Study – Great Barrier Reef, Aus

- Australia's north-east coast
- More than 2,300 km along Queensland coastline
- Covers 344,4000km2
- Includes 3000 coral reefs, 600 continental islands, 300 coral cays and 150 inshore mangrove islands.



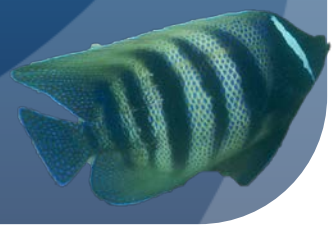
Case Study – Coral Triangle

- Indonesia, Malaysia, the Philippines, Papua New Guinea, Timor Leste and Solomon Islands
- 75% of all known coral species,
- 30% of the world's coral reefs,
- 40% of coral reef fish species,
- greatest extent of mangrove forests anywhere in the world.

The application of **systems thinking** to understanding the **causes and likely consequences** of the environmental change being investigated

What is systems thinking?

- The syllabus requires us to apply human environment systems thinking to understand environmental change.
- The first part of this is to develop an understanding of the biophysical processes related to marine environments/coral reefs. An understanding of the sustainability of coral reefs also needs to be investigated.
- We will then need to investigate how human actions are causing changes to these biophysical processes.



Systems thinking – biophysical processes

- Geomorphic processes
  - Continental drift
  - Subsidence
  - Volcanic activity
  - Chemical weathering

Systems thinking – biophysical processes

- Hydrologic processes and features
  - Currents
  - Water temperature
  - Salinity/Turbidity
  - Wave action

Systems thinking – biophysical processes

- Atmospheric processes
  - Temperature
  - Precipitation
  - Wind
  - Tropical cyclones

Systems thinking – biophysical processes

- Biological processes
  - Bioeroders
  - Invasion
  - Succession
  - Reproduction
  - Symbiotic relationships
  - Adjustments and adaptations

Human-environment systems thinking - sustainability

- Source – the capacity of the environment to provide us with materials we rely on such as timber, water and soil.
  - Fisheries – food
  - drugs
- Sink – the ability of the environment to remove and breakdown waste.
  - CO_2

Human-environment systems thinking - sustainability

- Service – processes that enable our existence such as stabilising the climate.
  - Protect coastlines
  - Provide habitats
  - Tourism/recreation activities
- Spiritual – how the environment provides us with psychological benefits or spiritual connections
  - Social and cultural activities
  - Spiritual site.

Causes and consequences of environmental change

- Climate change – including associated sea level rise, ocean temperatures, ocean acidification, increased occurrence of extreme weather events such as cyclones, and movement of species.
- Invasive species – e.g, Crown of Thorns Starfish
- Population pressure – turbidity, sewage, pollution
- Commercial and Recreational Fishing
- Agriculture (particularly sugar cane farming
- Tourism
- Industry - dredging, mining (e.g. Adani mine)

The application of geographical concepts and methods to the management of the environmental change being investigated

What are environmental worldviews?

An examination of management of environmental change impacting marine environments (coral reefs), needs to discuss the influence of people's worldviews on any programs or initiatives put in place.

Environmental worldviews are the viewpoints that people hold about how the world works and where people fit into the world. The worldview that someone holds will form the assumptions and values that guide an individual's actions towards the environment.

What are environmental worldviews?

Egocentric: where people see themselves and their needs as the most important factor to consider.

Anthropocentric: acknowledges that humans have a variety of needs and wants that often must be placed above the desire to protect environments.

Stewardship: recognises that although humans need to make use of environments for survival and development, they have a responsibility

Biocentric: recognises the significant role that the Earth and its environments play in sustaining life, including human life. It strives to minimise the impact of human activities on environments and species.

Ecocentric: a worldview that places the preservation of environments above all other needs and wants.

What are environmental worldviews?

Implications – competing demands for and uses of coral reefs result in varied and sometimes opposing management of the marine environment (coral reefs).

Management strategies

- International agreements and government cooperation
- Government Policy
- Legislation
- World Heritage Sites/ Marine Parks
- Zoning
- Periodic closure
- Equipment restraints
- Artificial lagoons
- Reef restoration
- Species protection

Management strategies (cont.)

- Ecotourism
- Yield Constraints
- Education
- Research
- Species monitoring
- Traditional use of low intensity fishing techniques
- Taboos
- Reef and lagoon tenure

The application of environmental, economic and social criteria in evaluating managements responses to the change.

Evaluating management responses.

Students will need to make a judgement about the benefits and costs of management strategies implemented.

- How effective are the management strategies?
- How can communities and governments attempt to balance environmental, economic and social criteria?
- To what extent can there be trade offs between them?
- What are the practical and ethical dilemmas of national and international conservation programs?

See part two for “Emerging technologies...