An Altered Ecosystem

Subject matter: analyse results from models to determine potential reef futures under various scenarios.

Recommended reading: Coral Reefs and Climate Change - A shifted baseline (p.138-140), An altered ecosystem (p.142-143), State of the reefs (p.125), A safer target (p.152-153)
View video: Coral Reefs and Climate Change - Altered ecosystem
Check AIMS - Models to determine potential reef futures could include those produced from the Australian Institute of Marine Science (AIMS). https://www.aims.gov.au/docs/research/climate-change/position-paper.html

Global outlook - Classroom

The aim of this activity is to explore the costs and benefits of climate change in different ecosystems across the world. You will investigate and create a poster presentation on the changes that will occur in human communities and natural systems if global temperatures increase above two degrees Celsius.

The consensus that is derived from the data is that, if we wish to avoid the harsher effects of climate change, the average global temperature increase must remain below 2°C, with CO_2 emissions remaining at a 450ppm CO_2 equivalent. The long term projections by the IPCC suggest we are already dancing on this critical edge.

It is suggested that beyond 2°C the ecological fabric begins to tear, causing shifts in species range and transforming entire landscapes over time. Impediments such as farms, roads and cities lie directly in the path of the most favourable migration routes. This is why we see the projected increase in the rate of extinction occurring with the increases in global temperatures into the future. Redistribution of rainfall will impact natural and agricultural systems. The temperatures for the germination of some plants will be surpassed, with the extension in the ranges of pest and weed species contributing to a decrease in land productivity of staple cereal crops.

Vector borne diseases such as malaria, dengue and yellow fever will breach their equatorial confines as the range of their mosquito carriers is expanded with the increases in temperature. These alone will place a substantial additional burden on health systems, even in developed countries such as Australia. The further we move away from this threshold, the greater the magnification of the health effects. Malnutrition, diarrhoea, and mortalities due to heat waves and flooding become part of an expanding array of health issues that must be addressed as terrestrial and marine ecosystems tend towards carbon sources rather than sinks, accelerating changes.

Every country, regardless of their geographic location and economic status, will be affected by climate change to some degree. Developing countries will be the most vulnerable but developed nations will also be overwhelmed. America watched, first in fascination, then in horror, as one of its states descended into chaos and anarchy when Hurricane Katrina caused the death of 1800 people as 80% of New Orleans was submerged in flood waters.

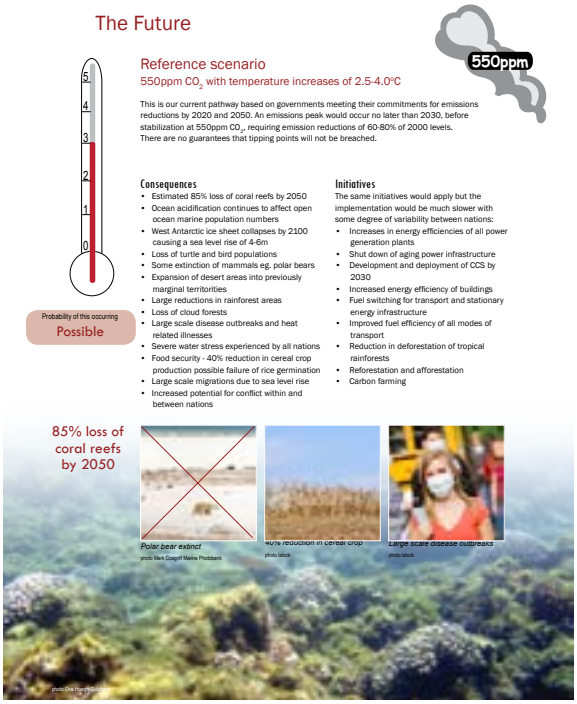
The science informs us that to avoid the dangerous impacts of climate change, CO_2 levels should be no greater than 450ppm, a situation expected to arrive in the next six years. The economists, while conceding that this is the case, point to the economic realities, which show why it is not achievable in the near term, resulting in setting a limit of 550ppm CO_2. Beyond this is unknown territory. The International Energy Agency has suggested that on current trends we are moving to an emissions scenario where 1000ppm by the end of this century is a very real possibility. Inherent within all these conclusions is a level of risk.

The two strategies available to us are mitigation (taking steps to reduce our carbon emissions) and adaptation (coping with those effects that cannot be avoided). It will be the level of engagement on local and international scales that will

An Altered Ecosystem

determine the risks of the adverse affects of climate change. While each nation will have its own individual approach, tailored to their social and economic circumstances, it will only be through an international agreement on the accepted levels of carbon dioxide in the atmosphere that the scope of response by each nation state will be determined.
To achieve a level of stabilisation for carbon emissions at 450ppm will require nothing short of an energy revolution. Following a global agreement, all countries would need to reduce their 2000 level carbon emissions by 80-90% by 2050. The sheer scale of the challenge that would confront all nations makes meeting this target unlikely in the short to medium term. To keep our reefs intact, 350ppm is suggested as the target level for a safe climate, which we have already surpassed.

1. During this activity you will research and create a poster on the effects a 2°C temperature increase will have on a chosen biome.
2. In a group of three choose one of the following biomes:
   Tundra
   Polar region
   Rainforest
   Deserts
   Temperate forests
   Grass and rangelands
   Marine ecosystems
   Freshwater ecosystems
3. Research the following question: What are the costs and benefits of a 2oC rise in temperature to the biome, the people who use it and the economy it helps to support?
4. Create a poster to display along side other biomes on the planet that other groups will research.
5. As a class, discuss each biome briefly and the kinds of costs and benefits climate change means.



Questions

1. State the biome you investigated and how you would be personally affected by the changes predicted there from a 2oC global temperature rise.
2. What is the relationship between developed and developing countries and the geography of the biomes?
3. List some ways of improving the resilience of biomes and the communities that they support.
4. Which regions are most likely to benefit from climate change and why?
5. Describe what tipping points are.
6. What are the factors that influence any ecosystem surpassing these points?
7. Explain ways that temperature increase magnifies and exacerbates the existing pressures within an ecosystem.
8. What are some tipping points that may be triggered within your biome?
9. How are changes within an ecosystem linked to the overall stability of an economy?
10. Discuss some of the key changes within our society that will ensure that we stay below the 550ppm CO^2 limit.

Further research questions

1. Investigate the issues of food and water security.
2. Using a diagram and labels, draw what an 'energy revolution' would look like.
3. What are the social and ecological impacts resulting from the loss of one of these biomes?
4. What are the security implications of climate change?
5. How would you manage some of the situations given in the example of the future?