Classifying Ecosystems

Some examples of terrestrial ecosystems:

- Tropical Rainforest
- Deserts
- Coastal Sand Dunes
- Tundra
- Polar Regions

Some examples of marine ecosystems:

- Coral Reefs
- Intertidal Wetlands
- Seagrass Habitats

Ecosystems vary greatly in complexity and scale/extent:

- Rainforests and coral reefs are extremely complex
- Grassland ecosystems are comparatively simple

The higher the biodiversity and connections within the ecosystem, the more complex and resilient the ecosystem will be.

Productivity of Ecosystems

Productivity of ecosystems can be measured in 2 ways:

- Biomass: the mass of new living matter produced per square metre of land, per unit of time
- Energy Flows: the amount of (in kilojoules) that is “locked into” all the organisms in an area per unit of time

When analysing the impact of humans, refer to biodiversity, energy flows and biomass.

Ecosystems

Ecosystems comprise of the following organisms:

- Producers (autotrophic organism) : an organism that produces its own energy from sunlight, water and minerals; ie. plants
- Consumers (heterotrophic organism) : an organism that is unable to produce its own energy; ie. a human
- Decomposer : an organism that feeds by breaking down dead organic matter. Most chemicals are returned to soil for autotrophic organisms.

Energy Flows

Throughout all ecosystems, energy is lost in the form of heat. Organisms that share the same food in a food chain share the same trophic level also.

If the marsupial mouse on pg. 8 became extinct, the producers below it would grow in biomass and energy flows among the autotrophic organisms would grow with each new plant due to a lack of predators. The trophic level above the marsupial mouse would suffer due to a reduction in prey, and as these organisms are heterotrophic, they need to eat prey to obtain energy. As such, biodiversity would be negatively impacted with a shortage of prey for the dingo and the hawk. The animals of the same trophic level would prosper as there would be an abundance of producers for them to consume and gain energy from; however biodiversity would ultimately still suffer with the loss of a species.

Nutrient Cycling

Nutrients such as oxygen, carbon, nitrogen and phosphorus constantly cycled through ecosystems, making them available for plant growth.

Dissolved are absorbed by plants and then passed up the food chain providing nutrients for herbivores and carnivores.

Human interactions are constantly altering these cycles, causing disruptions to the functioning of ecosystems worldwide.

The natural carbon cycle is the process by which atmospheric carbon is converted by plants through photosynthesis. This carbon is found in the oxygen humans exhale, in the water and in dead organic matter. This is then converted to glucose or oxygen and provides energy to animals who consume the plants.

The importance of Ecosystem Management and Protection

Anthropocentric vs Ecocentric

Anthropocentric - human focused - people are the most important species on earth. We should protect ecosystems because they serve a purpose to us.

Ecocentric - ecosystem focused - each species has a right to exist, it is ethically wrong for humans to initiate negative environmental change.

Reasons for ecosystem management and protection include:

- Maintenance of genetic diversity
- Utility values
- Intrinsic values
- Heritage values
- Need to allow natural change to proceed

Maintenance of Genetic Diversity

Ecosystems (and species) rich in diversity are more resilient to stress.

The loss of genetic diversity that is brought about by human stress in considered an opportunity cost of an expanding human population.

When diversity is diminished, the functioning of ecosystems (and the well-being of humans who depend on the ecosystems) is put at risk.

The GBR has a very high level of species diversity, however some of these species, ie. the Dugong, have a low level of genetic diversity. This can make them more susceptible to disease and less able to adapt to change.

Utility Value (anthropocentric)

Utility is the usefulness or potential usefulness of something.

We should protect ecosystems because of the:

- Products they provide (medicine)
- Services they provide (tourism)

The earth's plants and animals constitute a vast store of chemical compounds of which some have medical applications.

Eg. A plant extract known as hyoscine is used as a treatment for motion sickness and stomach disorders from the side effects of chemotherapy. Therefore, without careful management of ecosystems, humans lose the potential of finding new medicines.

Commercial fishing contributed $139 million to GDP in 2006/07 and recreational use contributed $153 million. Therefore, we must protect the GBR ecosystem in order to retain healthy economic growth through fishing.

Intrinsic Value (ecocentric)

Ecosystems have value simply because they exist.

Three types of intrinsic values include:

- Existence
- Spiritual and philosophical
- Aesthetics

Activities such as photography, bushwalking and ecotourism are closely linked to the growing appreciation of aesthetic and intrinsic values of environments.

The link between indigenous people and the environment is particularly strong. Indigenous people derive spiritual strength from their relationship with the environment.

For example, the Worimi people at Stockton Bight Sand Dunes. Coastal Dunes are also very attractive, drawing people to live near them.

The GBR is very attractive, attracting $5 billion annually in the tourism industry alone.

Heritage Values

Ecosystems can have natural or human (cultural) heritage values.

Heritage gives us a sense of place and links to the past.

UNESCO - United Nations Educational, Scientific and Cultural Organisation

The GBR was listed as a World Heritage Site in 1981 and is the largest world heritage site. The GBR has major cultural importance, including middens, fish traps, rock quarries and story sites.

Need to allow Natural Change to Proceed

Ecosystems are the net result of millions of years of evolutionary changes in response to environmental changes.

Humans have an ethical responsibility and selfish requirement to see this process continue.

Achieved at the GBR through management strategies such as zoning where the reef is broken into 8 different sections which determine what activities are permitted to take place.

Vulnerability and Resilience of Ecosystems

Ecosystems are vulnerable to:

- Natural stress
    - Cyclones or storms
    - Biological invasions (crown of thorns starfish)

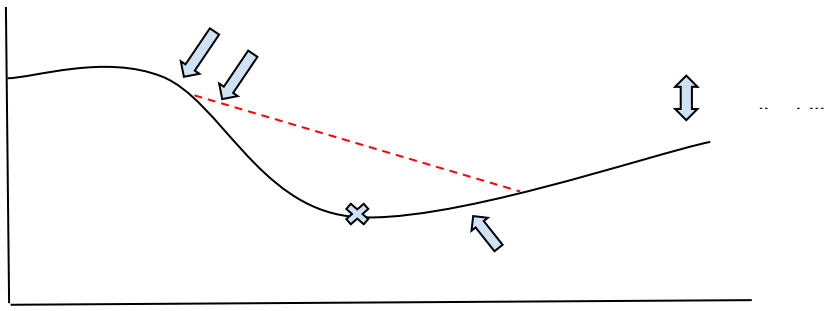
- Human induced modifications
    - Habitat destruction (farming, ocean dredging)
    - Pollution (farming runoff)
    - Introduced species (bitou bush, rabbits)

These impacts can be either *catastrophic* or *gradual.*

	Catastrophic	**Gradual**
Natural sources of environmental stress	• Drought • Flood • Fire • Earthquake	• Climate change • Adaptation/evolution • Ecological succession • New species
Human-induced sources of environmental stress	• Deforestation • Overgrazing • Ploughing • Erosion • Mining • Urbanisation	• Irrigation • Soil compaction • Water/air pollution • Excessive tourism • Exotic species • Overfishing

Elasticity - the rate of recovery of an ecosystem following disturbance / stress.

Malleability - the difference between the ecosystems' final recovery level and the pre-stress level. The greater the difference, the less resilient.



However, the factors affecting how vulnerable or resilient an ecosystem is to natural stress and human induced stress include an ecosystems':

- Location
- Extent (size)
- Biodiversity
- Interdependency - Species diversity

Location

The actual geographic location determines most of the physical constraints on an ecosystem.

- Latitude - determines to some extent temp, hours of daylight, rainfall and thus, climate.
- Proximity to large populations of humans

Some ecosystems are located in extreme conditions. Organisms living in these conditions need to be highly specialised.
Coral flourishes in shallow, nutrient-deficient waters. An increase in nutrients increases algal blooms, diminishing sunlight.
Coral bleaching can be caused by a change in water temp.

Extent (size)

Refers to the boundaries of an ecosystem. Larger ecosystems tend to be more resilient, whilst smaller ecosystems will be more vulnerable.

Biodiversity

Can be considered at three levels:

- Genetic diversity - the variety of genetic information contained in an ecosystem.
- Species diversity - measure of the number of species at each trophic level within an ecosystem.
- Ecosystem diversity - refers to the diversity present within an ecosystem.

Biophysical Interactions

Interactions means: something happens → leads to an action/effect/impact.

The biophysical interactions create the unique characteristics of an environment.

The atmosphere, hydrosphere and lithosphere (abiotic features) interact to provide optimal conditions for the biosphere.