Ecology and Sustainability Study Notes

Module 1 – Ecology and sustainability

Introduction to ecology and sustainability

What is the difference between abiotic and biotic factors?

A biotic factor is any living component that affects the population of another organism or the environment, while an abiotic factor is a non-living factor that influences or affects an ecosystem and the organisms in it.

What are some examples of biotic factors?

Availability of food and resources, competition, predation, physiology, mutualism (symbiosis, commensalism, parasitism), succession

What are some examples of abiotic factors?

Light/sunlight, temperature, water, topography, rainfall, geology, pH

What is an ecological niche?

The role and position a species has in its environment and how it meets its needs for food and shelter, how it survives and how it reproduces. → The way an organism fits into an ecological community or ecosystem

What are the levels of organisation?

1. **Organisms**: living organisms, fundamental units of populations and communities e.g. snow moose morphs
2. **Populations**: group of individuals of a species living in one place at one time – species specific e.g. Australia wood duck
3. **Ecosystems and communities**: Assemblages of species populations occurring together in space and time → includes multiple species e.g. small mammal communities (all the small mammals that occur in a particular area, community at particular site), reef ecosystem
4. **Landscapes:** spatially connected parts of the ecosystem e.g. river catchment
5. **Biomes**: a large naturally occurring community of flora and fauna occupying a major habitat – distinct region. A specific environment that's home to living things suited for that place and climate e.g. a forest

Describe population dynamics

Populations are communities are dynamic, very rarely stable and constantly in flux. Gains to a populations result from births and immigration, and losses to a population result from deaths and emigration. Disturbances include physical and biological factors.

What are ecosystems?

An interdependent community of organisms interacting with its local non-living environment. E.g. rainforests, coral reefs, wetland. They can be artificial or natural.

What does biodiversity involve?

Genetic variability, species richness (number of species), species diversity (number of species and abundance), functional diversity (relative number of different functional

organisms), gradient diversity (speciation – formation of a new species - of ecological equivalents), community diversity (number, sizes and spatial distribution of communities) and landscape diversity.

What is a food web?

A trophic structure of feeding relationships that determines the energy flow. Species in a community or ecosystem are divided into different trophic levels based on the main source of nutrition.

Key issues of sustainability

Describe the case study relating to sustainability

- Case study: Platypus conservation in Australia
- Environmental problem: increasing evidence of threats such as erosion, fishing nets, dams, climate change
- Status and environment: most iconic and evolutionary important animals in the world 0 egg laying mammals
- Role of environmental science: measure 'health' of platypus in different rivers, test for genetic differences above and below dams, study movements
- Management: structures that allow movements over dam walls, regulations and changes to fishing nets to avoid drowning, environmental flows

Describe the present rate of extinction?

Humans (Anthropocene era) are responsible for 20% extinction. The background rate from the fossil record showed that for every thousand species one became extinct every thousand years. The current rate based on recent extinctions is 1000 times the background rate, and the projected future rate is up to 10,000 times the background rate.

Why is this extinction rate worrying?

We are currently going through a major extinction event which has a faster rate than the previous 5 mass extinction events. Time acts as a buffer and allows species to adapt and migrate, however how extinction rate is 10,000 times the rate of previous mass extinction events. There is no time buffer for species to try and adapt and survive.

Why should we study extinction rates?

Extinction rates give us a good idea of what may happen in the future and an indication of the present state and the causes behind it. They are a warning signal and provide evidence that the world is currently going through another mass extinction rate.

Why should biodiversity loss be a concern to the general community?

- **Resources for humans:** Biodiversity is the main source we rely on for our own strength and resilience e.g. medicine and materials
- **Health (environment + people):** A strong and healthy biodiversity corresponds to a strong and healthy environment e.g. water and air quality – intense biodiversity loss in an area corresponds to pollution → leads to negative effects on humans e.g. plants filter air, convert carbon dioxide to oxygen
- **Utilitarian services:** they provide utilitarian services and regulate ecosystems – clean air, water, pollination (for crops) → big negative impact for local communities

What are the six major threats to biodiversity?

- Habitat loss and degradation (terrestrial and freshwater)

- Pollution
- Climate change
- Pest species and invasive species
- Overexploitation – overharvesting
- Disease

What are the challenges to being sustainable as humans?

Increasing human populations and consumption → diet (food), water, energy → leading to increasing loss, degradation and fragmentation of natural ecosystems

Definitions of sustainability

Describe a case study relating to sustainability

- **Case study**: Rhino poaching
- **Environmental problem**: rhino poaching – used for medicines and daggers, one horn in China is worth up to 1 million dollars
- **Effect on environment**: large herbivore removed from ecosystem, estimated that one rhino is poached per day in South Africa, Kruger lost 90 rhinos in 2011
- **Role of environmental science**: document long term trends, provide advice about management
- **Management**: reduce poaching, tracking, poisoned horns, indelible horns, remove horns from rhinos so they are not killed

What is the biggest issue regarding sustainability?

It is not very well understood. Different organisations and people define sustainability differently and hence their sustainability management plan corresponds to the definition of the company. It is very difficult to measure therefore. A clear definition provided by government departments and policy makes on what sustainability is, is needed, in particular ecological sustainability, in order to stop companies from pretending they address ecological sustainability. → No universal definition, role of economics in sustainability

What are the sustainable development goals?

They were implemented in 2016 and apply to all countries. They promote intergenerational equity and protect the planet.

What are some things preventing sustainability?

- World disparity regarding ecological footprints – uneven wealth
- Lack of public awareness
- Global waste – food and energy
- Resource scarcity
- Poverty
- Conflicts between nations
- Economic system
- Lack of technology
- Mass consumption