Stability and change

Allowing Stability

D4.2.1 – natural ecosystem = stable

Stability => ecosystems that can persist for long periods of time [Resistence to change]

- ↳ self-supporting
- ↳ biodiverse
- ↳ lots of photosynthesis
- ↳ cycling nutrients

Amazon RF.

D4.2.2 – Stability requirements

Stability depends on:

1. Constant energy supply
2. Nutrient cycling
3. Genetic variation within species
   - ↳ surviving selective pressures
4. Stable climate

Disruptions include:

1. Removal of materials
2. Removal of species
3. Eutrophication
4. Climate change

D4.2.5 – Keystone species

Keystone species => organism that has a disproportionately large effect in a community

- ↳ removal = ecosystem will likely collapse -> even species indirectly related to them
- ↳ change in their # => trophic cascade

1. Wolves in Yellowstone
2. African elephants
3. Parrotfish
4. Starfishes

- They poo nutrients
- They break some trees => space for other ones
- Branches fall => living habitat for small animals
- Spread seeds
- Knock down fruits others pick up

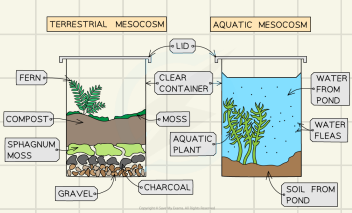
Building models of stability

D4.2.4 – Models for investigation

unrealistic

Mesocosm => small replicates of ecosystems that allow controlled experiments

- ↳ Allows for heightened control => control everything but the factor being studied
- ↳ They are distinctly set up depending on the IV being tested



Advantages:
- Replicates
- easy
- ↑ control

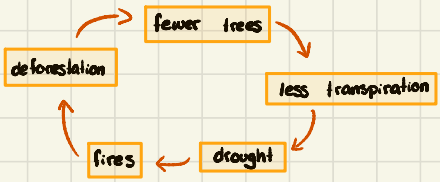
Disadvantages:
- impossible to replicate all natural factors

Booo humans!

D4.2.3 – Deforestation of Amazon rainforest

Tipping point => reaching a level of disturbance that causes quick change that is difficult to reserve

Amazon Rainforest:



positive feedback loop

The tipping point can be uncertain

D4.2.7 – agriculture sustainability

Negative factors

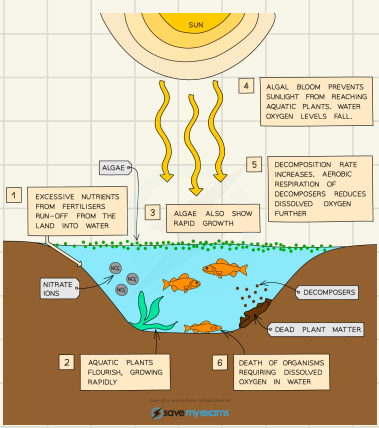
1. Soil erotion [land needs to be cleared => roots that hold soil = lost]
   - ↳ Tilling causes soil loss
2. Nutrient leaching
   - ↳ causes eutrophication
3. Pollutants
   - ↳ Pesticides
4. Carbon footprint
   - ↳ Energy / Fuels

tilling

D4.2.8 – Eutrophication

Steps and effect

1. Rain allows large quantities of nutrients to runoff into waterways
2. Algae bloom on surface of water
3. Algae blocks sunlight from reaching depths
4. Kills plants on bottom
5. Decomposing bacteria feed on dead plants and increase in #
   a) They respire aerobically
6. Decomposers consume all O_2
7. Increases BOD (biological oxygen demand)



D4.2.9 — biomagnification of pollutants

Bioaccumulation => increase in toxin levels throughout an organism's life

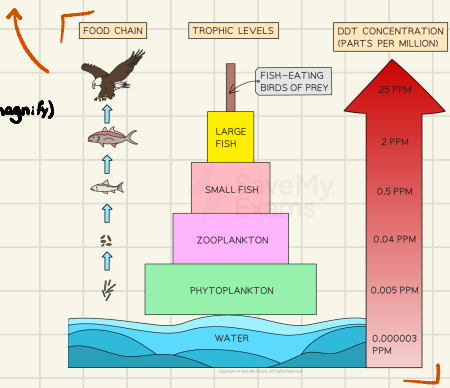
Biomagnification => increase in toxin levels through trophic levels / magnified @ higher trophic levels

↳ they become more concentrated bc. of the decreasing biomass

Toxins that are fat-soluble / remain in tissues

a) DDT pesticides => insecticide

b) Mercury => released into environment & converted into methyl mercury — TOXIC —



D4.2.10 — microplastics in oceans

↳ Plastics = non-biodegradable + release toxic compounds (bioaccumulate + magnify)

Macroplastics => large, visible waste

Problems:
i. Ingestion by marine life
ii. Entanglement

Microplastics => small plastic fragments from degradation of large pieces

Problems:
i. Prolific (found everywhere)
ii. In animal tissues
iii. Effect to be determined

Yay Humans!

D4.2.6 — Sustainability of resource harvesting

↳ Sustainable resource harvesting:

- Rate at which we take materials must be ≤ rate at which they are replenished

↳ Example:

1. Cod

Strategies:
a) Protected breeding zones - no fishing
b) Increased net hole size - young fish = escape
c) Harvest limits
d) Monitor populations

D4.2.11 — Restoration by rewilding

Rewilding => remove effects of human intervention to allow natural processes to restore ecosystems

Methods:
i. Stop human activities — farming, deforestation
ii. Reintroduce species — apex predator, keystone
iii. Distributing plant seeds that should be there
iv. Control invasive species
v. Reconnect habitats

Example: Hinewai reserve (New Zealand)
↳ removal of alien species (goals)
↳ Farmland → forest

Human intervention effects

D4.2.12 – Ecological succesion

Ecological succession => biotic ǂ abiotic changes that transform an ecosystem

- Change in species
  - grass as predominant producer → trees
- ↳ less ground light, ↓ temp.

D4.2.13 – Primary succesion

Primary succesion => succesion starting with an environment with few living organisms

↳ Could look like:

1. Explosion
2. Bare rock formation
3. Bacteria ǂ lichens cause erotion
4. Soil development
5. Herbs = first type of plants growing
6. Shrubs
7. Trees

Changes occurring:

- ↳ ↑ primary production (photosynthess)
- ↳ ↑ Species diversity
- ↳ ↑ food web complexity
- ↳ ↑ nutrient cycling

D4.2.14 – Cyclical succession

Cyclical succession => patterns of change and succession that occur either naturally or due to periodic disturbances

↳ Examples:

1. Oak forests → (can't grow on shade. Fallen Seeds ≠ grow) → grasslands → (Some seeds have sunlight access now) → Oak forests

2. Evergreen forests regenerating after fires

D4.2.15 — climax communities ! arrested succession

Climax community -> stable, relatively unchanging ecosystem

Plagioclimax -> alternative climax community that results from human activity (stable but not natural)

a) Livestock grazing
- Protected, artificially high livestock pop. (no predators)
- Grasses persist
- No succession by shrubs/trees (no forests)

b) Wetland drainage
- Swamps ! bogs = natural carbon sinks
- Waterlogged ! anoxic, special adaptations
- Drainage = other plants thrive