CONSERVATION

Learning Outcomes

- *20.4.1* – **Describe** a sustainable resource as one which is produced as rapidly as it is removed from the environment so that it does not run out
- *20.4.2* – **State** that some resources can be conserved and managed sustainably, limited to forests and fish stocks
- *20.4.4* – **Describe** how endangered species can be conserved, limited to:
  a) monitoring and protecting species and habitats
  b) education
  c) captive breeding programmes
  d) seed banks
- *20.4.5* – **Explain** how forests can be conserved using: education, protected areas, quotas and replanting
- *20.4.6* – **Explain** how fish stocks can be conserved using: education, closed seasons, protected areas, controlled net types and mesh size, quotas and monitoring
- *20.4.7* – **Describe** the reasons for conservation programmes, limited to:
  a) maintaining or increasing biodiversity
  b) reducing extinction
  c) protecting vulnerable ecosystems
  d) maintaining ecosystem functions, limited to nutrient cycling and resource provision, including food, drugs, fuel and genes
- *20.4.8* – **Describe** the use of artificial insemination (AI) and in vitro fertilisation (IVF) in captive breeding programmes
- *20.4.9* – **Explain** the risks to a species if its population size decreases, reducing genetic variation (knowledge of genetic drift is not required)

CONSERVATION AND SUSTAINABILITY

Conservation : preservation, protection and restoration of the natural environment and wildlife. __Why have conservation programmes__:

↳ __Maintaining or increasing biodiversity__ : more variation enables a population to be more resilient in the face of a changing environment and more likely to cope and adapt to prevent extinction. A more biodiverse ecosystem is more likely to have a species that can replace another if it dies (maintains equilibrium).
Also, preserving genes could prove useful for future uses (ex: new breeds, GMOs)

↳ __Reducing extinction__ : Preventing the permanent loss of a species could be for many reasons - ethical, aesthetic, economic or ecological. Could argue that if the loss is anthropogenically-caused, it is our duty to prevent it. Or it could be viewed as 'natural' Objectively, extinction is a permanent loss in genetic resources and preventing this loss is advantageous

↳ __Protecting vulnerable ecosystems__ : many species (both plant and animal) can only reside in a particular habitat, so if the habitat is lost, so too will other species. This approach is called habitat-based (in situ) conservation, where protected areas seek to preserve natural habitats in order to maintain ecological interactions and biodiversity.

↳ __Maintaining ecosystem functions__ : Ecosystems perform a number of regulating services : plants purify air and water, fix carbon and act as carbon sinks, regulate water cycle via transpiration, prevent floods, and roots prevent soil erosion Animals pollinate flowers, predators keep herbivores in check, herbivores prevent algal blooms, and decomposers recycle nutrients.
Ecosystems provide resources such as food, fuel, materials for drugs and genes for potential future modification/breeds

Sustainability . the use and management of resources that allow full natural replacement of the resources exploited and full recovery of the ecosystems affected by their extraction and use.

↳ **Sustainable resource** : one which produced as rapidly as it is removed from the environment so that it does not run out

fish stocks   forests

populations stable / ← harvest < replacement   harvest > replacement → resources decline → population crashes /
resources remain   sustainable   unsustainable   resources run out

Conserving and harvesting fish stocks sustainably

1 Education
Raises awareness of the importance of maintaining fish stocks and the economic, health, and ecological impacts of overfishing
ex: Public campaigns, school curricula, partnerships with NGOs

2 Protected areas
Large areas of oceans (marine protected areas) are monitored and enforced to allow fish stocks to re-populate to allow sustainability. Some focus on restoring degraded habitats or enhance biodiversity.

3 Quotas
Restrictions are imposed on fishing such as limits on amount caught, fish size to allow younger fish to grow and reproduce, vulnerable areas, or time spent fishing per year.
Quotas can be allocated to fishermen or industries and traded/sold

4 Closed seasons
Sensitive times such as breeding seasons are closed to ensure females lay eggs, fertilization and successful reproduction

5 Controlled net types and mesh size
Net types which damage habitats are limited or prohibited. The size of the mesh can allow for smaller fish or non-target species to be avoided or allowed to escape

6 Monitoring
Keeping track of fish catches, and using sonar and sensors, fish stock numbers can be estimated. Patrols are done to police catches and practice

Conserving and harvesting forests sustainably

1 Education
Programmes can help people understand why conservation is necessary, such as the importance of maintaining food webs or ecological services.
ex: education via school curriculum, social media, government messages, guided tours in protected areas/zoos, forest education centers

2 Protected areas
areas of land where development, hunting, deforestation, farming or residence is prohibited. Should aim to preserve greatest amount of natural habitat within an ecosystem (maintaining ecological interactions). Areas of particular importance:
● edge of rivers, to promote water retention
● mountain slopes, to reduce erosion
● areas with rare species and habitats
ex: Yellowstone Park, Kabili-Sepilok Reserve, Serengeti Park

3 Quotas
Limits on the amount of resources that may be removed from a given area or within a set time period. Ensures sustainable harvesting
ex: Smartlogging allows timber to be tracked from its source, allowing deforestation to be monitored, controlled, and advertised to consumers

4 Replanting
Planting new trees to replaced those that have been felled is a vital effort in mitigating losses, maintaining enough for sustainable harvesting, and tackling rising CO_2 levels
ex: Online initiatives like Teamtrees can help raise money

CONSERVING ENDANGERED SPECIES

The "Red List of Threatened Species" is published by the International Union of Conservation of Nature (IUCN)

↳ assesses conservation status of particular species in order to determine which species are at risk and need help/intervention

Least Concern ⟶ Near Threatened ⟶ Vulnerable ⟶ Endangered ⟶ Critically Endangered ⟶ Extinct in Wild ⟶ Extinct

What factors put a species at risk of becoming endangered?

↳ **Small population size**
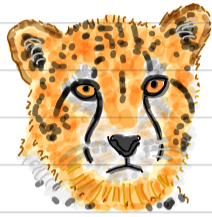
reduced gene pool ∴ more prone to inbreeding and less resilient to environmental change
ex: Cheetahs and big cats

↳ **Highly specialized**

Species with specific diets or habitat requirements are more vulnerable and less adaptable
ex: Koalas only eat eucalyptus leaves
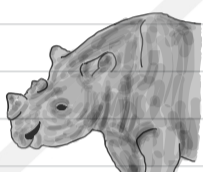
↳ **Narrow distribution/range**

Species that are only found in a small area are more vulnerable as loss of this area leads to species loss
ex: Golden lion tamarin only found in small area of Brazil

↳ **Low reproductive rate**

long gestations and lower rates mean species can take long time to recover
ex: Orangutans have 1 offsing/6-8 years

↳ **Fragmented habitats**

Species in fragmented habitats may be unable to maintain larger population sizes
ex: Sumatran rhino in fragmented forest

↳ **High trophic level**

Apex predators and carnivores more vulnerable due to naturally lower populations and affected by changes lower down food chain
ex: Dhole endangered due to lack of prey

↳ **seasonal migrants**

Migratory species have long hazardous journeys (with potential barriers) and require habitats at both ends
ex: Songbirds migrate to breed
ex: Salmon migrate upstream to spawn

↳ **Poor dispersal**

Species that cannot move to new areas easily are vulnerable to changes in their habitat
ex: flightless birds, like Dodo, are trapped to their areas

↳ **Island species**

Islands tend to have lower populations, home to endemic species and more difficult to disperse
ex: 60% of all extinctions in last 400 years were island-dwelling

Conserving Endangered Species

1 Monitoring and Protecting Species and Habitats

In order to best assess when conservation or intervention is needed or progress in species status, monitoring needs to be done regularly. For habitats these are regularly patrolled and changes to habitats reported. For mobile animals, devices like bands, collars or tags allow their movements and population numbers estimated.
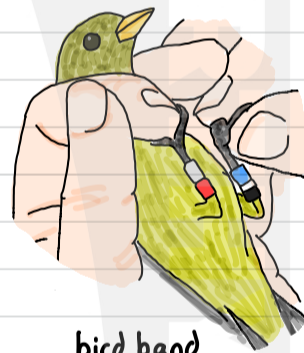
bird band

radio collar

2 Education

In order to conserve effectively, public support is crucial as funds are needed but also a change in behaviour and sense of duty. This is more likely to occur if they understand why conservation is important. This can be done via social campaigns, school curricula, tours at zoos/aquaria, etc.

3 Captive Breeding Programmes

Allow species in captivity to breed. Once adults they may be re-introduced into the wild to help re-populate. This can be successful as predation/poaching is prevented and care given. Trades between zoos can ensure genetic diversity

↳ **Artificial insemination**

In cases where matings are unsuccessful or males are absent, sperm can be harvested from a male and injected into the oviduct of the female for fertilization and pregnancy. Sperm could also be stored and frozen for later use or trades.

↳ **In-vitro fertilization**
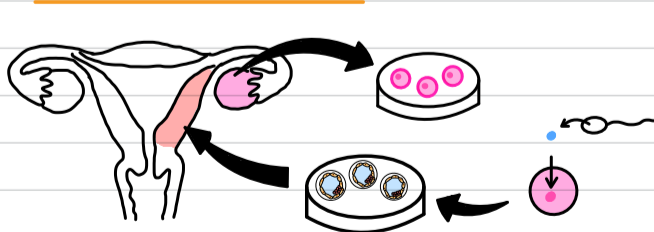
1- female given fertility drugs
2- ova and sperm collected
3- sperm nucleus injected into ovum
4- embryos grown in dish
5- embryos injected into female's uterus and pregnancy starts

4 Seed Banks

Plant seeds are stored in a dried or frozen state in secure vaults. These can be used to:
- preserve genetic diversity for species
- used to develop new breeds
- used to grow and re-introduce in the wild

ex: Global Seed Vault in Norway, Millenium Seed Bank in UK