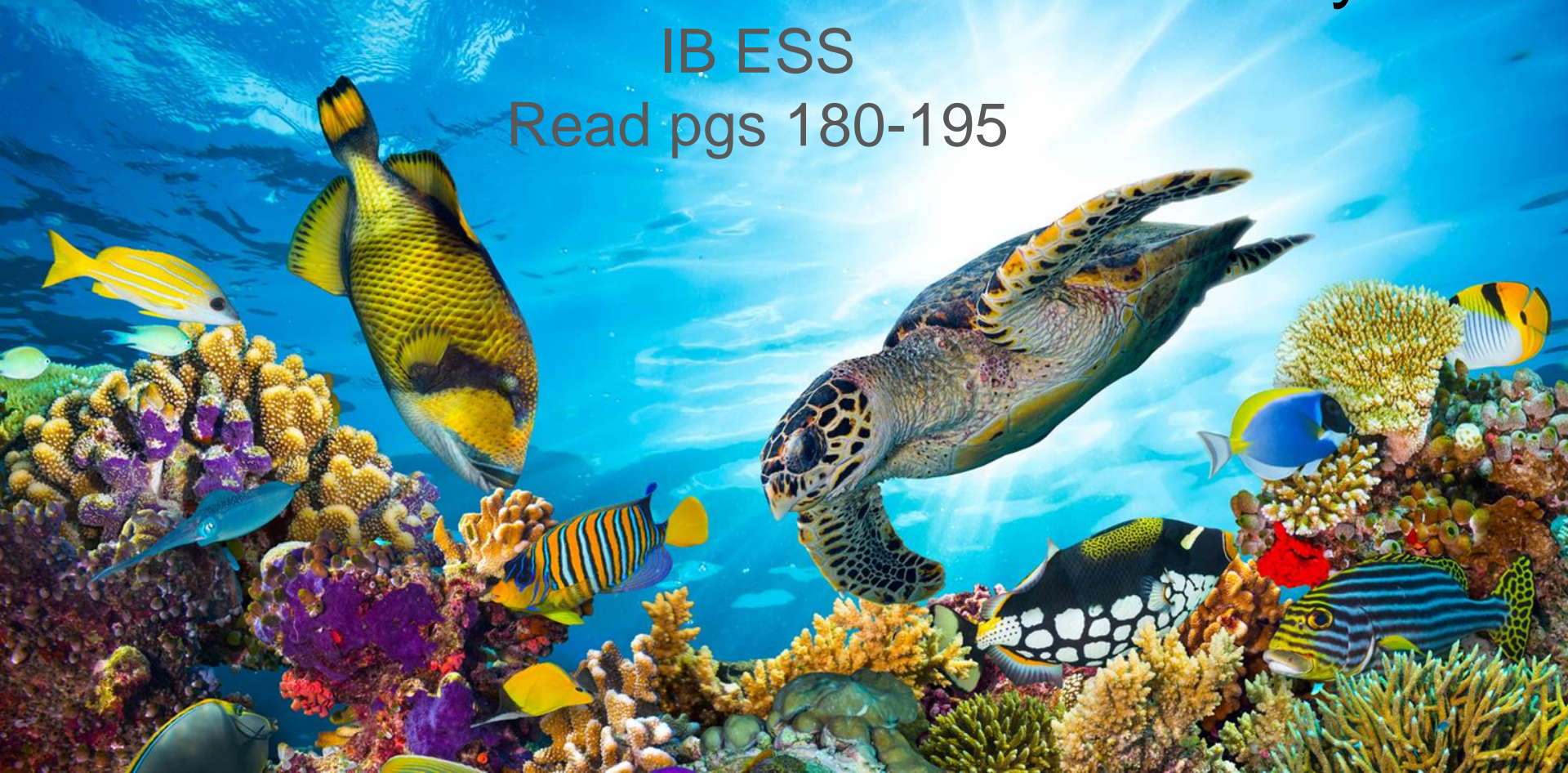# 3.4 Conservation of biodiversity

IB ESS
Read pgs 180-195

Learning Objectives:

- Describe how arguments about conservation can be based on aesthetic, ecological, ethical or economic grounds
- Explain the criteria used to manage protected areas
- Describe how the loss of biodiversity increases conservation efforts
- Understand how local community support is vital to the success of conservation efforts
- Explain various approaches to conservation and evaluate their strengths and weaknesses

KEY QUESTIONS:

1. How does the loss of biodiversity drive conservation efforts?

2. How is a society's environmental value system (EVS) linked to arguments about conservation?

3. What are the strengths and weaknesses of different approaches to the conservation of biodiversity?

Arguments for preserving species & habitats

- Economic arguments - cite the valuation of ecotourism, genetic resources & natural capital
- Ecological arguments - center on preservation of ecosystem
- Ethical arguments - include intrinsic value of species

'Direct value' - easier to measure, calculated in terms of economics

'Indirect value' - assessed in terms of the 'services' that an ecosystem provides for local or global community

- Include scientific & educational value, potential source of medical products, value to world climate & weather patterns

Values of biodiversity that can be measured directly

- Direct Value from food from plant & animal sources
  - Common food plants like rice & maize...farmed animals like sheep & cattle
  - Important to maintain gene pool of these species so sufficient diversity available if changes occur in future
    - EX. older or wild varieties of plants may have genes that can be introduced or reintroduced into domesticated strains to promote resistance to a pest
    - Rare or traditional breeds of animal retain genes that offer protection against new diseases, which modern varieties have lost

Values of biodiversity that can be measured directly

- Bananas
  - All cultivated bananas produced from 1 original variety
  - Clones produced asexually, genetically identical
  - Cannot evolve resistance to disease
  - Agriculture research organization in Honduras
    - Cross-breeding cultivated bananas with wild ones
    - Create new varieties that are resistant to Panama disease
      - Potential to wipe out worldwide banana crop

Values of biodiversity that can be measured directly

- Timber & pharmaceuticals obtained from plant & animals
  - Digoxin from digitalis
  - Aspirin from chemically synthesized salicylic acid in white willow bark
  - Morphine and other opiates from opium poppy
  - Rubber, palm oil & cotton from other plants
  - Silk, honey, milk, meat & fish from animals

Indirect Value

- Impossible to quantify…
  - Aesthetic value of unspoilt ecosystem
  - Pleasure provided for recreation & tourism
  - Educational value of an ecosystem with natural biodiversity
- Ecosystem productivity not just just a measure of biomass
  - Also includes factors vital to system function & to function of other systems
    - Plants remove carbon dioxide from air & release oxygen (environmental stability)
    - Climate regulated by rainforests
    - Decomposers essential to recycling waste to provide nutrients
    - Insects & other pollinators needed by crop plants
    - Animals disperse plant seeds
  - Preservation of biodiversity keeps natural systems stable & balanced
    - Stable systems less likely to be disturbed by external factors (disease or abiotic events)

- Indicator species - organisms which have different tolerances to pollutants or changes in other factors
  - Can show changes occurring in an ecosystem long before the change has become measurable
  - EX. lichens = key indicator species of changes in the atmosphere
    - Unable to survive if small increase in sulfur dioxide in air...death = poor air quality
- Genetic diversity
  - Preserved in complex ecosystems...hard to quantify
  - Larger gene pool important in enabling pop to adapt to changes in environment
  - Wild varieties are source of new genes for cultivated plants & domesticated animals
- Human rights & ethical considerations
  - 50 million of the world's 300 million or more indigenous people live in rainforests
  - Modern philosophies accept that, as well as humans, EVERY species has a right to exist
  - Important for people to accept their responsibility to preserve biodiversity for sake of all species

Intergovernmental & non-governmental conservation organizations

- Key objective = preserve species & their habitats throughout the world
    - Global or local
    - Categorized by the way they are set up & funded
        - IGOs - intergovernmental organizations
        - Governmental organizations - groups that follow the policies of one or more governments and are funded by them
        - Non-governmental organizations (NGOs) - groups funded by individuals or independent groups
    - Effectiveness varies due to different strategies adopted in their work

Pages 186-187	**Government organization (i.e. UNEP)**	**Non-governmental organization (NGO) (i.e. WWF)**
Use of media	- Professionals produce statements - Good communication with media outlets	- Use internet & social media, advertisements, membership drives & direct action for communication & publicity - May produce press packs, flyers & web links
Speed of response	- Slow & bureaucratic...often many countries involved in negotiations - Each country has its own view or legal position	Generally faster...NGOs are independent & able to make decisions quickly
Diplomatic constraints	- Often held back by political arguments between different countries - Must respect legal requirements of each nation	Not affected by diplomatic constraints
Political influence	Has direct links to governments of many countries	Influence is indirect & depends on lobbying & pressure groups & public protests
Legal powers	Can pass laws on environmental issues	Public opinion & pressure used rather than legal powers

United Nations Environment Program (UNEP)

- Governmental organization that coordinates with UN work on the environment and helps LEDCs implement environmentally sound policies
- Founded in 1972, headquarters in Kenya
- Objectives:
  - Provide leadership and encourage partnership in caring for the environment by inspiring, informing, & enabling nations and peoples to improve their quality of life without compromising that of future generations
- Gathers, collates & verifies data on biodiversity & ecosystems from many sources
  - Can be used as a reliable source of information
- Promotes global & regional cooperation & develops environmental laws
  - Covers range of issues like atmosphere, marine & terrestrial ecosystems & the green economy
- Works with NGOs to implement its policies

World Wildlife Fund (WWF)

- An NGO & best known international conservation organization
- 1961...works with businesses, governments & local communities around the world
- Focuses on safeguarding wildlife & places it considers to be of global importance
- Lobbies governments & runs campaigns to change legislature & policy to protect environment & biodiversity
- Major campaigns: climate change, energy, housing & protection of marine environment

Important international conventions on biodiversity

- Meetings, conventions & global summits
  - Raise profile of conservation
  - Some produce legally binding agreements
  - Some pressure governments to act on conservation issues (publicity & public opinion)
- Encourage collaboration between nations
- Key dates & meetings:
  - 1948 - IUCN founded
  - 1961 - WWF set up
  - 1966 - Red Data Book published
  - 1973 - First Convention on the International Trade of Endangered Species of Wild Fauna & Flora (CITES convention) held
  - 1980 - World Conservation Strategy announced - highlighting need to preserve genetic diversity & ensure sustainable use of species & ecosystems
  - 1982 - UN World Charter for Nature agreed
  - 1991 - IUCN Caring for the Earth conference

Important international conventions on biodiversity

- Key dates & meetings:
  - 1992 - United Nations Conference on Environment and Development (UNCED) - the Earth Summit, in Rio de Janeiro
  - 2000 - UN Millennium Summit
  - 2002 - UN World Summit on Sustainable Development
  - 2005 - UN World Summit, New York
  - 2012 - UN Earth Summit Rio +20

Approaches to conservation

- 3 approaches of a program of conservation of a species
  - Conservation of a habitat so that species can survive
  - Conservation based on protection of a species
  - Combined approach to conserve both habitat & species within it

Criteria used to design areas of protected habitat

- Shape, size & interconnection between protected areas
- **Size**
  - Larger is better...can support more species and a greater diversity...more complex interactions
  - Small supports small pop #s...inbreeding risk...genetic diversity diminished
    - Risk of a natural disaster (i.e. flood or forest fire) wiping out all individuals
    - Edge effect significant in small areas
- **Edge effect**
  - Center of nature preserve more likely to have different features from areas around edges
  - EX. woodland has more light & wind but less moisture at the edge
  - Organisms at center protected better from influence of other organisms (farm animals or humans just outside reserve)
  - Organisms at edge disturbed or competing with organisms outside reserve
  - Size matters
    - Edge effect greater in small reserves (more edge per hectare than large ones)
  - Shape is a factor
    - Long, thin reserves have larger edge than round or oval shape covering same area

Criteria used to design areas of protected habitat

- **Wildlife corridors**
  - corridor - strip of land used to link 2 or more separated reserves
  - Can be under busy roads or railways
  - Not ideal
    - Animals using it exposed to dangers
    - Can come closer contact with humans
    - Can act as conduits for spread of disease
    - May make certain species easy targets for poachers or hunters
  - Benefits
    - Gene flow between otherwise isolated areas...promote diversity
    - Seasonal movements (even large migrations) can happen safely
    - Less chance animals will be killed by traffic once they are accustomed to using it
- **Buffer zones**
  - Semi-protected areas surrounding a nature reserve
  - Managed or left wild, but outside influences are minimized (people in nearby towns or impact of local agriculture)
  - Limits the spread of pests & disease into reserve

Criteria used to design areas of protected habitat

- **Management**
  - Usually by government or government-funded organizations
  - Without active management...some species can dominate & threaten survival of other important organisms
  - Should allow for scientific study & education
    - Allow visitors in manageable #s

Species-based conservation strategies

- Focus on individual species or groups of species & aim to protect them & increase their #s
- **Role of CITES**
  - - an international agreement that aims to limit international trade in wild plants & animals & their body parts so trade in specimens does not endanger the survival of a species
  - Came into force in 1975...membership voluntary
    - Member governments produce own national laws to support
  - Species grouped according to degree of threat they face
    - If threatened with extinction, no trade at all
    - Less threatened, traded within regulations to make sustainable
    - Species included at request of specific country due to cooperation needed to prevent illegal trade
  - Species listed:
    - All primates, cetaceans (whales & dolphins), turtles & tortoises & plants like orchids & mahogany
    - importing/exporting specimens, body parts or derivatives of the species must be authorized & licensed

Species-based conservation strategies

- **CITES**
  - Strengths:
    - Trade in endangered plants & animals significantly reduced
    - Permits & licenses required to trade in listed species
    - Raised awareness of trade in endangered species
  - Weaknesses:
    - Voluntary & countries can withdraw
    - Penalties may be less than the profit being made from trading or smuggling
    - Some countries unable to enforce the laws effectively (lack of resources, long unmanned borders or corruption among politicians or law enforcement agencies)

Species-based conservation strategies

- **Captive breeding programs, reintroduction programs & zoos**
  - <u>Zoos</u> - most actively involved in captive breeding & conservation programs aiming to increase #s of endangered animals & work to reintroduce them into their native habitats
    - Best hope of saving species severely endangered
    - Provide location for <u>*ex-situ conservation*</u> - preserving species whose #s are very low, by selective breeding animals outside natural habitat
      - Difficult
        - Behave differently in zoos
        - Breeding can be problematic (especially if complex breeding behaviors or require special environmental conditions)
        - Artificial insemination or embryo transfer can be used
      - But awesome
        - Use science to select based on genetic profiles (large gene pool maintained = as much diversity as possible)
        - Keep pedigrees...those with greatest variation selected & exchanged with other zoos
        - Difficult pregnancies monitored & young cared for after born

Species - based conservation strategies

- PLANTS
    - More straightforward to maintain
    - Botanic gardens supply correct environmental conditions
    - Computer-controlled greenhouses maintain correct temp & humidity needed
    - Many countries keep national collections of native plants, exotic genera & food plants
    - Seed banks (store seeds in cool, dark conditions to prevent germination)
        - EX. Millennium Seed Bank (Wakehurst Place in England) & Svalbard Seed Bank (Norway)

Reintroducing species into the wild

- Not easy
- Habitat loss may prevent ability to live
- Released animals may not have behaviors needed to survive
    - Humans may need to intervene (feed or protect them)
    - EX. young orangutans have to be taught to socialize, climb & forage for themselves before they can become fully independent
- EX of success:
    - Arabian oryx in Oman & Saudi Arabia
    - Condor in USA
    - Przewalski's horse in Mongolia
    - Golden lion in Brazil

Strengths of captive-breeding & reintroduction programs:

- # of rare species can be increased to boost #s in the wild
- Genetic diversity can be maintained by selective breeding
- Artificial insemination or embryo transfer can help when animals fail to breed naturally
- Offspring may have better chance of survival
- Zoos have valuable role in education & public awareness
- Plants species can be held in seed banks for many years & provide source of genetic variability

Weaknesses of captive-breeding & reintroduction programs:

- Captive breeding programs are expensive
- Reintroduction of species is difficult & poorly supported programs may leave vulnerable animals at risk
- Reintroduced species may be targeted by hunters or poachers if local people do not support the program
- Ethical issues need to be considered (ex. Should humans interfere with nature & keep animals in zoos?)

Selection of 'charismatic' species to help protect others in an area

- Should endangered animals be given priority over other species? What basis should one species be chosen over another?
- Zoos select animals likely to increase visitor #s & provide financial support
  - Decisions may be made for aesthetic or economic reasons (rather than ecological ones)
  - Primates & rhinos attract visitors more than beetles or worms
  - Different zoos have different levels of experience & expertise...tend to develop species they know best

Choosing species for...

- Aesthetic reasons can:
  - Raise public awareness
  - Increase funding & support
  - Engage local populations (who may benefit from increased tourism)
  - Be important in preserving overall beauty of an area
- Ecological reasons can:
  - Be more likely to benefit the whole ecosystem
  - Fail due to lack of support & funding
  - Result in species which the public consider unattractive being conserved

Keystone species

- One that has a disproportionate effect on the structure of a community
    - Include specific predators or grazers
        - EX. limpets on a rocky shore (they control level of algae as they graze)
        - EX. lobsters (when fishermen remove too many from Atlantic ocean, sea urchin populations increase and lead to destruction of large areas of kelp….complex communities of molluscs & other small organisms are then destroyed
        - EX. grey wolf (see side margin pg 155)
    - Diversity of species & complexity of food webs reduced if keystone species in decline

Evaluating the success of a protected area

- No guarantee a project will be successful...it needs:
  - Governmental support
  - Adequate funding
  - Research & education programs
  - Support of local community
    - Important that needs of local people are met as part of the project
  - Location (must be situated in regions suitable distance from urban centers...surrounding land can act as a barrier to human interference)
    - But close enough to allow access for local people & tourists (if tourism is used for funding project)