IB BIOLOGY · A4.2 · SL

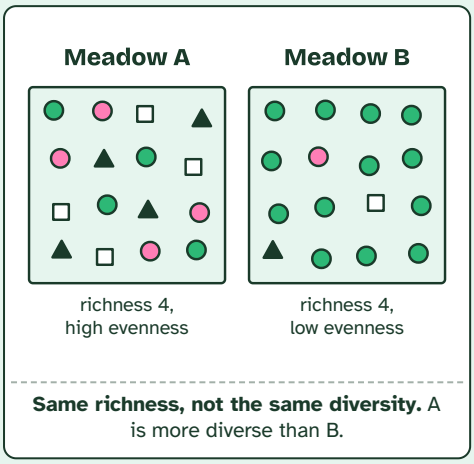
REVISION ON TWO PAGES

Saving the *variety* of life

What to know, what to draw and what to say. Nothing else.

THE ONE IDEA

Humans are causing a sixth mass extinction. No single method can stop it, so conservation combines several and puts EDGE species first.



Same richness, not the same diversity. A is more diverse than B.

A4.2.1 START HERE

Biodiversity at three *levels*

- **Biodiversity** is the variety of life in all its forms, at three levels: ecosystem, species and genetic.
- Species diversity has two parts: **richness** (how many species) and **evenness** (how equally the individuals are shared among them).
- Two places with the same richness need not be equally diverse: if one species makes up nearly all the individuals, diversity is lower.

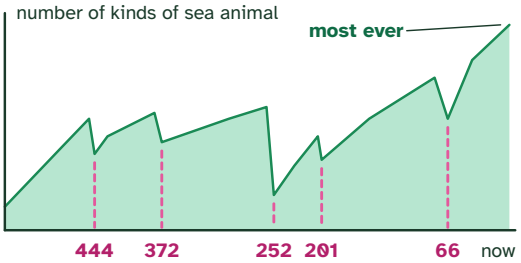
THE THREE LEVELS

E Ecosystem	**S** Species	**G** Genetic
the range of habitats and communities in an area	how many species, and how evenly shared	variety of alleles in a species, so it can adapt

A4.2.2

More species than *ever*

- About **2 million species** are named and described; millions more await discovery (one estimate: 8.7 million eukaryotes).
- Fossils suggest **more species are alive today** than at any time in the past.
- Five mass extinctions broke the rise; after each, recovery took millions of years.
- **Nature of science:** classifying is pattern recognition. From the same data, **splitters** name more species than **lumpers** (giraffes: one species or four).



millions of years ago; pink: mass extinctions

A4.2.3

Extinctions *we caused*

- The **sixth mass extinction** is happening now, and it is **anthropogenic**: caused by humans. The five before it had natural causes.

CASE STUDY	HOW HUMANS DROVE IT OUT
North Island giant moa *Dinornis novaezealandiae*	**Megafauna lost on land.** A giant flightless bird, slow to breed, with no fear of people. Settlers from about 1300 **hunted** it and burned its forest; gone within about 150 years.
Caribbean monk seal *Neomonachus tropicalis*	**A marine species lost.** Basked on beaches and did not flee. Killed for **oil and meat** from the 1500s, and its food fish overfished. Last seen 1952; declared extinct 2008.
One from your area for example	**Great auk, 1844.** A flightless North Atlantic seabird, hunted until the last known pair was killed on Eldey, Iceland.

Either the common or the scientific name is accepted.

A4.2.4

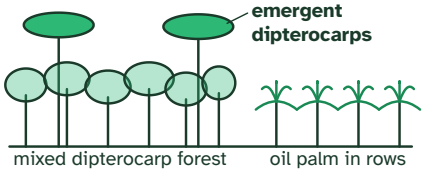
Losing a whole *ecosystem*

- Lose an ecosystem and you lose **every species that depends on it**. Every cause here is human, directly or indirectly.
- **Case 1: mixed dipterocarp forest**, the lowland rainforest of Southeast Asia, named after its tall hardwood trees. On Borneo it is home to orangutans and hornbills.
- **Case 2, near you:** for example the **Aral Sea**. Its rivers were diverted to irrigate cotton; the lake shrank and its fishery and wetlands collapsed.

STEP 1
Logging
Dipterocarp timber taken first, near coasts and rivers.

STEP 2
Roads, clearance
Roads open the forest to **oil palm** and farms.

STEP 3
Fire, drainage
Drained peat and logged forest burn in droughts.



A plantation is green from the air, but it is not forest: one species in rows.

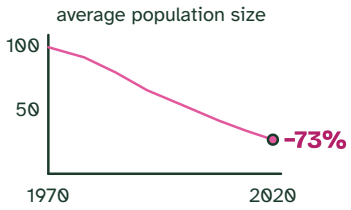
76% of Borneo was forest in 1973

53% by 2010: about half

A4.2.5 and 6

The biodiversity *crisis*: evidence and causes

- A crisis is a change, so a survey must be **repeated the same way** over years to show a change in **richness and evenness**.
- **Living Planet Index:** almost 35,000 monitored vertebrate populations fell by 73% on average, 1970 to 2020.
- **IPBES** (the UN biodiversity panel), 2019: about **1 million species** threatened with extinction.



Peer-reviewed by experts
Published with its method, so others can **check and verify** it.

Citizen science by the public
Data on a huge scale, but skill varies and people record where they go, not a random sample.

A4.2.6 · CAUSES: HUMAN POPULATION GROWTH DRIVES THE REST

HIPPO

- **H** **Habitat loss** deforestation, land cleared for farms, urbanisation
- **I** **Invasive species** and pests and diseases, spread by global transport
- **P** **Pollution** pesticides, fertiliser run-off, plastics, CO_2
- **P** **Population** human growth: the overarching cause
- **O** **Overexploitation** hunting, overfishing, poaching, wildlife trade

A4.2.7

No single *approach* is enough

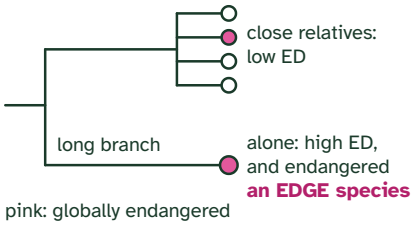
- Different species need different measures, so conservation **combines several approaches**.

APPROACH	WHAT IT DOES
In situ in its habitat	Protects species where they live, in **managed nature reserves**: patrols against poaching, invasive species removed.
Rewilding, reclamation	Restores degraded land: lost species reintroduced (**beavers**, wolves), drains blocked, mines reclaimed.
Ex situ away from it	**Zoos and botanic gardens** breed species for later release.
Seed and tissue banks	Store **germ plasm**: dried, frozen seeds or cells, a reserve of genetic diversity.

A4.2.8

Choosing species: *EDGE*

- Money is limited, so the **EDGE of Existence** programme puts first species that are **Evolutionarily Distinct and Globally Endangered**.
- Distinct means few or no close relatives. Lose one and a **whole branch** of the tree of life goes.
- **Nature of science:** which species to save has ethical, political, economic, social and cultural sides, so it must be debated.



WATCH OUT

Six mistakes that *cost marks*

- ✕ **Richness is not diversity.** Two places with four species each differ if one is uneven.
- ✕ **One survey shows no crisis.** Only repeated surveys, done the same way, show change.
- ✕ **The sixth extinction is caused by humans.** Volcanoes and the asteroid caused earlier ones; do not use them here.
- ✕ **An oil palm plantation is not forest.** One species in rows supports a small fraction of the species.
- ✕ ***Ex situ* backs up *in situ*, never replaces it.** A captive-bred animal needs a habitat to return to.
- ✕ **Evolutionarily distinct is not rare.** It means few close relatives on the tree of life.

COVER THE SHEET

Can you *answer these?*

1. Distinguish between species richness and evenness.
2. Compare the number of species today with the past.
3. Outline how humans drove the North Island giant moa and the Caribbean monk seal extinct.
4. Describe how dipterocarp forest is being lost.
5. Explain why a single survey cannot show a biodiversity crisis, and what can.
6. State the overarching cause and four specific causes.
7. Outline one *in situ* and one *ex situ* approach.
8. Explain why EDGE species are given priority.

IN THE EXAM

Name the case study (species, place, date) and **link each human cause to the loss**: "hunted faster than it could breed", not just "humans".

GO FURTHER

Animated figures, a dry lab and a marked Check are in the full guide online.