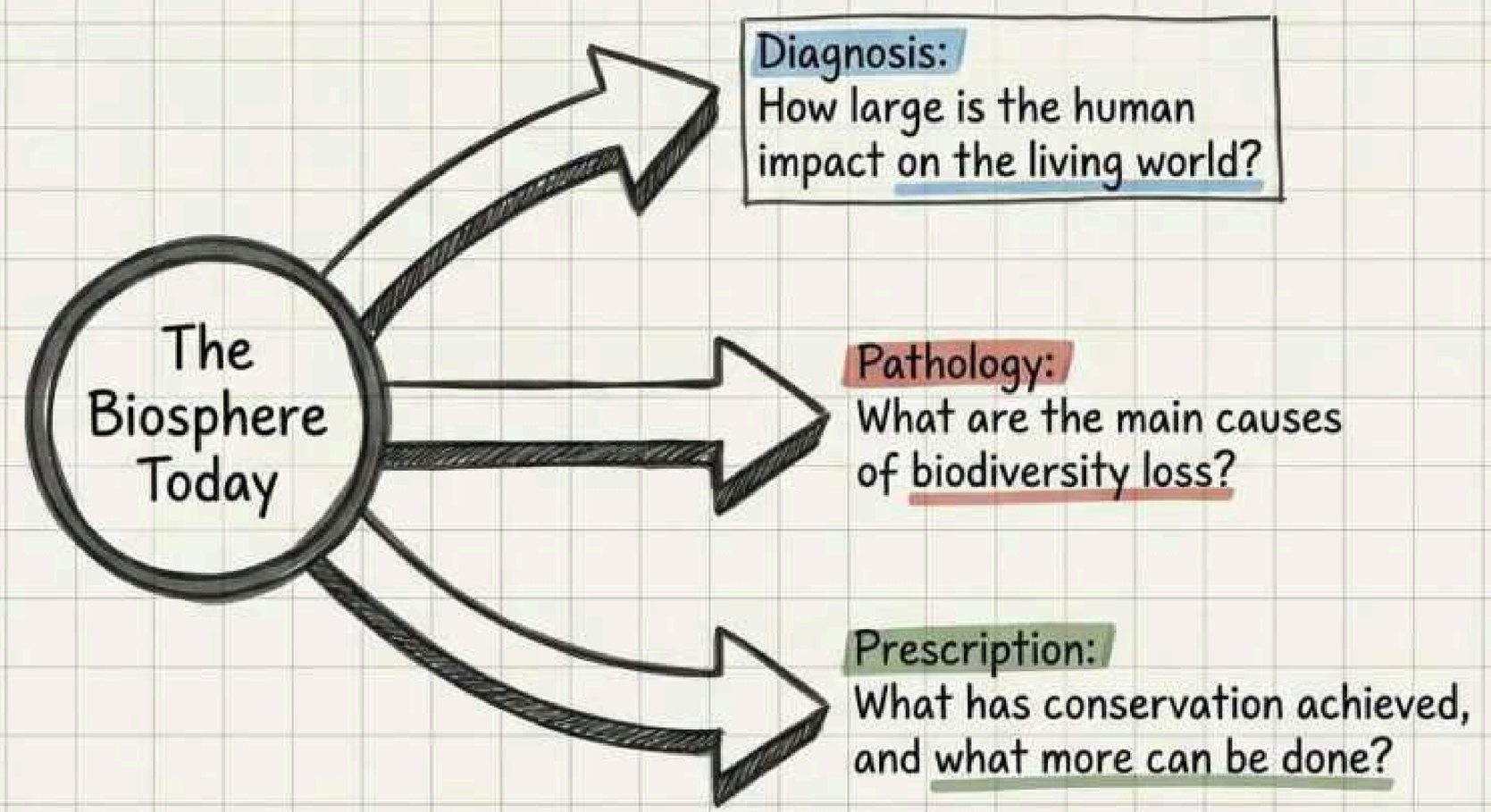
Humans and the Biosphere

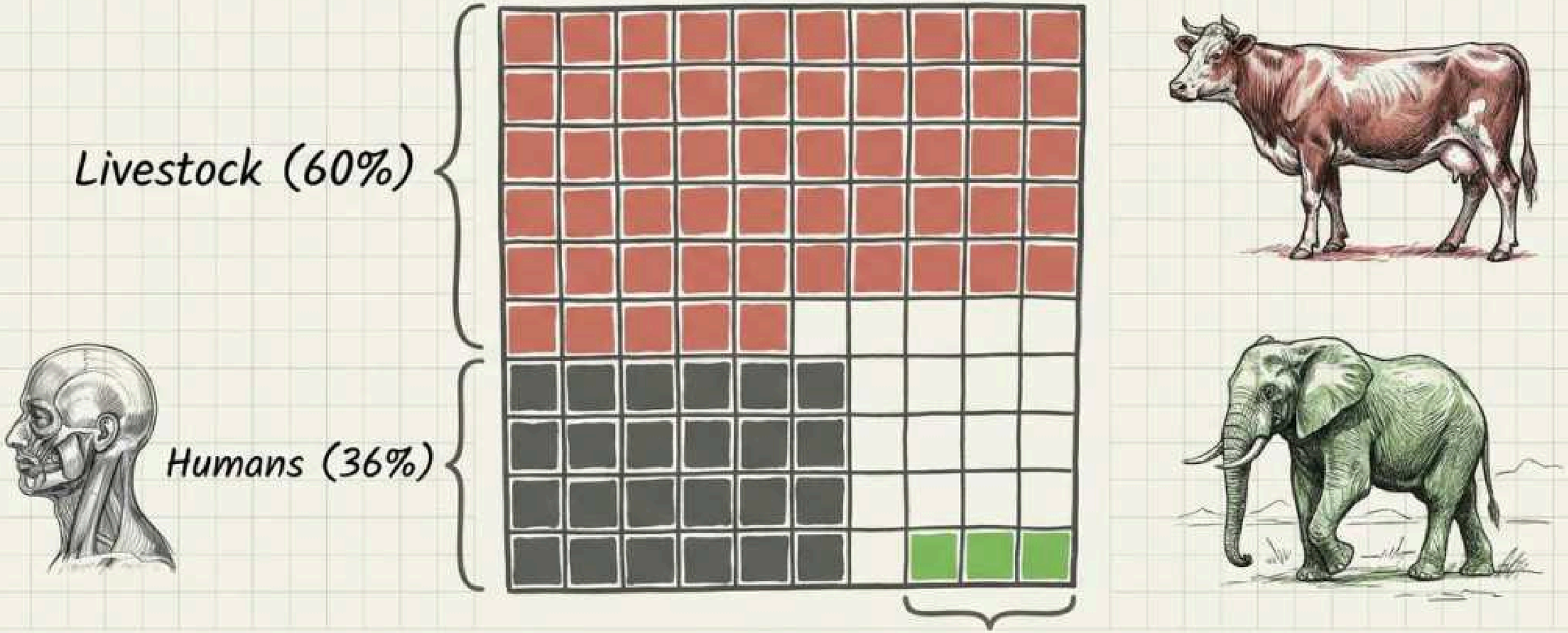
¶ 6.1



The Weight of Humanity

¶6.2

Humans now shape the biosphere on a planetary scale.



Based on 2018 estimates by
Yinon Bar-On, Rob Phillips, and Ron Milo.

The Symptoms of Decline

¶6.3

Species Threat

1,000,000



Animal and plant species threatened with extinction, many within decades.

(IPBES, 2019)

Population Decline



Average decline in monitored wildlife populations since 1970.

(Living Planet Index, WWF & ZSL, 2024)

The Sixth Mass Extinction Debate

¶ 6.4

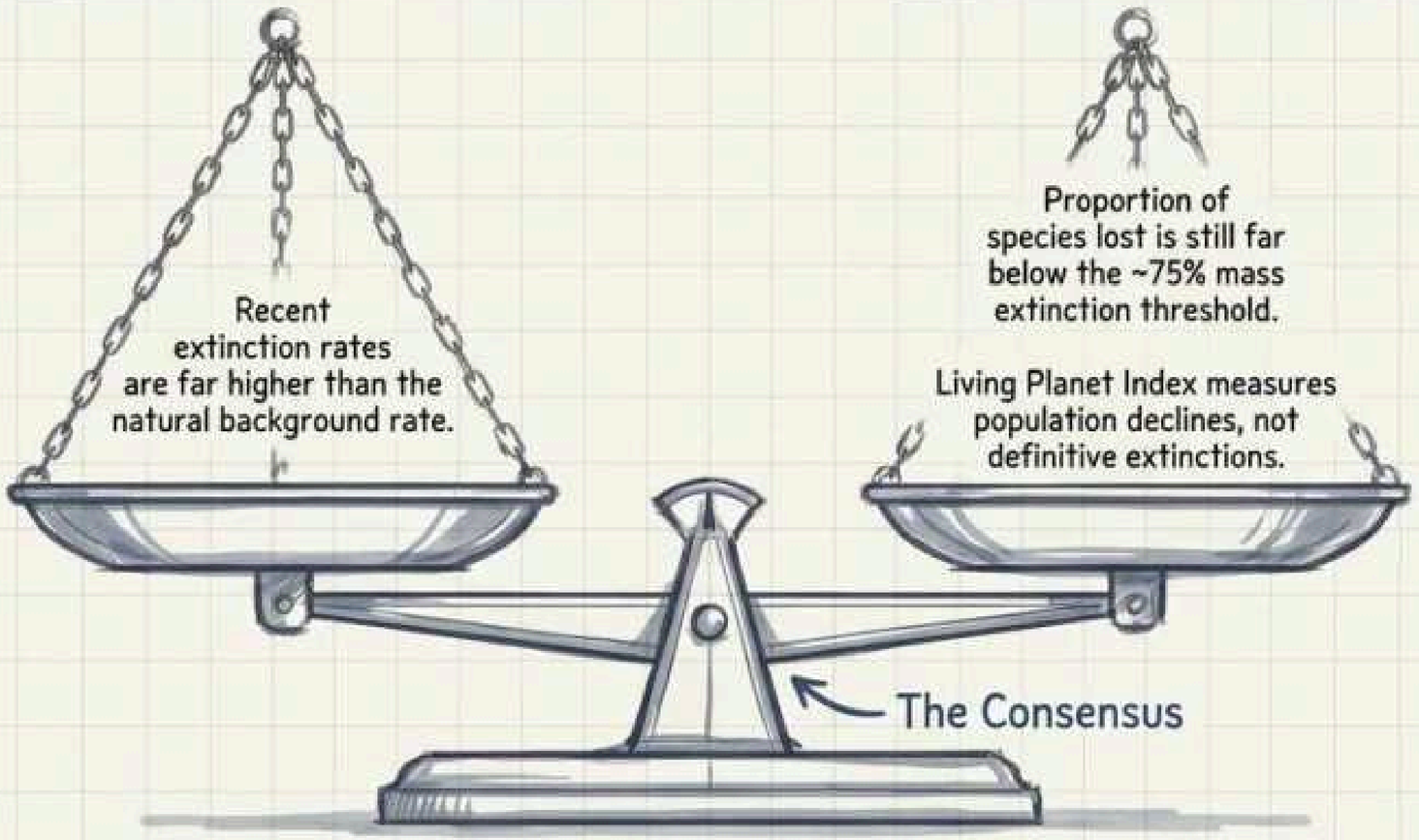
The Sixth Extinction is Here

Recent extinction rates are far higher than the natural background rate.

Approaching, but Not Yet

Proportion of species lost is still far below the ~75% mass extinction threshold.

Living Planet Index measures population declines, not definitive extinctions.

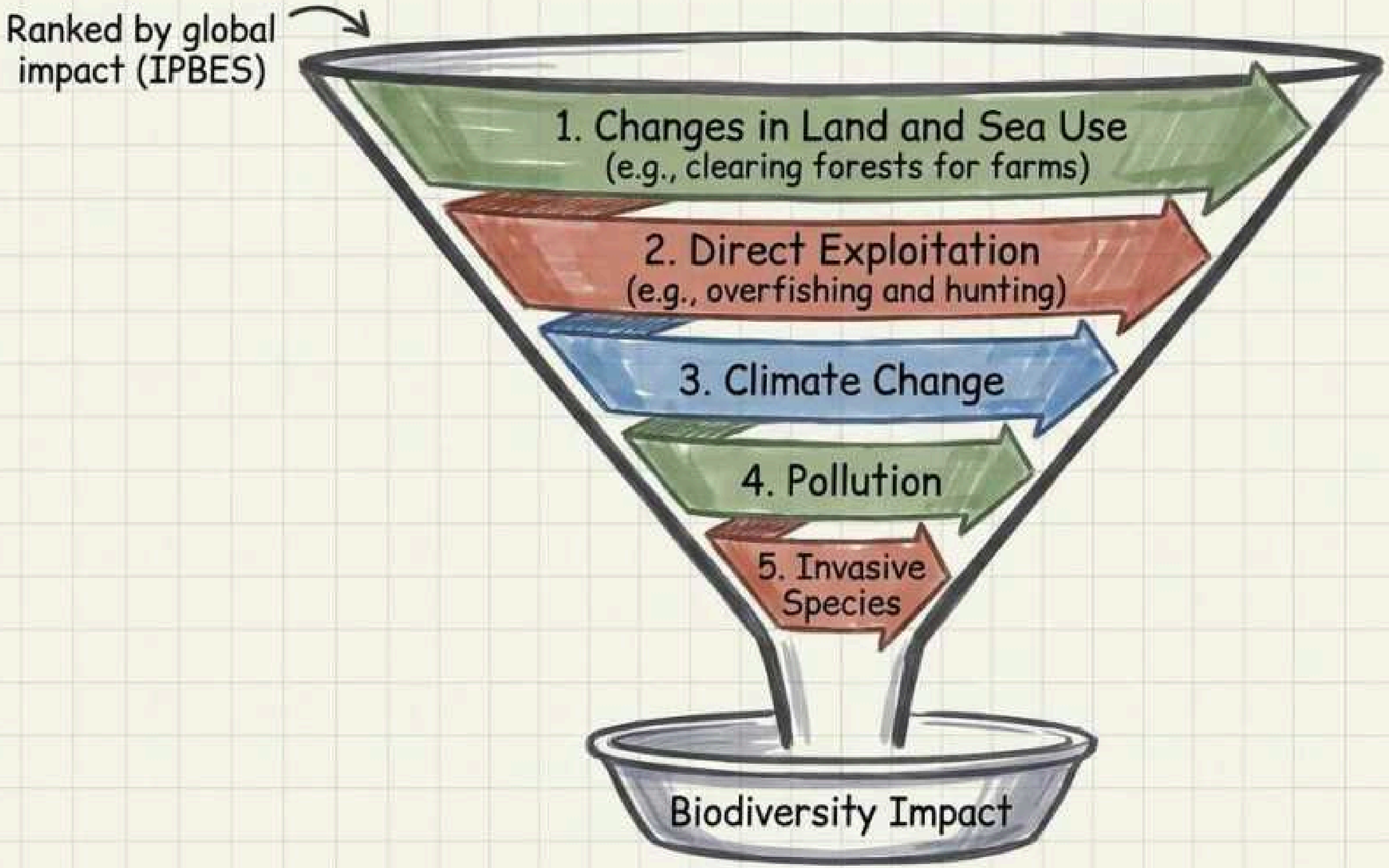


The Consensus

Current trends are alarming, but much can still be saved.

The Five Drivers of Decline

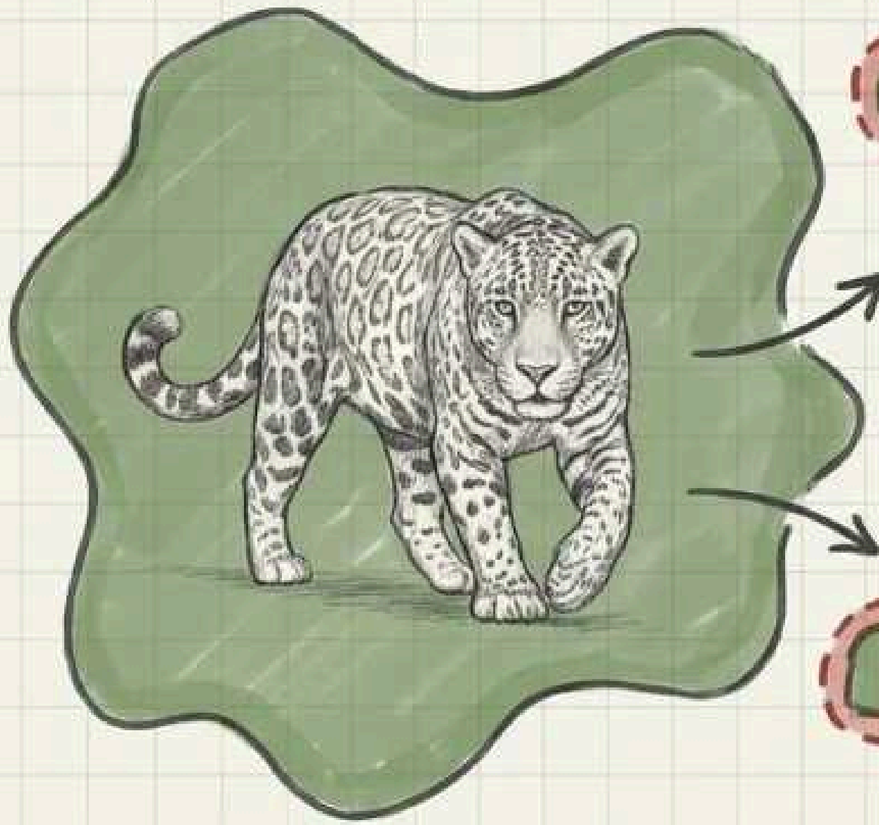
¶ 6.5



Driver #1: Habitat Loss & Fragmentation

¶ 6.6

The biggest single cause of decline. Primary drivers: cattle ranching, soybeans, palm oil, timber, drained wetlands, plowed grasslands.



INTACT HABITAT

Edge Effects

Increased exposure to external threats, altered microclimate, predation.

FRAGMENTED ISLANDS

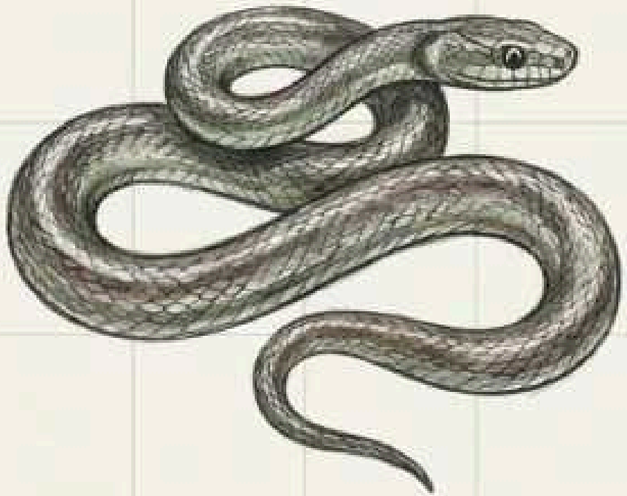
$$\Delta p = \frac{p(1-p)}{2N}$$

Mechanism of collapse: Species needing large areas decline; isolated populations become vulnerable to **drift** and in**breed**ing.

Driver #5: Invasive Species

¶ 6.7

Case 1: Guam



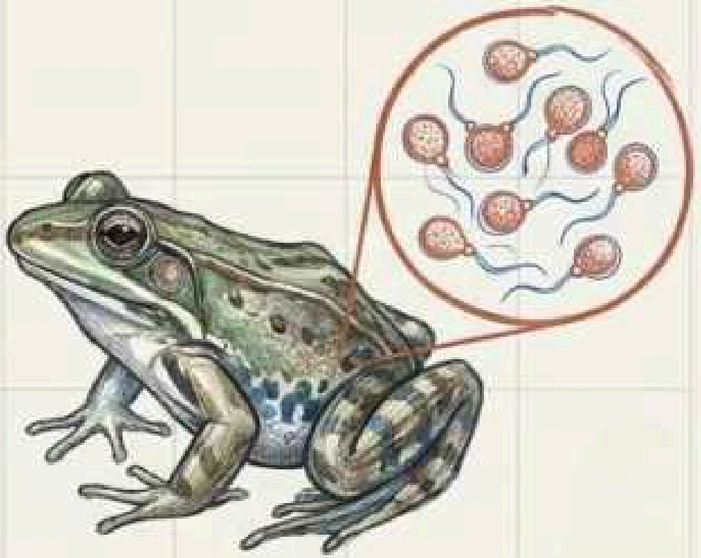
Accidentally introduced post-WWII; wiped out most native forest birds.

Case 2: Island Ecosystems



Rats, cats, and goats cause devastating extinctions among island-evolved species.

Case 3: Global Amphibians

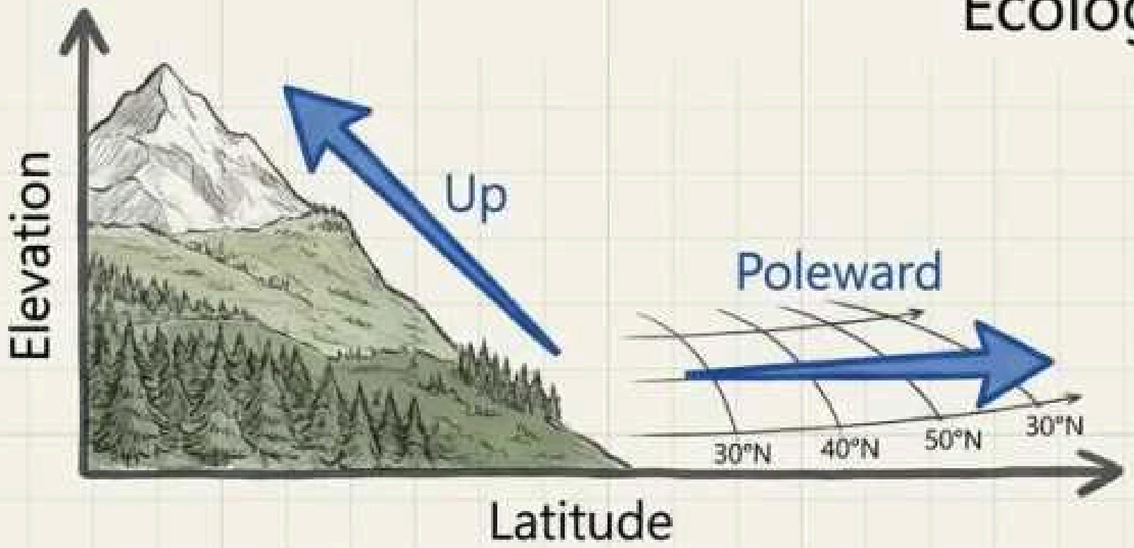


Chytrid fungus spreads globally, driving severe amphibian decline and extinction.

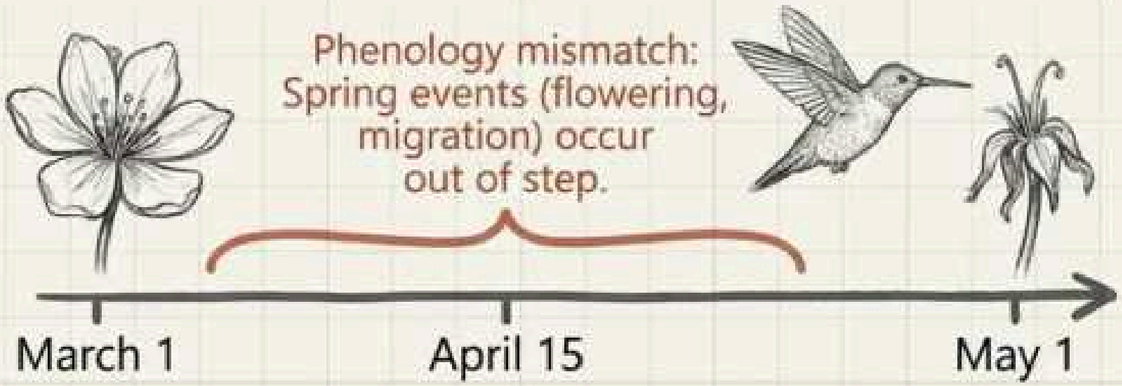
Driver #3: Climate Change

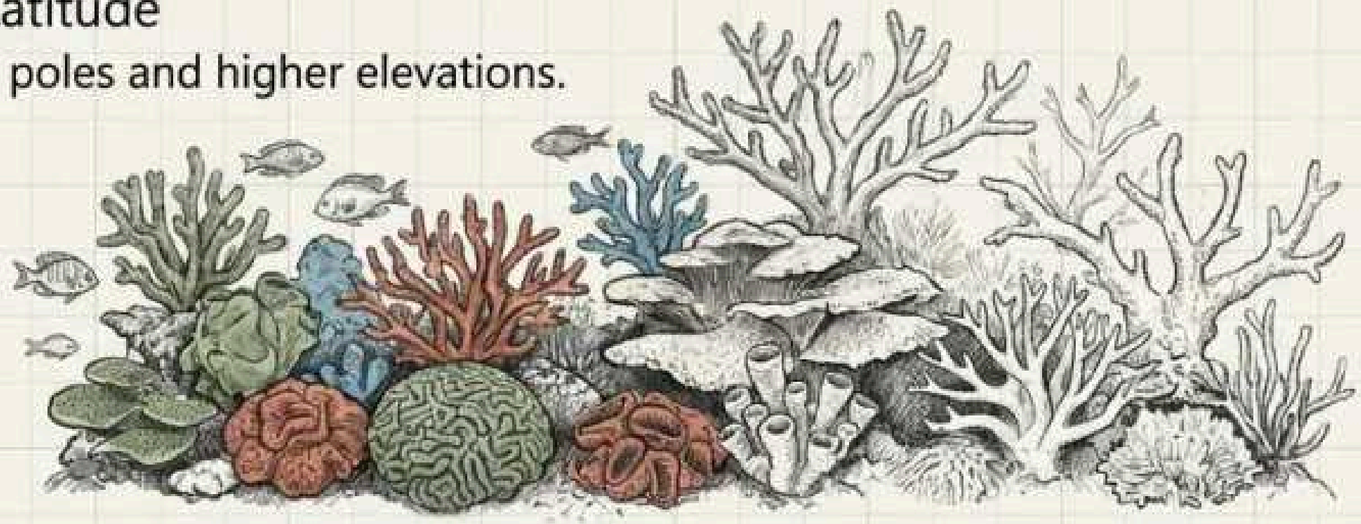
¶6.8

Ecological Shift



Species shift toward poles and higher elevations.



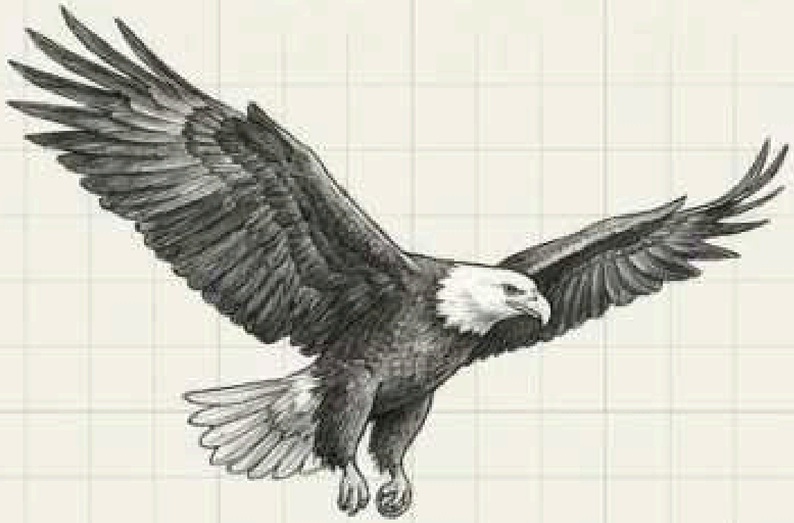


Marine heatwaves cause mass coral bleaching (e.g., Great Barrier Reef since 2016).

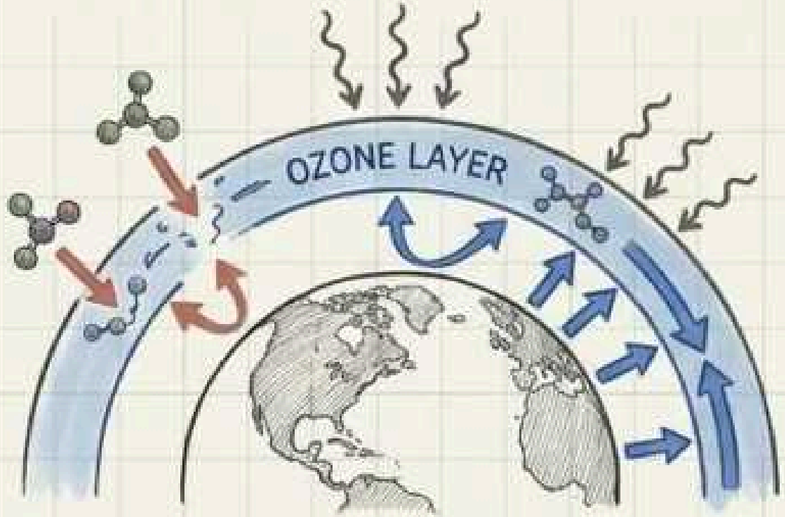
Evidence of Recovery

¶6.9

Milestone Intervention







1972 / 2007

DDT banned (1972)
→ Removed from endangered list (2007).

1986

Commercial whaling banned (1986)
→ Populations rebounded.

1987

Montreal Protocol phased out CFCs (1987)
→ Ozone layer is slowly healing.

The Cornerstone: Protected Areas

¶ 6.10



Kunming-Montreal Global Biodiversity Framework (Dec 2022). Target: Protect 30% of the planet's land and sea by 2030.

The Three Pillars of Effective Protection

1. Consistent Funding

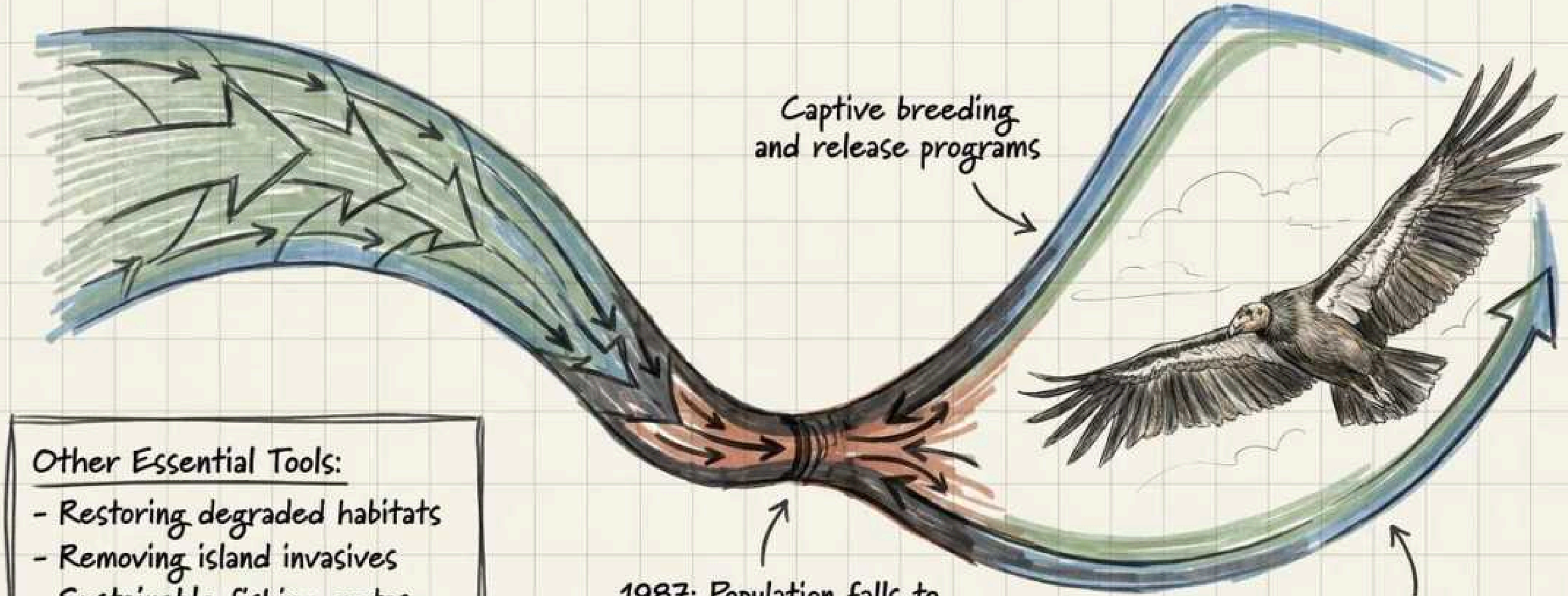
2. Strong Enforcement

3. Involvement of Local & Indigenous Communities



The Conservation Toolkit

¶ 6.11



Other Essential Tools:

- Restoring degraded habitats
- Removing island invasives
- Sustainable fishing quotas
- Wildlife corridors

Methodologies of Conservation

¶ 6.12

Strict Protection

Focus:
Setting aside wild areas.

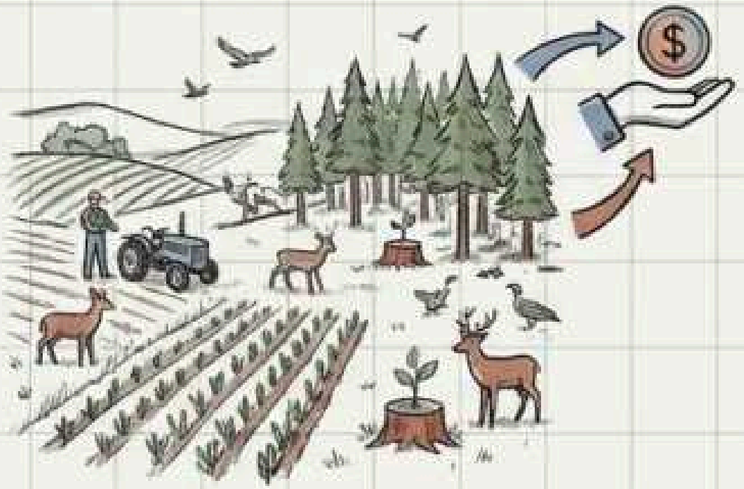
Human role:
Minimal human use.



Working Landscapes

Focus:
Farming, forestry, and wildlife coexisting.

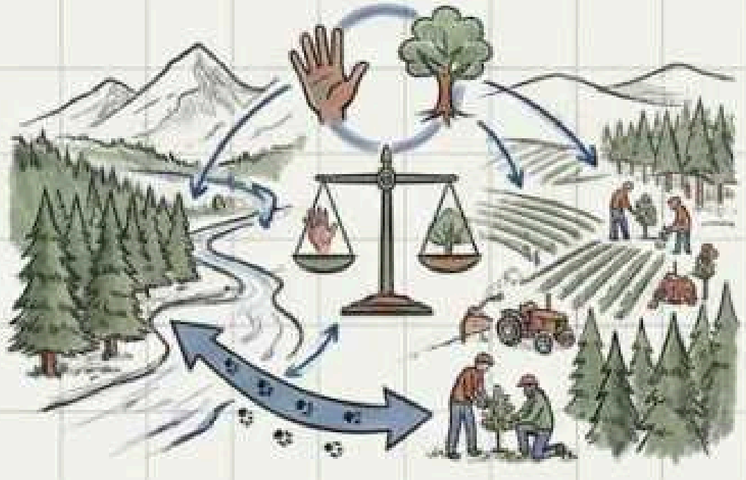
Human role:
Economic incentives (e.g., payments for protecting forests).



The Modern Synthesis

Focus:
Combining protection and working landscapes.

Goal:
Recognizing that people and nature must thrive together.

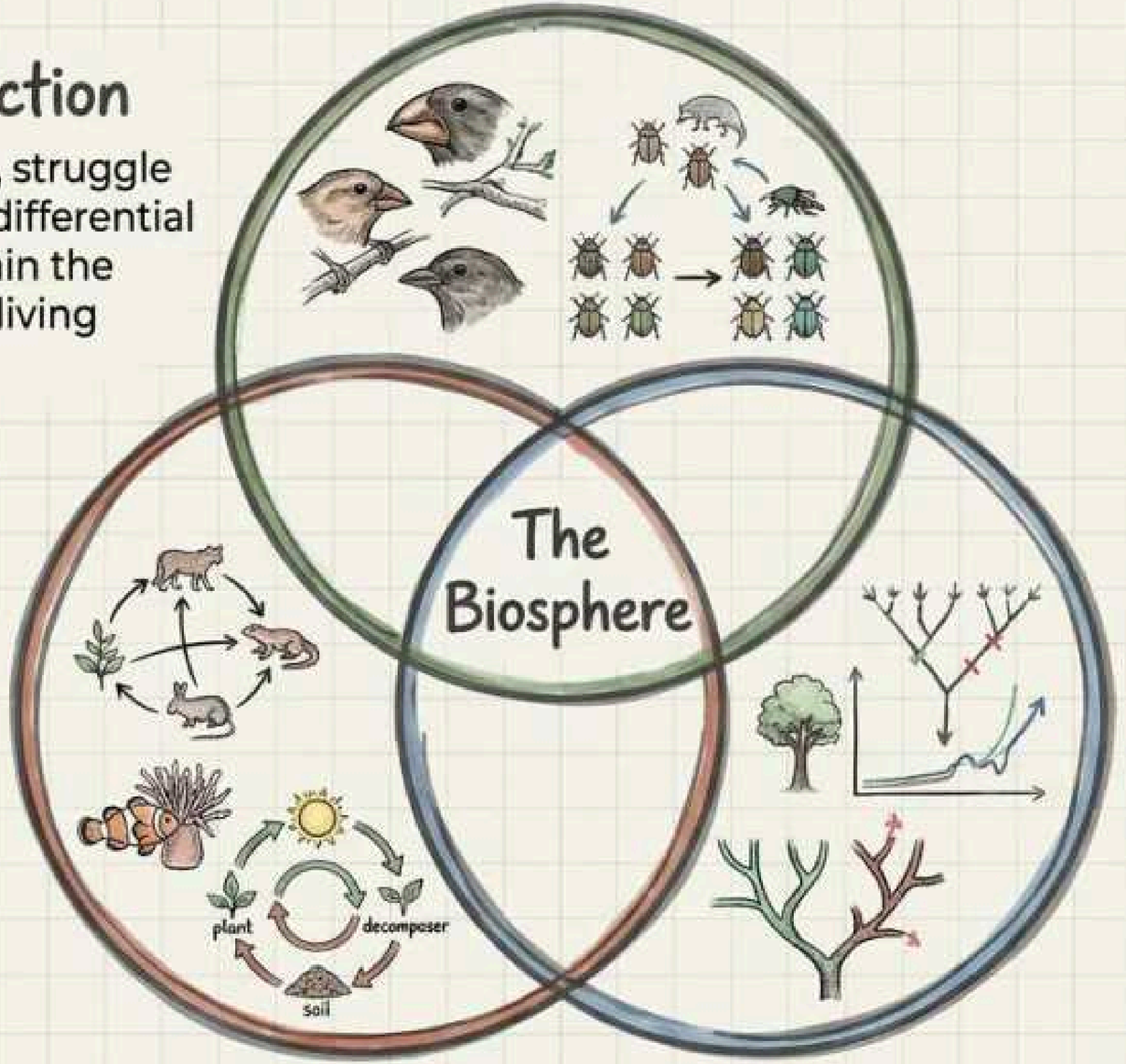


The Biosphere Framework (Course Synthesis)

¶ 6.13

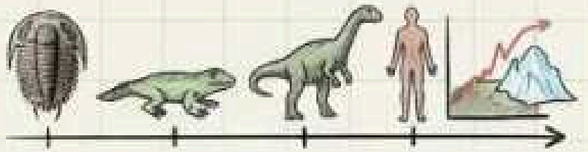
Natural Selection

Inherited variation, struggle for existence, and differential reproduction explain the diversity and fit of living things.



Interdependence

Species are linked (competition, predation, mutualism, energy/nutrient cycles); changing one part changes others.

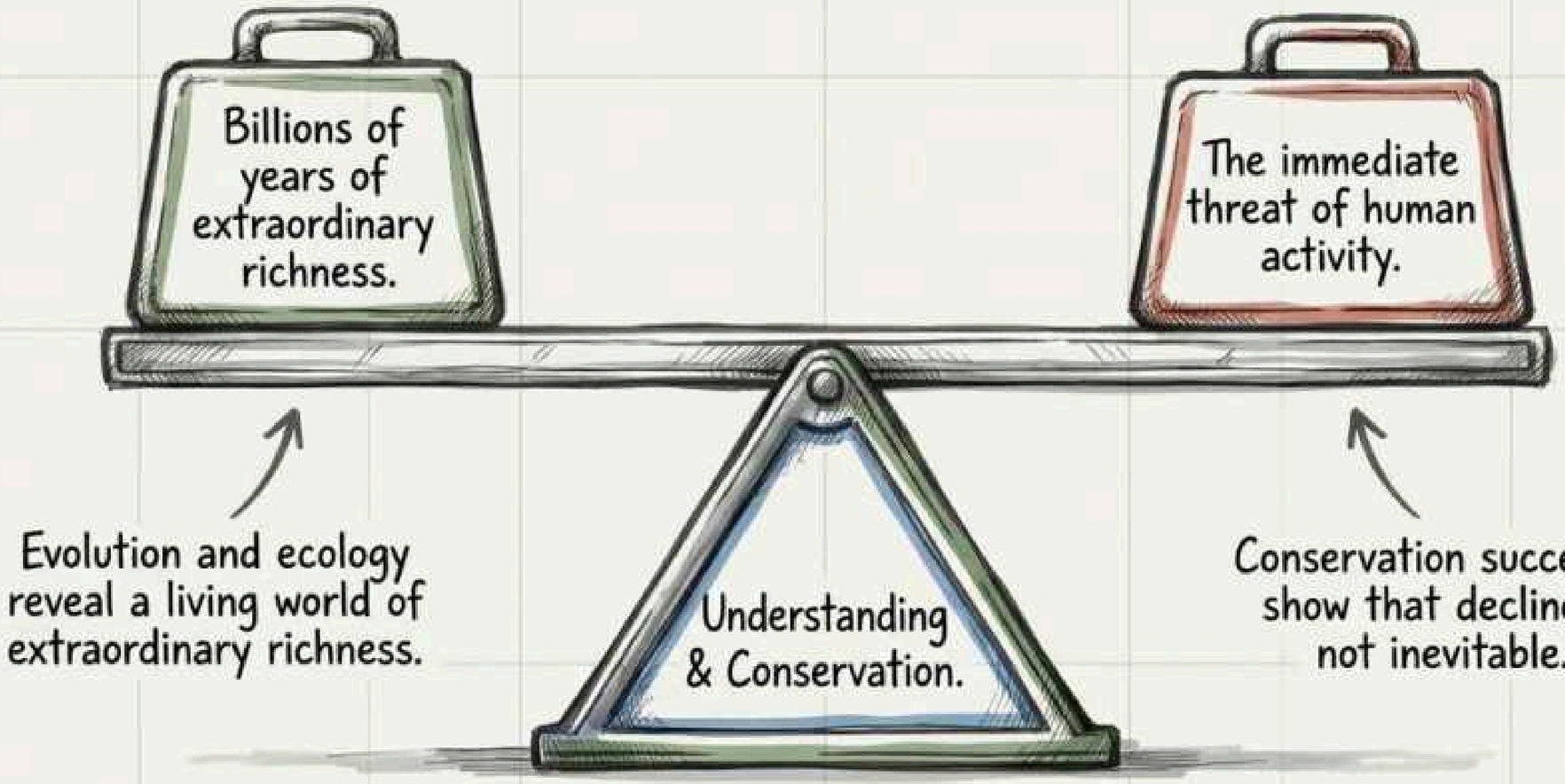


Change Over Time

Life changes through speciation and extinction over 4 billion years. Humans are now a major force of this change.

A Balanced Prognosis

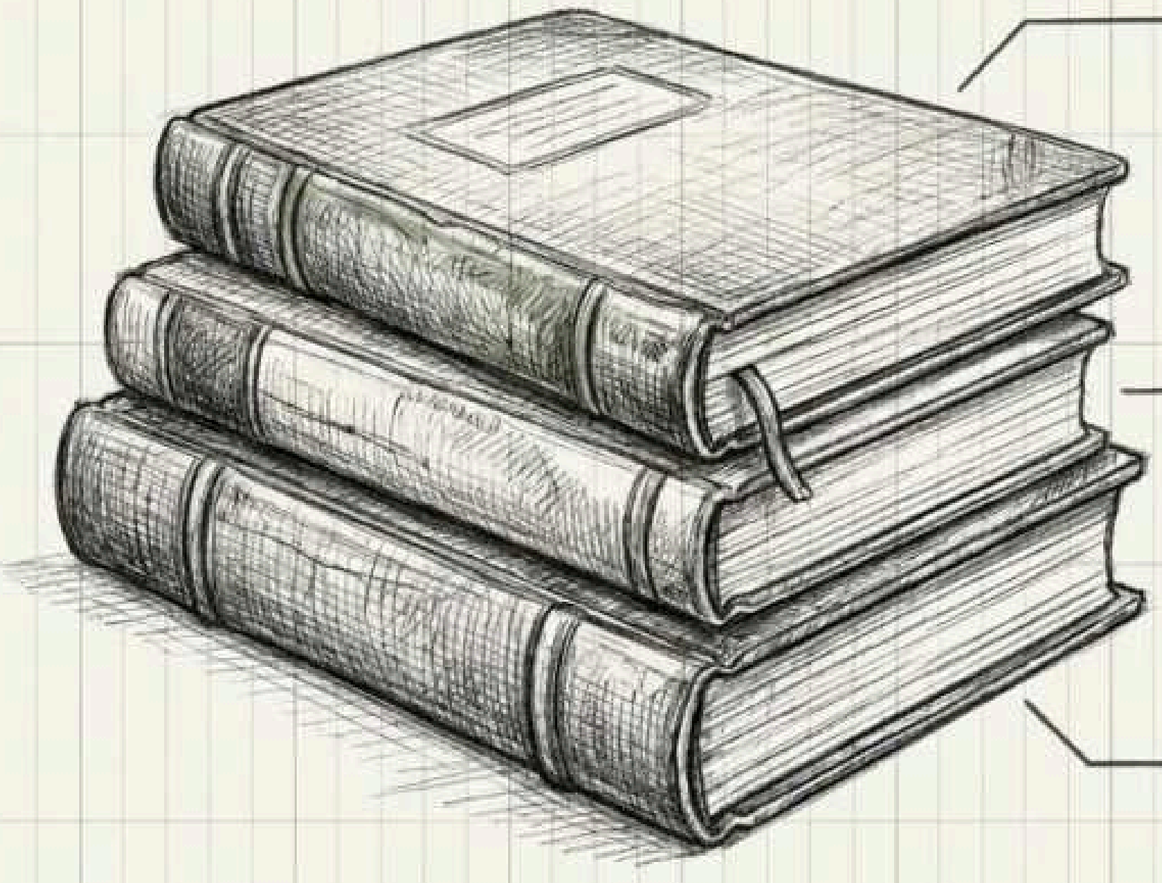
¶ 6.14



Understanding how life works is the foundation for protecting it.

Where To Go Next

¶ 6.15



Hannah Ritchie: Not the End of the World (2024) – Environmental data presented with cautious optimism.

E. O. Wilson: Half-Earth (2016) – The argument for protecting half the planet.

Elizabeth Kolbert: The Sixth Extinction (2015 Pulitzer Prize winner).

¶ 6.16

Field Assignment

Step 1: Choose a threatened species from your local region.

[_____]

Step 2: Identify which of the five main drivers threatens it most.

[_____]

Step 3: Suggest two concrete conservation actions that could help.

Action A: [_____]

Action B: [_____]

Course Note: Prepare for the lecture quizzes, final exam, and tripos questions next.

¶ 6.17

Pay It Forward

For those taking this course for free, your payment is to pay it forward. Be of service to humanity. Then tell us how you did it and what you learned.

Email: garyanderson@mail.grokbot.com
X (Twitter): @garyanderson

That is full compensation. Thank you for studying Biology 220 B with Anderson Academy.