Six pressures on the variety of life

HIPPCO is a memory aid for major human pressures on biodiversity. The pressures interact; they are not six independent problems or a ranking of importance in every ecosystem.

1. CONNECT HIPPCO TO THE ECOLOGICAL EFFECT

H

HABITAT DESTRUCTION

Land conversion removes living and breeding space. Clearing forest for farms or roads can also divide the remaining habitat.

I

INVASIVE SPECIES

Introduced harmful species can compete with native species, consume them, spread disease or change habitat conditions.

P

POPULATION GROWTH

More people can increase demand for land, food, water and energy. Per-person consumption and technology also shape the impact.

P

POLLUTION

Toxic chemicals can impair survival or reproduction. Excess nutrients can drive algal growth and oxygen depletion in water.

C

CLIMATE CHANGE

Changes in temperature, rainfall and sea level can make existing habitat unsuitable and shift where species can live.

O

OVEREXPLOITATION

Harvesting organisms faster than populations replace them can cause decline; examples include overfishing and unsustainable hunting.

2. COUNT MORE THAN THE NUMBER OF SPECIES

Biodiversity includes genetic variation within species, the variety and relative abundance of species, and the variety of ecosystems. A landscape can retain many individuals of one crop or livestock breed while losing genetic, species or ecosystem diversity.

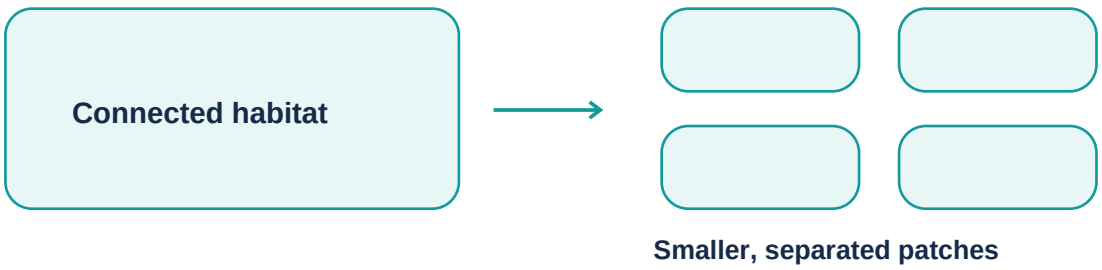
HIPPCO framework: College Board, EIN-4.C.1.
Threat mechanisms and interacting pressures: OpenStax, Biology 2e 47.3.

Scope: College Board APES CED, Topic 9.10, EIN-4.C.1-6, pp. 192-193.

Habitat change and genetic narrowing

The amount of habitat matters, but so does its arrangement. Human management can also reduce variation within a species even when its total number of individuals remains high.

1. FRAGMENTATION CHANGES CONNECTIONS



Schematic: gaps represent converted land or barriers such as roads; not to scale.

Roads, pipelines, logging and development can interrupt movement between populations. Effects depend on species: a gap crossed by a flying bird may block a small ground-dwelling animal. Isolation can reduce access to mates and gene flow.

2. CLIMATE CHANGE CAN REMOVE SUITABLE HABITAT

Warming, altered precipitation and rising sea level can shift or shrink suitable habitat. A species may not reach a new location if roads, farms or other barriers block its route. Protecting a patch does not prevent climate conditions within it from changing.

3. DOMESTICATION CAN NARROW GENETIC DIVERSITY

People manage organisms such as livestock and honeybee colonies for economic returns. Heavy reliance on a few breeding lines or replacement of diverse local breeds can reduce genetic variation. Large numbers do not guarantee a broad gene pool. Lost variation may include traits useful under disease or climate stress. Conserving diverse breeds and breeding stock can retain future options.

Fragmentation, movement and habitat connections: National Park Service, Santa Monica Mountains.
Domestication and climate-related habitat change: College Board, EIN-4.C.3-5.
Within-breed diversity: FAO, Animal Genetics.
Breed replacement and adaptation: FAO, Genetic Diversity of Livestock.

Scope: College Board APES CED, Topic 9.10, EIN-4.C.1-6, pp. 192-193.

Choose solutions and check their limits

Conservation combines protection, connectivity, sustainable resource use and restoration. The strongest choice addresses the main threat in the specific place and is checked against ecological outcomes.

1. COMPARE FOUR CONSERVATION APPROACHES

PROTECTED AREAS	Retain habitat and populations by limiting damaging activities. Boundaries alone cannot stop pollution, warming or illegal exploitation; management matters.
HABITAT CORRIDORS	Link suitable patches to support movement and gene flow. A corridor must suit the target species and may also spread disease or invasive organisms.
SUSTAINABLE LAND USE	Retain native habitat features, reduce damaging inputs and avoid extracting resources faster than they recover. Benefits depend on local practice and compliance.
HABITAT RESTORATION	Re-establish native vegetation, hydrology or other damaged functions. Recovery takes time and may be incomplete, especially if the original pressure continues.

Restoration is not a guarantee that destroying intact habitat can be fully offset.

2. MEASURE THE RESPONSE AT THE RIGHT LEVEL

Compare native species richness and abundance, genetic diversity where relevant, and habitat area, quality and connectivity. Use consistent survey methods and repeated observations. More individuals of a single managed species are not evidence that total biodiversity has recovered.

3. REDUCE MULTIPLE PRESSURES TOGETHER

A corridor helps movement, but pollution or overharvesting may still cause decline. Combine habitat measures with action on other identified pressures, then adjust management using monitoring results.

Protected areas, corridors and restoration: OpenStax, Biology 2e 47.4.
Habitat monitoring and landscape connections: National Park Service.

Scope: College Board APES CED, Topic 9.10, EIN-4.C.1-6, pp. 192-193.