From population decline to extinction risk

Endangerment describes a risk, not an inevitable outcome. A species may recover if the pressures causing its decline are reduced before its remaining populations disappear.

1. KEEP THE STATUS TERMS DISTINCT

ENDANGERED	Under the U.S. ESA: facing extinction danger across its entire range or a significant part of that range.
THREATENED	Under the U.S. ESA: expected to reach endangered status in the foreseeable future across all or a significant part of its range.
EXTINCT	No living individuals remain anywhere. Extirpation is disappearance from one area, not from the whole planet.

Threatened and endangered are not interchangeable; criteria differ among assessment systems.

2. LOSS OF HABITAT AND RESOURCES

Habitat destruction removes food, shelter and breeding sites. Fragmentation splits remaining habitat into smaller patches and can block movement. Competition for limited food, territory or breeding space can reduce survival and reproduction; invasive species may intensify that competition.

3. MORTALITY CAN EXCEED REPLACEMENT

Overharvesting can remove individuals faster than reproduction replaces them. Pollution, introduced predators or disease, and climate change may add further pressure. Several threats often act together: a shrinking population may also be losing the habitat needed to recover.

A low count alone is not a complete assessment. Population trends, distribution, reproduction and the severity of ongoing threats help reveal extinction risk.

ESA status terminology: NOAA Fisheries, Endangered Species Act glossary.
Habitat loss, overharvesting and other threats: OpenStax, Biology 2e 47.3.

Scope: College Board APES CED, Topic 9.9, EIN-4.B.1-5, p. 191.

Why the same change has unequal effects

Species differ in diet, habitat needs, dispersal ability and reproductive biology. The same environmental change can leave one species relatively secure while pushing another toward extinction.

1. SPECIALISTS HAVE FEWER ALTERNATIVES

A species dependent on one food source or a very specific habitat may have few substitutes when that resource disappears. A broader diet or ability to reach suitable habitat elsewhere can reduce risk. Movement only helps if a safe route and usable destination exist.

2. SELECTIVE PRESSURE IS NOT A NEED TO CHANGE

VARIATION

Individuals differ in inherited traits.

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SELECTION

Conditions affect survival and reproductive success.

→

GENERATIONS

Advantageous heritable traits may become more common.

Predators, competitors and climate can act as selective pressures. Evolutionary adaptation occurs in populations over generations; an individual does not evolve because it needs to survive.

3. SMALL, ISOLATED POPULATIONS FACE EXTRA RISK

A storm or disease outbreak can remove a large share of a small population. Genetic drift can eliminate genetic variation, while mating among relatives can expose harmful recessive alleles. Reduced diversity can limit future adaptive responses. Restoring gene flow may help, but does not remove habitat threats.

Behavioral flexibility and evolutionary adaptation are different responses. Neither guarantees rescue if conditions change too quickly or suitable genetic variation is absent.

Diet, habitat needs and movement: College Board, EIN-4.B.1-4.
Selection and inherited variation: OpenStax, Biology 2e 19.3.
Small-population risk and gene flow: National Park Service, Bison Population Vitality Study.

Scope: College Board APES CED, Topic 9.9, EIN-4.B.1-5, p. 191.

Match conservation to the cause of decline

Protecting individuals is most effective when the habitat and ecological relationships needed for long-term survival are protected too. Conservation must address the actual limiting pressures.

1. LINK EACH ACTION TO A BIOLOGICAL BENEFIT

HABITAT LOSS	Protect and restore feeding and breeding areas so populations retain resources needed for survival and reproduction.
FRAGMENTATION	Maintain suitable connections between habitat patches to support movement, access to mates and gene flow.
OVEREXPLOITATION	Prohibit poaching and enforce harvest or trade restrictions to reduce avoidable deaths and removal of breeders.
INVASIVE SPECIES	Control the damaging invader to reduce competition or predation; check for unintended effects on native species.

Trade-off: a corridor can also carry disease or invasive organisms. Its design must match the species and landscape.

2. LEGISLATION SUPPORTS CONSERVATION

The U.S. Endangered Species Act provides protection for listed plants and animals and their habitats. It requires federal agencies to avoid actions that jeopardize listed species or damage designated critical habitat. Effective protection also needs implementation, enforcement and recovery work.

3. VERIFY THAT THE POPULATION IS RECOVERING

Track survival, breeding success, population trends and habitat quality over time. A short-term increase does not prove lasting recovery. Captive breeding may support some species, but release will not solve a problem if the original threats remain.

Habitat conservation, corridors and captive breeding: OpenStax, Biology 2e 47.4.
U.S. legal framework: EPA, Summary of the Endangered Species Act.

Scope: College Board APES CED, Topic 9.9, EIN-4.B.1-5, p. 191.