Why protect biodiversity?

Conservation protects and manages genetic diversity, species and ecosystems. Local extinction removes a population from an area; global extinction means that no members of the species remain anywhere.

1. CONNECT EACH THREAT TO POPULATION DECLINE

Habitat loss / damage	Clearing, fragmentation or pollution reduces food, shelter and breeding sites; isolated populations may lose gene flow.
Climate change	Conditions shift beyond tolerance limits or disrupt seasonal interactions. Species may not migrate or adapt fast enough.
Hunting / harvesting	Removal faster than replacement by reproduction reduces population size; loss of breeding adults is especially damaging.
Competition	Competitors reduce access to limited resources. Native species may be displaced when an introduced species spreads.

Small, isolated populations are also vulnerable to chance events, inbreeding and loss of alleles through genetic drift. Threats can reinforce one another.

2. KEEP ECOLOGICAL, PRACTICAL AND ETHICAL REASONS

A. Ecosystem functions	Pollination, nutrient cycling and food-web interactions support functioning ecosystems.
B. Resources and options	Species provide food, medicines and useful alleles for breeding; losses can remove future possibilities.
C. Human and intrinsic value	Biodiversity has cultural, recreational and economic value. Ethical arguments recognise other species and future generations.

Threat mechanisms: OpenStax, Biology 2e 47.3.
Biodiversity values: OpenStax, Biology 2e 47.2.

Cambridge Biology 9700 syllabus: 18.3.1-6, p. 46.

Protect habitats and keep backups

In situ means conservation in the natural habitat. Ex situ means conservation outside it. These approaches can support each other; keeping specimens alone does not protect their ecosystem.

1. IN SITU: CONSERVED AREAS

National parks and marine parks protect habitats and interacting species. Management can restore damaged habitats, limit harvesting and reduce disturbance. Protection needs enforcement, monitoring and local participation; boundaries alone cannot stop pollution, climate change or illegal hunting.

2. EX SITU: MATCH THE COLLECTION TO ITS ROLE

Zoos	Managed breeding can support threatened animal populations, research, education and suitable reintroductions. Use breeding records to limit inbreeding.
Botanic gardens	Maintain living plant collections for propagation, research and education. They can supply plants for restoration and hold species unsuitable for seed storage.
Seed banks	Dry and store suitable seeds at low temperature, sample diverse parent plants and test viability. Not all seeds tolerate drying or freezing.
Frozen zoos	Cryopreserve living cells, gametes or embryos for research and potential future breeding. They store biological material, not whole frozen animals.

A backup has limits: collections contain only sampled diversity and require long-term care. Reintroduction also needs suitable habitat and control of the original threats.

Protected areas and zoo conservation: OpenStax, Biology 2e 47.4.
Seed conservation: Kew, Millennium Seed Bank.
Cryopreserved collections: San Diego Zoo Wildlife Alliance, Frozen Zoo.

Cambridge Biology 9700 syllabus: 18.3.1-6, p. 46.

Assisted reproduction

IVF, embryo transfer and surrogacy can help endangered mammals reproduce when natural mating is difficult. They are distinct stages, not three names for fertilisation.

1. FOLLOW THE PROCESS AND TRACK THE PARENTS

A. Collect gametes

Obtain mature eggs from a donor female and sperm from a selected male. Stored sperm may be used after thawing.

B. IVF: outside the body

Fertilise an egg with sperm under laboratory conditions. Culture the resulting embryo through early development.

C. Embryo transfer

Place an embryo into the uterus of a suitably prepared recipient female. Transfer does not guarantee implantation.

D. Surrogacy

The recipient carries the developing offspring and gives birth. In this embryo-transfer route, the surrogate does not supply the egg.

2. RETAIN GENETIC DIVERSITY

The embryo inherits nuclear alleles from the egg and sperm donors, not the surrogate in this route. Selecting less-related donors can reduce inbreeding and preserve rare alleles; IVF does not automatically create new alleles.

Limits: few suitable donors, species-specific methods, cost and animal-welfare considerations. Success means more than producing embryos: healthy offspring, breeding populations and safe habitat are still needed.

Conservation IVF, embryo development and surrogates: BioRescue FAQ.
Banked reproductive material: San Diego Zoo Wildlife Alliance, Frozen Zoo.

Cambridge Biology 9700 syllabus: 18.3.1-6, p. 46.

Coordinate conservation action

Species recovery usually needs several actions together: reduce the threat, protect habitat, retain genetic diversity and check whether populations actually recover.

1. CONTROL INVASIVE ALIEN SPECIES

Alien species occur outside their natural range following human introduction. Invasive alien species spread and cause harm; not every introduced species is invasive. They may compete with native species, prey on them, spread disease or alter habitats. Prevention and early detection can avoid widespread damage. Control must consider effects on non-target species.

2. IUCN AND CITES HAVE DIFFERENT ROLES

IUCN: assess and guide

The International Union for Conservation of Nature brings together conservation expertise. Its Red List assesses extinction risk and records threats, distribution and conservation needs, helping identify priorities.

CITES: regulate international trade

The Convention on International Trade in Endangered Species of Wild Fauna and Flora is an agreement between governments. It regulates trade in listed wildlife and their products so that international trade does not threaten species survival.

3. CHOOSE ACTIONS THAT ADDRESS THE CAUSE

A population declining because of habitat loss needs habitat protection or restoration, not only a breeding programme. Trade controls help with international exploitation, but do not directly solve every local threat.

Monitor abundance, breeding success, genetic diversity and habitat condition. Adapt management and work with local communities so protection remains effective over time.

Invasive alien species and prevention: IUCN.
Red List assessments: IUCN Red List supporting information.
International wildlife trade agreement: CITES glossary.

Cambridge Biology 9700 syllabus: 18.3.1-6, p. 46.