

THE IN A HURRY SERIES

Conservation

in a Hurry

Saving what's left, and why

Max Brocklesby

BOOKSINAHURRY.COM

Contents

The Whole Thing in One Page 4

Why You Should Care 5

The Core Ideas 7

How It Actually Works 21

What People Get Wrong 30

Use It 35

Terms 39

Go Deeper 45

Notes and Sources 46

Bibliography 54

The Whole Thing in One Page

Conservation is usually pictured as an ark: a few rare animals carried to safety while the flood rises around them. The image flatters human rescue and shrinks the problem. Conservation also deals in plants, fungi, rivers, grasslands, genetic variation and ecological processes, much of it with no photogenic survivor at the centre. Its practical job is to find why living systems are losing abundance, range, variation or connection, then change the pressure, rule or incentive that keeps the loss going.

Extinction is the final entry in a long account. Before the last individual dies, populations contract, become isolated and lose choices. A bad breeding season, one fire or a new disease then matters more than it would in a large, connected population. Decline can begin reinforcing itself. Conservation tries to interrupt that process early enough for recovery to remain possible.

The immediate causes are familiar: land and sea use change, direct exploitation, climate change, pollution and invasive alien species. Those labels are only a start. A forest can disappear because a road changes land prices. A seabird can fail because rats eat its eggs. A condor can be bred successfully and still die after feeding on lead-contaminated carrion. The intervention must fit the mechanism.

Protected areas are one answer, but a line on a map protects nothing by itself. A reserve is a set of rights, restrictions, budgets, staff, relationships and enforcement. It must include the right places, remain connected to the wider landscape and be governed in ways that people can live with. A paper park is geography without power.

Species recovery follows the same logic. Captive breeding, nest boxes, predator control, habitat repair, harvest limits, legal protection and translocation are tools, not victories. The question is which bottleneck prevents the population from replacing itself in the wild. Remove the wrong threat and the decline continues politely beneath the programme.

Conservation also has to cross property lines, roads, borders and generations. Animals move, rivers carry effects, genes travel and climates shift. Corridors can help, but only when the intended organisms use them and survive the journey. The geometry of a landscape can decide whether isolated successes add up to persistence.

Then come the people. Conservation redistributes access, risk, income and authority. It can defend local rights or violate them. It can make wildlife valuable to the people living beside it, or ask those people to bear concentrated costs for benefits enjoyed elsewhere. Durable programmes treat communities and Indigenous Peoples as rights-holders and decision-makers, not obstacles to be managed.

Why save any of it? Nature supports food, water, health, climate regulation and livelihoods. It also carries histories, identities and relationships that markets cannot price. And many people hold that other forms of life have worth beyond their usefulness to us. These reasons overlap, but none can replace all the others.

Money, time and political attention are finite, so conservation must choose. Good triage does not ask which species deserves to exist. It makes goals explicit, compares costs, benefits, chances of success and urgency, and tries to keep the largest set of future options open. The narrowing of options creates the crisis. Preserving options is the work.

That is the book.

Why You Should Care

In 1980, the entire black robin population consisted of five birds on a small island in the Chatham archipelago. Only one pair could breed. Conservation staff moved the birds, placed eggs and chicks with Chatham Island tomtits as surrogate carers and induced females to lay again. Every black robin alive today descends from the last fertile female, Old Blue. By August 2025 the population had reached 445, and the new problem was finding enough predator-free habitat for the recovery to continue.

That story contains both the promise and the warning. Human action can prevent an extinction that once seemed unavoidable. It can also move the constraint rather than end it. First the problem was too few eggs. Then it was too little genetic variation and suitable habitat. Recovery is not a moment when the graph turns upward. It is a sequence of bottlenecks, each of which has to be understood before the next one appears.

This matters because the global picture is easy to misread. The IUCN Red List Version 2026-1 contains assessments for 175,909 species, of which 49,505 are classified as threatened, yet well under one in ten described species has had its extinction risk evaluated. The list is indispensable and incomplete. IPBES estimates that roughly one million animal and plant species face extinction, many within decades, under current pressures. The exact total is uncertain. The direction is not.

The same evidence gives a reason against fatalism. A 2024 synthesis of 186 studies and 665 trials found that conservation action improved biodiversity or slowed its decline in about two thirds of comparisons with inaction. Protected areas, habitat restoration, invasive-species control, sustainable use and species management often work. The failure is not that intervention is futile. It is that successful action remains too small, too short-lived or badly matched to the forces driving loss.

Conservation changes what you notice. A rare bird is no longer an isolated victim. It is a population with a birth rate, a death rate, a range, a gene pool, a food supply and a set of threats. A national park becomes a governing arrangement rather than green paint on a map. A wildlife crossing becomes a testable claim about movement, survival and gene flow. A subsidy becomes ecological policy whether or not the finance ministry calls it that.

The subject reaches ordinary decisions faster than its wildlife imagery suggests. Housing, roads, farms, fishing rules, pesticides, flood control, trade and public budgets all decide which populations retain room to recover. Conservation is often present when nobody uses the word: in a planning condition, a seasonal closure, a culvert design or a rule about what may cross a border.

It also forces a harder question: why should anything be saved? One answer is use. Pollinators, fisheries, forests, wetlands and soils contribute to human welfare. Another is relationship. Species and places carry memory, identity, kinship, beauty and obligations between generations. A third is intrinsic worth: the judgement that a living lineage should not need to earn its continued existence through service to humans. Conservation becomes distorted when one answer tries to swallow the others.

There are limits. Conservation cannot preserve every historical arrangement in a changing climate. It cannot repair every loss, remove every conflict or turn political choices into neutral science. Protection can dispossess people. Recovery can create animal-welfare problems. Money spent on one intervention cannot be spent twice. Some decisions remain tragic even after the evidence is good.

But the subject is not a catalogue of decline. It is the study of how losses become avoidable. Once you can see the driver, the bottleneck, the boundary, the rights and the counterfactual, the future stops looking like a single line. It becomes a set of choices, and choices can still be changed.

The Core Ideas

Extinction Is a Process, Not a Last Death

The last individual attracts the camera. Conservation begins much earlier, when a population starts losing the properties that let it survive ordinary bad luck.

Abundance is the obvious one. In a large population, a dry year or failed breeding season may leave thousands of survivors. In a small population, the same proportional shock can remove every breeding female. Chance also acts through births and deaths. Ten animals do not produce five males and five females on schedule. They may produce eight males, or no young at all. The arithmetic becomes noisy precisely when error is least affordable.

Range matters separately. A species spread across several places can

survive a local fire, storm, epidemic or political failure. The same number crowded into one site has placed its whole future behind one door. Genetic variation matters because close relatives are more likely to carry matching copies of harmful recessive variants, and because a narrow gene pool can limit future adaptation. Connection matters because immigrants can replace lost individuals and restore variation. Conservation therefore tracks more than a head count. It asks how many populations exist, where they are, whether they breed and whether individuals can move among them.

A species can also remain globally present while vanishing from most of the places where it once mattered. Conservation calls a local disappearance extirpation. Ecological function may fade even sooner: a pollinator can become too scarce to service plants, or a large herbivore too rare to shape vegetation, long before its species approaches the final individual. Presence is therefore a weak measure of security. A name on a checklist says little about abundance, distribution or role.

This is why conservation cannot be organised only around species already close to extinction. Once-common organisms can decline across huge areas while remaining formally secure at the global level. Their loss can remove pollination, seed dispersal, grazing, predation or nutrient movement long before a Red List category becomes alarming. Preventive conservation often looks less dramatic because it protects abundance before emergency status arrives. It may mean retaining ordinary habitat, reducing routine mortality or keeping several healthy populations instead of attempting to rebuild one remnant later. The cheapest rescue is frequently the decline that never becomes a rescue case.

Smallness can then create new causes of decline. Individuals may struggle to find mates. Cooperative hunters or group defenders may fall below the number needed to function. Pollinators may cease visiting a plant that has become too sparse. This is an Allee effect: per-individual success falls as the population becomes rarer. Inbreeding, skewed sex ratios, chance events and lost social behaviour can join it in an extinction vortex, where decline makes further decline more likely.

The heath hen shows the trap. Once common along the eastern coast of North America, it survived by the late nineteenth century only on Martha's Vineyard. Protection allowed the remnant population to rebound into the thousands. That looked like rescue. Yet every bird remained on one island. Fire, a severe winter, predators, disease, habitat change and a worsening sex ratio struck a population with no second refuge. The last male, nicknamed Booming Ben, disappeared in 1932.

The lesson is not that small populations are doomed. Black robins and Mauritius kestrels prove otherwise. It is that the last death is a lagging indicator. A species can still be present after its safety margins have gone.

This changes the job. Conservation must preserve or rebuild abundance, range, variation and connection before emergency husbandry becomes the only option. It also explains why waiting for certainty is dangerous. Evidence improves as decline becomes visible, but the biological room for action shrinks at the same time. The most important threshold may be crossed before anyone can name it precisely.

Threats Are Mechanisms, Not Labels

A threat list can create the illusion of explanation. Habitat loss, overexploitation, climate change, pollution and invasive alien species are the five direct drivers with the largest global impact identified by IPBES. Each category contains many different causal chains, and no intervention follows from the label alone.

Take habitat loss. A wetland may be drained for housing, cut off from its river by a flood wall, deprived of water by upstream abstraction or made unsuitable by nutrient runoff while remaining coloured blue on a map. The visible result is less usable habitat. The remedies are different: planning refusal, restored flooding, water allocation, pollution control or changed farming practice. Buying the remaining patch will not repair a severed water regime.

Direct exploitation can mean hunting, fishing, logging, collecting plants or killing animals caught unintentionally. An albatross drowned on a baited

longline requires different action from an elephant killed for ivory. One may be reduced by weighted lines, bird-scaring devices and fishing at night. The other may require enforcement, demand reduction, local security, intelligence and changes to the value of living wildlife. Calling both overexploitation is correct and operationally thin.

Invasive species make the distinction sharper. On an oceanic island, rats may eat seabird eggs, goats may strip vegetation and an introduced plant may prevent native seedlings from replacing old trees. Eradicating a rat from a small island can remove the main bottleneck in a single campaign. On a continent, eradication may be impossible and permanent control more realistic. A programme that attacks the most visible invader can fail if another one is holding the system in its altered state.

The same driver can sit several steps away from the victim. A road opens access, raises land values and makes clearing profitable. A subsidy makes fishing effort cheaper. A trade rule rewards a crop that replaces forest. A pesticide removes insects, then food disappears for birds. Conservationists distinguish direct pressures from the institutions, markets and behaviours producing them because the durable intervention may belong in a finance ministry, port, planning office or supply chain rather than in the reserve.

Diagnosis draws on several kinds of evidence. Field counts show where decline occurs. Tracking reveals migration routes and mortality points. Necropsies identify toxins, disease or trauma. Genetics can expose isolation. Remote sensing can show habitat change at scales no field team could walk. Interviews, harvest records and local knowledge can reveal pressures hidden from formal surveys. Each method sees a different part of the chain, and agreement among them is stronger than a single persuasive story.

Threats also combine. Climate change can make fire more severe, fragmented habitat can block movement towards cooler areas, and an invasive grass can supply the fuel. Removing one pressure may help without reversing decline. That is not proof the action was useless. It is evidence that the causal model was incomplete.

Good conservation therefore writes a chain: this activity changes this condition, which alters survival or reproduction through this pathway. Each link creates a place to intervene and a claim to test. The animal on the poster is the endpoint. The work begins upstream.

A Protected Area Is a Rule, Not a Fence

A protected area looks solid on a map. On the ground it is an agreement about what may happen, who decides, who benefits, who is excluded and whether anybody can enforce the answer.

The modern national park became one of conservation's strongest inventions and one of its deepest sources of injustice. Yellowstone was established in 1872 as a public park, but the land was not empty. The National Park Service now recognises 27 associated Tribes with ancestral and modern connections to the area, and its own historical account links the park's creation to forced Indigenous removal. The model of wilderness without people often protected scenery by erasing the people who had shaped and used it.

That history does not make protected areas dispensable. It makes governance part of conservation performance. Some places need strict limits on extraction. Others support sustainable use, customary management, tourism, fishing or grazing compatible with the conservation goal. IUCN categories recognise this range. Other effective area-based conservation measures, or OECMs, recognise places not designated as protected areas whose governance nonetheless produces lasting biodiversity outcomes.

The global commitment known as 30 by 30 reflects the scale of the need. Under the Kunming-Montreal Global Biodiversity Framework, governments agreed to conserve at least 30 per cent of land, inland water and sea by 2030. The full target is more demanding than the slogan. Areas should be effectively conserved, ecologically representative, well-connected and equitably governed, with Indigenous and traditional territories recognised where appropriate.

The 2024 Protected Planet Report found official coverage of 17.6 per cent on land and inland waters and 8.4 per cent in marine and coastal areas. Coverage is the easiest part to count. Only 8.52 per cent of land was both protected and connected under the report's indicator, while 32 per cent of Key Biodiversity Areas lay wholly outside protected and conserved areas. Site-level governance assessments reported to the global databases covered only 0.22 per cent of the protected and conserved area on land and 0.001 per cent at sea. The map is far more complete than the evidence about how many of those places are equitably governed and producing durable biodiversity outcomes.

Placement is as important as acreage. Protecting a cheap, remote area can raise the national percentage while missing breeding grounds, freshwater flows, lowland forests or coastal nurseries. Representation asks whether the network includes the different ecosystems and species it claims to conserve. Effectiveness asks whether populations and habitats are better off than they would have been without designation. Those tests are harder than drawing polygons and therefore easier to avoid.

This is the paper-park problem. A government can draw a boundary where political resistance is low, announce a percentage and provide no staff, budget or control over mining, hunting or fishing. It can protect rock and ice while more contested lowlands, rivers or coasts remain exposed. Harm can also leak across the line or move elsewhere. A forest reserve does not stop a road outside it from isolating animals, nor a marine boundary stop pollution arriving with the current.

A working protected area has an explicit purpose, legal authority, resources, local legitimacy, monitoring and a place within a wider landscape. The boundary matters because rules change there. The rules matter because the boundary cannot act.

Recovery Means Removing the Bottleneck

A species can be numerous in captivity and unable to sustain itself in the wild. Conservation has not finished until the causal obstacle to wild survival or reproduction has been reduced enough for the population to persist.

The California condor makes the distinction visible. By 1982 only 23 survived, and in 1987 every remaining wild bird was brought into captivity. Breeding succeeded. Releases began in 1992, and the combined captive and free-flying population has since grown beyond 500. Yet the recovery programme still identifies lead poisoning from spent ammunition as the primary cause of death in the wild and the greatest obstacle to self-sustaining populations. Breeding more condors treats the shortage of condors. It does not remove the lead in carrion.

The same logic applies when the organism has no cage, nest box or public following. In May 2026, Kew reported receiving 29 seeds from the last known wild *Dendroseris nerifolia*, a tree daisy clinging to a cliff on Robinson Crusoe Island in Chile. Eight had germinated. That is valuable insurance, not wild recovery. The plant's future still depends on producing viable descendants and securing conditions in which a population can exist outside cultivation. Seed banks and living collections can prevent biological information from vanishing while habitat work catches up. They cannot turn storage into persistence by definition.

This is why conservation uses a toolbox rather than one heroic technique. Legal protection can stop deliberate killing. Habitat purchase can secure breeding sites. Predator control can raise nest success. Supplementary feeding can bridge a shortage. Nest boxes can replace lost cavities. Captive breeding can increase numbers. Translocation can establish a second population. Genetic rescue can restore variation. Trade controls can reduce extraction. None is inherently the right tool. The right tool changes the demographic rate that is preventing recovery.

Finding that rate requires more precision than saying a species is threatened. Is adult survival too low, or are too few young produced? Are

eggs failing, juveniles dying or breeding adults unable to find mates? Does habitat exist but remain unreachable? Is food scarce throughout the year or during one season? The answer can overturn an attractive plan. Planting habitat may be pointless if adults are killed on migration. Protecting nests may add little if juveniles cannot survive their first winter.

Law can change the bottleneck when biology alone cannot. The Convention on International Trade in Endangered Species, CITES, regulates cross-border trade through permits and restrictions rather than banning every listed trade. Domestic endangered-species laws can prohibit killing, require recovery plans, protect habitat and force public agencies to consider damage before approving projects. These rules work when enforcement, courts, funding and political support make them credible. A species does not read the statute, but the people altering its survival do.

Recovery also requires a goal. Avoiding extinction is a minimum, not an endpoint. Under the United States Endangered Species Act, recovery means improving a listed species until the law's protection is no longer necessary for survival. That demands multiple robust populations, manageable threats and enough certainty that emergency intervention can decline. Other programmes may aim to restore ecological function, cultural relationships or a former range. Different goals require different evidence.

Some species remain conservation-reliant. Their habitat depends on mowing, grazing, burning or water management; an invasive predator returns whenever control stops; a migration route continues through dangerous infrastructure. Continued management is not failure if the altered world has removed the conditions for independence. The honest question is whether the commitment and funding exist for as long as the dependency lasts.

The bottleneck principle prevents rescue theatre. Count the wild outcome, locate the limiting process and keep following the chain until the population can replace itself under real conditions. A breeding centre is valuable when it buys time to repair the world outside it. Without that repair, it is an archive with a pulse.

Landscapes Have Geometry

A habitat patch can contain everything an animal needs and still fail because the animal cannot reach it. Conservation therefore cares about shape, distance, barriers and the quality of the land between protected places.

Fragmentation does two things at once. It reduces total habitat and divides what remains. A road may remove little area yet create noise, mortality and a barrier to movement. A dam can leave river habitat above and below while cutting the route between feeding and breeding grounds. Farms, cities and fences can turn a continuous population into small groups that each face greater risk. The pieces may look green from above and function like islands.

Movement connects them. Individuals disperse to find mates and territory. Migrants follow seasonal routes. Seeds travel with wind, water and animals. Gene flow can reduce inbreeding. A population lost from one patch can be replaced from another. In a metapopulation, local extinctions are expected; persistence depends on recolonisation outpacing loss. That makes the network, not any single patch, the conservation unit.

Corridors are one response. They can be continuous strips of habitat, stepping stones, fish passages, hedgerows, culverts or an entire working landscape made permeable enough for movement. A meta-analysis of corridor experiments found that connected patches received more movement than isolated ones on average. The average is not a design. Species differ in what they will enter, how far they travel and which risks they tolerate.

Banff National Park supplies the memorable object: a bridge for animals. Along the Trans-Canada Highway, Parks Canada combined fencing with 44 underpasses and overpasses across 82 kilometres. Wildlife-vehicle collisions fell by more than 80 per cent, and by more than 96 per cent for elk and deer. Monitoring also showed why concrete alone is not proof. Some wary species took years to use the crossings. Different animals preferred

different dimensions, and human use discouraged wildlife.

The land between formal habitats matters as much as the labelled corridor. Ecologists call it the matrix. A shaded coffee farm, hedgerow or lightly used forest can be permeable to some organisms, while an illuminated road, fence or bare field may be nearly absolute. Improving the matrix can connect more habitat than purchasing one narrow strip, and may spread benefits across an entire landscape. The useful geometry is species-specific and three-dimensional: rivers, tree canopies, soil, airspace and the dark of night can each carry a different route.

Use is only the first outcome. A crossing may record thousands of passages while contributing little to breeding or gene flow. It can also direct animals towards poor habitat. Corridors may spread fire, disease or invasive species as well as native organisms. Connectivity is therefore a hypothesis: this route will allow the right movement, at an acceptable cost, and improve the population outcome that matters.

Climate change raises the stakes without making movement easy. Suitable conditions shift, but cities, intensive farms, seawalls and borders remain fixed. A reserve designed around today's range can become a trap if species cannot move as temperature and rainfall change. Migratory species add jurisdictional geometry: a bird can be protected at its breeding site and lost at a stopover or wintering ground thousands of kilometres away.

The map must therefore show more than protected hectares. It must show flows, barriers, seasonal routes, mortality points, ownership and the likely future position of suitable habitat. Conservation succeeds in space when separate actions form a route rather than a collection of dots.

Conservation Is a Social Contract

Conservation changes who may use land, water and wildlife. That makes it political before it becomes technical.

The costs and benefits are often distributed in opposite ways. A predator's return can enrich a national landscape while one household loses livestock.

A wetland can reduce flood risk downstream while restricting cultivation beside it. A marine reserve may improve catches outside its boundary after several years while fishers bear the immediate closure. When benefits are broad and costs local, applause from elsewhere does not settle the arrangement.

Older protected-area models often treated people as contamination. Residents were removed, hunting and gathering were criminalised, and long-managed landscapes were described as untouched wilderness. This fortress approach could protect some habitats, but it also violated rights, destroyed knowledge and created hostility towards the institutions claiming to save nature. The global 30 by 30 target now includes equitable governance, recognition of Indigenous and traditional territories, and respect for rights because those are conservation conditions, not charitable additions.

Indigenous Peoples manage or hold tenure rights over at least 38 million square kilometres in 87 countries and politically distinct areas, more than a quarter of the world's land surface. Those lands intersect about 40 per cent of terrestrial protected areas and ecologically intact landscapes. The figure is conservative because tenure is incompletely recognised and mapped. Conservation cannot be scaled by treating the people already governing much of the world's remaining biodiversity as guests in their own territories.

Participation is not a meeting after the plan is written. It concerns authority: who sets the goal, controls information, receives revenue, enforces rules and can change the programme. A global assessment of protected areas found positive conservation and socioeconomic outcomes more often where local people were empowered, livelihood costs were reduced, cultural benefits maintained and governance shared. That does not prove every community arrangement works. It shows that exclusion carries ecological as well as moral risk.

Namibia's communal conservancies illustrate the institutional move. Legal reforms allowed organised communities on communal land to gain rights over wildlife management and tourism benefits. Conservancies could then

treat wildlife as an asset they had authority to manage rather than a state resource imposing crop damage, livestock loss and restrictions. The model has supported large areas outside formal parks, but it still depends on governance, fair benefit distribution, conflict management, tourism markets and external technical support. Devolution creates the possibility of alignment. It does not remove politics.

Knowledge is part of authority too. People who fish, herd, burn, gather or travel through a place can notice seasonal change and animal behaviour that short studies miss. Indigenous and local knowledge should not be treated as folklore awaiting scientific approval, nor romanticised as incapable of error. The practical question is whether different knowledge systems can be brought into decisions without stripping their holders of control or turning consultation into extraction.

There is no single local interest. Communities contain differences of wealth, gender, age, livelihood and power. A village leader may not represent women collecting fuelwood, mobile pastoralists, tenant farmers or people living nearest dangerous animals. Revenue can be captured by elites. Compensation can arrive late or reward the wrong behaviour. Tourism can collapse during a pandemic. Conservation must examine who within the word community gains and who carries the risk.

The social contract is therefore practical: rights recognised, costs acknowledged, benefits shared, decisions contestable and promises funded. Enforcement still matters. So do limits on use. Legitimacy does not guarantee ecological success, and local authority is not automatically equitable or sustainable. But rules imposed without credible rights, voice or benefit-sharing often create evasion, conflict and political fragility that can become conservation failures in their own right.

Scarcity Forces Choices

Conservation would be easier with one agreed value and unlimited money. It has neither.

People save nature for different reasons. Instrumental values concern what

nature does for human ends: food, water, materials, climate regulation, medicine, income and insurance against future need. Relational values arise from attachment, responsibility, identity, kinship and ways of living with a place or species. Intrinsic value is the judgement that other life has worth independent of service to humans. These categories can support the same action and conflict over another. A wetland may be protected as flood defence, sacred ground, bird habitat and a community's home. No single price captures the whole case.

Goals therefore need to be stated before projects are ranked. Is the aim to prevent extinctions, retain evolutionary history, protect ecological functions, represent every habitat type, support cultural relationships or secure services for people? Spending can look irrational only because two programmes are solving different problems. A tiny plant with no public profile may be irreplaceable in one country. A common wetland may protect far more species and people per pound. Both can be defensible under different goals.

Scarcity then becomes arithmetic. A project-prioritisation approach compares expected benefit, cost and likelihood of success, often adjusted for urgency, distinctiveness and the consequences of delay. This can reveal that several modest actions prevent more loss than one expensive rescue, or that a costly intervention is justified because no substitute exists. It can also expose charisma bias. Mammals and birds attract attention more readily than fungi, plants and invertebrates, even when the latter hold greater ecological or evolutionary distinctiveness.

The word triage alarms people because its medical origin implies leaving some patients untreated. In conservation, the alternative is rarely a world without triage. Choices are already made through political visibility, donor fashion, institutional history and whoever submits a proposal first. Explicit prioritisation makes those choices open to challenge. It can include equity, cultural obligation and uncertainty rather than pretending money alone decides.

Economics enters before the conservation budget is allocated.

Governments subsidise farming, fishing, energy, roads and extraction on a scale that can overwhelm spending on protection. The global biodiversity framework calls for harmful incentives to be reduced by at least 500 billion US dollars a year by 2030. Reforming one destructive incentive may prevent more loss than financing dozens of repairs downstream. Biodiversity offsets attempt the reverse transaction, allowing damage in one place to be compensated elsewhere, but evidence repeatedly shows how easily promised gains become delayed, partial or impossible. Some habitats and lineages are not replaceable units.

Triage can still be abused. A government may cite efficiency after starving conservation of funds. Low estimated success can become a reason to abandon neglected species whose chances are low because nobody invested earlier. Data-poor species can lose against well-studied ones. Cost-effectiveness can reward cheap action in places where land rights are weak or labour underpaid. Ethical judgement must sit inside the method, not be added after the spreadsheet prints a rank.

Evidence improves the choice but does not make it automatic. The 2024 global synthesis found positive effects in about two thirds of conservation comparisons, which means interventions often work and sometimes do not. Evidence databases now summarise thousands of actions, yet many species, regions and techniques remain poorly studied. Adaptive management treats an intervention as a decision with a prediction: act, monitor, compare, learn and change course. Failure that changes practice can be useful. Failure repeated because nobody measured it is only expensive.

This closes the book's causal loop. Decline narrows abundance, range, variation and connection until chance begins deciding the future. Scarcity narrows the human response too. Good prioritisation resists both forms of collapse by preserving options: more populations, more places, more genetic variation, more legitimate institutions and more routes for future action.

The deepest conservation question is therefore not which fragment

deserves to be placed in the ark. It is which decisions keep the living world from becoming a sequence of last chances.

How It Actually Works

Four birds and a decision

In 1974, fieldworkers could confirm only four Mauritius kestrels, including one breeding pair. The bird had lost most of its native forest. Rats, cats, mongooses and macaques reached nests or killed young. Pesticide use had added another pressure to a falcon already confined to one island. The numbers were so poor that a prominent conservation writer later used the kestrel as an example of a species that might be abandoned in favour of better prospects.

A count that small changes the texture of the work. Every nest matters. Every dead adult changes the breeding structure. A broken incubator, cyclone or funding delay can enter the population history. The line between research and management disappears because learning what the birds need may require handling the last individuals alive.

The rescue began by refusing to treat four as a verdict. Eggs were removed from wild nests and incubated, encouraging females to lay another clutch. Chicks were hand-reared, birds were bred and released, food was supplied, nests were watched and more than 300 kestrels were eventually reintroduced. Predator-resistant nest boxes improved breeding. Forest restoration expanded habitat. DDT use fell. The population rose into the hundreds.

Then came the second lesson. In one western population, monitoring and nest-box support were reduced after recovery appeared secure, partly because funding tightened. Numbers declined again, and the species was returned to a higher threat category in 2014. The same programme had demonstrated rescue, recovery and conservation dependence within a few decades.

Conservation works through that sequence. It detects change, defines what is being lost, identifies the driver, chooses an intervention, builds the authority to carry it out, measures whether the expected response occurs and keeps adapting until the system can persist at an agreed level. Every stage can fail while the project still looks busy.

Decide what the problem is

The first task is not action. It is definition.

What is declining: a species, a distinct population, genetic variation, a habitat, an ecological process or a cultural relationship with a place? The answer determines the unit of management. A widespread species may be secure globally and disappearing from one country. A plant may consist of several isolated lineages that look alike but are not interchangeable. A migratory fish cannot be conserved by counting adults at one spawning river if the sea phase is collapsing.

Conservation status is usually built from several measurements: population size and trend, geographic range, fragmentation, observed or projected decline, and quantitative extinction risk where data allow. The IUCN Red List turns those measurements into categories using published criteria. The categories are not a queue of moral worth. They are estimates of risk. Data Deficient does not mean safe, and Least Concern does not mean abundant everywhere.

The unit can also be larger than a species. Conservation may aim to retain an old-growth forest, a reef-building process, a migration, a seed bank or the range of genes within a crop's wild relatives. These goals overlap and can pull apart. Protecting one charismatic predator may help a wider habitat, but using it as an umbrella is a claim that needs evidence. Saving every named species in a degraded zoo-like remnant is different from preserving the interactions that made the place work.

A baseline is needed, but no baseline is neutral. Should a woodland be restored to the state before intensive farming, before colonial settlement, before a particular invasive species or before climate change shifted what

can grow there? Historical records may reveal former abundance while also recording a landscape already altered by people for centuries. Conservation goals should say which features matter and why rather than hide the choice behind the word natural.

The Mauritius kestrel goal could not be merely four becoming forty in cages. It required viable wild populations in suitable habitat, with enough breeding success and management capacity to survive. That definition made eggs, nest sites, predators, forest condition and long-term monitoring part of the same problem.

Build a causal account

Once the unit and goal are clear, the programme asks what controls the outcome now.

The simplest demographic identity is useful: a population changes through births, deaths, immigration and emigration. Fieldwork then looks for the rate that has shifted. Low nest success directs attention towards eggs, food and predators. High adult mortality may point towards hunting, roads, fishing gear, poison or disease. Loss of immigrants may reveal a barrier outside the breeding site. Poor recruitment can originate years earlier in a juvenile habitat nobody had protected.

Evidence arrives unevenly. Counts show trend but not cause. Tagged animals reveal movement and death locations but may represent a small sample. Camera traps record presence, not necessarily abundance. Environmental DNA can detect organisms without showing how many are alive. Satellite images expose land-cover change while missing hunting or chemical exposure beneath the canopy. Local observers may know when a species vanished from a valley long before any formal survey began. A causal account is strongest when methods with different weaknesses converge.

Uncertainty is part of the account rather than an excuse to postpone it. Population viability models can explore how survival, reproduction, catastrophes and management alter extinction risk, but their outputs depend

on sparse data and assumptions about the future. Managers use them to compare scenarios, identify sensitive rates and make uncertainty visible. A model that shows adult survival dominates the result can redirect effort even when it cannot predict an exact extinction date.

The chain often reaches beyond the conservation agency. Kestrel habitat was shaped by land use, introduced species and pesticide policy. Condor mortality leads to ammunition. Turtle bycatch leads to fishing gear and enforcement at sea. Forest clearance may lead to credit, tenure, roads or commodity prices. The direct pressure is biologically close to the species. The leverage point may be institutionally distant.

Conservation history records a gradual widening of this view. Early laws often protected game or restricted hunting. Parks set land aside. Twentieth-century programmes added pollution control, trade regulation and species recovery. CITES entered into force in 1975 to regulate international wildlife trade. The United States Endangered Species Act, enacted in 1973, joined listing to habitat, agency duties and recovery planning. Conservation biology emerged in the 1980s as a self-described crisis discipline concerned with small populations, habitat loss and extinction. Later conservation science paid greater attention to economics, governance, justice and coupled human-natural systems.

The job did not discard protection. It learned that protection without a causal model can preserve the setting of a decline.

Choose the intervention that matches the bottleneck

A good intervention has an explicit mechanism. It says what will change first and how that change should reach the outcome.

For the kestrel, removing eggs encouraged additional laying, which increased reproductive output. Artificial incubation and hand-rearing raised survival during the most vulnerable stage. Nest boxes reduced access by introduced predators. Supplementary food supported breeding. Releases created populations in restored habitat. Each action answered a different

bottleneck. The programme succeeded because the tools were combined in a sequence rather than defended as rival philosophies.

The wider menu is large. Protected areas restrict damaging use. Conservation easements or agreements change what can happen on private land. Harvest quotas, seasonal closures and gear changes reduce direct mortality. Invasive species can be eradicated from islands or controlled continuously on larger landscapes. Fire, grazing or mowing can maintain habitats that disappear under total exclusion. Rivers can be reconnected, wetlands rewetted and mines restored. Seeds, eggs, sperm and living animals can be kept outside the wild. Translocations can reinforce a population, restore a lost one or move organisms away from an imminent threat.

The mitigation hierarchy tries to keep this order honest. Avoid damage where possible, minimise what cannot be avoided, restore affected systems and consider compensation only for residual harm. In practice, pressure often runs the other way because avoidance can stop a profitable project while an offset allows it to proceed. The hierarchy matters because replacement is uncertain, delayed and sometimes biologically impossible. An ancient wetland or endemic lineage cannot be recreated on a convenient timetable.

Every tool carries side effects. Predator removal can release another prey or predator. Supplementary feeding can spread disease or alter behaviour. A translocation can move pathogens, mix unsuitable lineages or create conflict at the destination. Fire suppression can protect one season and increase fuel for a later disaster. A new reserve can shift extraction outside its boundary. Intervention design therefore includes risks, alternatives and a stopping rule.

The least intrusive action is not always the best. Leaving an invaded island alone can mean letting endemic birds disappear. Intensive handling can be justified when the alternative is extinction. The reverse is also true: technical rescue can absorb attention while the main pressure continues. The discipline is proportionality. Use enough control to change the bottleneck,

and no more than the goal and evidence justify.

Build the institution around the biology

A plan cannot operate without rights, money, staff and legitimacy.

Land ownership decides who can restore habitat. Fishing law decides whether a closure binds vessels. Customs officers decide whether trade rules have teeth. Courts decide whether habitat protection can stop a project. Budgets decide whether traps are checked, patrols run and data analysed after the launch photographs. Conservation outcomes often depend on administrative endurance more than biological novelty.

Jurisdiction must match the movement too. Migratory birds cross national borders, tuna move through several fisheries, rivers carry pollution between provinces and wildlife trade passes through producers, transit states and consumer markets. Treaties can coordinate rules, but implementation remains domestic. CITES permits affect international trade, not every local use. A legal chain is only as strong as identification, reporting, inspection, prosecution and cooperation along the route.

Financing must match the timescale. A three-year grant can start a programme whose obligations last for fifty years. Tourism revenue can support protection and collapse after a pandemic or political shock. Payments for ecosystem services can change landholder incentives and fail if contracts end before restored habitat matures. Endowments, public budgets, trust funds, licence fees, philanthropy and revenue-sharing can each help, but every source brings conditions and vulnerability.

The incentive system outside the project may be larger than the project itself. Governments can pay to restore wetlands while subsidising drainage, fund anti-poaching while permitting roads into remote habitat, or protect fish nurseries while supporting excess fishing capacity. The Kunming-Montreal framework's call to reduce harmful incentives by at least 500 billion US dollars a year by 2030 recognises that conservation cannot outspend a policy machine pointed the other way.

Legitimacy requires more than compensation. People affected by conservation need information, voice, recognised rights and a route to challenge decisions. Free, prior and informed consent has particular force where Indigenous rights and territories are involved. Co-management can combine state authority, local institutions and technical support. None of this removes disagreement. It decides how disagreement is handled and whether the people living with the outcome have power within the process.

For the kestrel, recovery depended on Mauritian institutions, local fieldworkers, international expertise, national-park designation and decades of attention. A nest box was a wooden object. Keeping thousands of small actions aligned around it was governance.

Measure against what would have happened

A rising population after intervention is encouraging and not yet proof.

Rainfall may have improved. A market may have collapsed. Disease may have receded. Counts may have become more thorough. To estimate effect, conservation needs a counterfactual: what would likely have happened without the action? The ideal design compares treated and untreated places before and after intervention. Random assignment is sometimes possible for nest boxes, plots or outreach methods. It is rarely possible for national parks, species rescues or river catchments. Conservation therefore combines experiments with matched comparison sites, time series, models and converging evidence.

Counting itself needs design. Animals are missed, plants remain dormant and rare species appear in bursts. Occupancy models separate detection from true absence. Mark-recapture estimates survival and movement from repeated encounters. Acoustic sensors, camera traps, satellite data and environmental DNA expand coverage while creating new biases. Monitoring plans choose methods according to the decision, not according to which device produces the most impressive map.

Measurement has to follow the mechanism. If fencing is meant to reduce road mortality, record collisions as well as crossing use. If a marine reserve

is meant to rebuild breeding biomass, measure age and size structure, not only the number of fish seen by divers. If community governance is meant to improve legitimacy, track who participates, who receives benefits and who loses access. A project can meet an activity target while missing the biological result.

Indicators should also be few enough to guide action. Measuring everything produces an archive rather than a decision system. A good set combines an outcome, such as population trend, with leading measures tied to the mechanism, such as nest survival, road mortality or invasive-predator detection. The leading signal can trigger action before the final outcome collapses.

Monitoring also catches harm. In India, physical removal of an invasive alga broke it into fragments and helped it spread, a failed intervention later used in the 2024 global conservation synthesis as an example of learning. Marine protection can increase predators and reduce a target prey species. A corridor can become a mortality trap. A captive-bred population can carry behaviours poorly suited to release. The possibility of surprise is a reason to monitor, not a reason to avoid action forever.

Adaptive management gives the learning a formal shape. State the prediction, act, measure, compare and alter the next decision. It is often described as learning by doing, but ordinary improvisation is not enough. Without recorded assumptions and thresholds, managers can reinterpret any result as success. Useful adaptation decides in advance what evidence would trigger expansion, redesign, suspension or exit.

Know when recovery has become durable

Conservation ends badly when the project ends before the pressure does.

A species may cross a numerical threshold while remaining in one place, genetically narrow or dependent on annual intervention. A habitat may look restored while its water source, disturbance regime or surrounding land remains unsecured. A law can be repealed. A community agreement can lose legitimacy when leadership changes. Durability is a property of the

whole arrangement.

Climate change makes durability a moving target. A restored population may be secure under the recent climate and exposed under the next one. Plans increasingly examine future habitat, extreme events and whether movement is possible. This does not mean abandoning historical knowledge. It means separating the features that define the conservation value from the exact past arrangement in which they happened to occur.

Recovery criteria should therefore cover abundance, trend, distribution, threat control and the capacity to respond when conditions change. Post-delisting monitoring tests whether legal protection was removed too soon. Long-term finance covers recurring tasks. Redundancy matters: several populations, several trained teams, several sources of support. Programmes should also identify which interventions can decline and which are permanent obligations.

The Mauritius kestrel's later downturn is valuable because it corrected the story. The bird had not failed to recover, and the earlier work had not been wasted. Managers had learned that parts of the population remained dependent on monitoring, nest support and habitat management. Success changed the work from emergency multiplication to maintaining the conditions under which wild breeding could continue.

That is how conservation progresses. It rarely restores a lost past in one movement. It moves a system from imminent loss to managed persistence, then tests whether management can become lighter, broader or more secure. The goal is not a photograph of return. It is a future in which the next bad year is a problem rather than an ending.

How we know

Conservation evidence is assembled from interventions that cannot always be repeated under laboratory control. Strong claims therefore come from comparisons: before and after treatment, managed and unmanaged sites, released and unreleased populations, alternative policies, long time series and multiple methods aimed at the same mechanism.

The evidence base is uneven. Birds and mammals, wealthy countries and protected areas are studied more heavily than fungi, invertebrates, tropical systems and many governance arrangements. Successful projects are easier to publish and remember. A species may improve for reasons unrelated to the programme, while a useful intervention can look weak if external pressures intensify.

Systematic reviews and evidence databases reduce selective memory by assembling positive, negative and inconclusive results. The 2024 global meta-analysis found conservation beneficial in about two thirds of comparisons with inaction, a strong result that still leaves variation, failure and missing evidence. The safest conclusion is neither that conservation always works nor that decline proves it does not. Particular actions work under particular conditions, and those conditions must be measured.

What People Get Wrong

"Conservation means leaving nature alone"

The idea comes from a useful reaction against exploitation. Stop cutting, shooting, draining and building, and many populations recover. Protection from pressure remains one of conservation's strongest moves.

It is not a universal instruction. Many surviving habitats are products of long human management. Meadows can close into scrub without mowing or grazing. Fire-adapted systems can change when every burn is suppressed. Islands invaded by rats do not regain seabirds through patience. A plant reduced to one roadside verge may need seed collection, propagation and carefully timed disturbance. Climate change can shift suitable conditions faster than a fragmented population can move.

The error is to confuse low intervention with low human responsibility. Sometimes restraint removes the bottleneck. Sometimes past action has created a dependency that only further action can repair. Rewilding explores one process-led route towards less control, but conservation owns a wider toolkit, including intensive management where extinction risk demands it.

The test is causal. What happens under inaction, and is that the desired trajectory? Leaving a functioning system alone can be wise. Leaving an active threat alone is a decision in favour of the threat.

"Thirty per cent protected means thirty per cent safe"

Area is measurable, politically legible and easy to celebrate. It is also a poor summary of performance.

The global 30 by 30 target is a minimum design commitment, not a warranty covering every species inside the boundary. Its full wording requires effective conservation, ecological representation, connection and equitable governance. Those conditions turn a percentage into a functioning system. Without them, a country can protect acreage while missing the places where loss is concentrated.

Remote rock, ice or deep water may be cheap to designate. Lowland forest, rivers, migration routes and coastal nurseries are often biologically rich and economically contested. A marine park can exist in law while fishing continues because surveillance and enforcement are missing. A reserve can protect breeding habitat while a migration bottleneck remains outside it. Damage can also be displaced across the line.

Even a well-run reserve does not make its contents safe forever. Fire, disease, pollution and climate cross boundaries, and small populations remain vulnerable to chance. Coverage matters because habitat needs space. The correction is that space must contain the right features, operate under credible rules and connect to a wider landscape. Percentages count designation. Conservation must count persistence.

"Captive breeding saves a species"

Captive breeding can prevent the final loss of a lineage, increase numbers and supply animals for release. Black robins, condors, kestrels, oryx and many other recoveries would not exist without intensive husbandry.

The attractive mistake is to count births as recovery. A species can thrive

behind wire while the cause of its wild decline remains untouched. California condors now number more than 500 across captive and free-flying populations, yet lead poisoning from ammunition remains the main known cause of wild death and the largest obstacle to self-sustaining populations. More chicks do not remove contaminated carrion.

Captivity also brings its own risks: adaptation to managed conditions, loss of learned behaviour, disease, pedigree errors and a population too small to retain variation. Release sites may lack habitat or social acceptance. A translocation can turn a breeding success into a mortality event.

Ex situ conservation is therefore time bought, not the world repaired. It succeeds when breeding is joined to threat reduction, suitable habitat, careful release, monitoring and a path towards wild reproduction. The proper unit of success is not animals produced. It is a population that can persist outside the rescue machinery.

"A corridor is a strip of green on a map"

Corridors are persuasive because fragmentation is visible and connection sounds physical. Draw a band between two reserves, plant it and the landscape appears repaired.

Organisms do not move through symbols. A bat, frog, beetle, elephant and seed each perceive distance, cover, light, moisture, traffic and risk differently. Some need a continuous route. Others can cross stepping stones or a permeable farming matrix. A river connection can help fish and spread an invasive organism. A wooded strip can provide passage for one species and a predator lane towards another.

Banff's highway crossings worked because fencing, placement, species-specific design and decades of monitoring were combined. Wildlife-vehicle collisions fell sharply, yet some wary animals took years to use the structures. Even use does not prove improved breeding or gene flow.

A corridor is a claim about function: the intended organisms will move,

survive and improve the population outcome that matters. That claim needs evidence before and after construction. The correction matters because connectivity budgets can otherwise purchase attractive green lines while barriers remain where animals die.

"Local people are the enemy of nature"

People can overhunt, clear habitat, pollute water and introduce species. So can distant companies, state agencies, tourists, consumers and policies designed far from the damage. Turning local residence into the presumed cause is poor diagnosis.

The myth grew from a wilderness ideal that treated protected land as empty. In many places, parks were created through forced removal or restrictions on communities whose use long pre-dated the boundary. Exclusion could defend habitat and also destroy rights, livelihoods, knowledge and trust. Yellowstone's own current history acknowledges Indigenous occupation and forced removal from land later described as national wilderness.

Evidence does not support replacing one simplification with another. Communities are not automatically sustainable, united or fair. Local institutions can be captured by elites, and economic pressure can overwhelm customary restraint. Yet protected areas more often achieve joint social and conservation success when local people have authority, livelihood costs are reduced and cultural benefits maintained.

The useful question is not whether people belong in nature. They already do. It is who holds rights, who causes the pressure, who bears the cost and which governance arrangement can keep the conservation outcome legitimate over time.

"Nature pays for itself"

Wetlands reduce floods, forests store carbon, insects pollinate crops and wildlife supports tourism. Valuing these contributions can move nature from the margins of a budget into the decision that threatens it.

The slogan becomes false when it implies every species or habitat produces

a market return large enough to finance its own protection. Many benefits are public, delayed, uncertain or enjoyed far from the people carrying the cost. A rare snail may have little measurable economic value. A floodplain may be worth more intact to a city downstream than to the farmer asked not to cultivate it. Markets do not automatically transfer that value.

Pricing can also narrow the case. Instrumental value sits beside relational and intrinsic value. A sacred place, an inherited fishing practice or a lineage with no substitute should not have to win a cost-benefit contest against immediate extraction. Biodiversity offsets are especially prone to treating distinct places as exchangeable when restoration is slow or uncertain.

Finance is necessary, and incentives matter. The honest conclusion is that societies must often pay for conservation because nature cannot invoice all its beneficiaries. Something can be economically valuable without becoming profitable to protect.

"Triage means giving up"

The word suggests a queue in which somebody decides who will be left to die. That fear is reasonable. Prioritisation can hide austerity, bias against poorly studied species and political neglect presented as science.

Yet refusing the word does not remove the choices. Budgets, staff and time are finite. Decisions are made through donor preference, public charisma, institutional habit and the order in which emergencies arrive. Invisible triage is still triage, with fewer reasons recorded.

A transparent approach states the goal, then compares expected benefit, urgency, cost, likelihood of success, distinctiveness and what delay would close off. It may fund a cheap preventive action before an expensive rescue, or defend the expensive rescue because no other population exists. Equity and cultural obligation can be included. So can uncertainty and the value of learning.

Triage becomes abandonment when low funding is treated as a law of nature or when past neglect is used to justify future neglect. Used properly,

it is an argument for acting early and spending coherently. Its aim is to preserve the widest set of living options before every decision becomes an emergency choice between last populations.

Use It

Find the driver, not the victim

When a conservation campaign shows you a declining species, trace the causal chain backwards.

What changed first? Survival, reproduction, movement or habitat quality? What activity changed that rate? What rule, price, road, subsidy, technology or ownership arrangement made the activity likely? The useful intervention may sit several steps from the animal.

This lens prevents symbolic action. Planting flowers for insects may help in one place and distract from pesticide exposure, mowing dates or lost nesting sites in another. Releasing fish can raise numbers briefly while a dam still blocks migration. Cleaning a beach removes visible plastic while fishing gear continues killing animals offshore. The closer an action sits to the mechanism, the easier it is to explain what outcome should change.

Do not demand a single cause where pressures combine. Write the chain with alternatives and identify the rate most likely to limit recovery now. Then ask what evidence would show that rate has changed. A campaign can be emotionally accurate and causally weak. Conservation becomes serious when the diagnosis predicts the response.

Name the unit and the goal

The phrase save nature hides several possible jobs.

Are you trying to prevent the global extinction of a species, retain a local population, preserve genetic variation, maintain a migration, protect a habitat type or keep an ecological function? A programme can succeed at one and fail at another. A captive population may preserve a lineage while

losing its wild role. A common species may remain globally secure while a culturally important local population disappears.

State the goal in measurable terms and include a time horizon. More animals next year is different from a self-sustaining population across several sites. More protected hectares is different from improved habitat condition. A restored wetland can be judged by water regime, breeding success, flood storage, plant composition or all of them, but those measures are not interchangeable.

This lens also reveals value conflicts. One group may want historical species composition, another flood protection and another customary access. The disagreement cannot be solved by pretending everyone means the same thing by restoration. Naming the unit and goal creates an honest argument about trade-offs and identifies which evidence belongs in the decision.

Ask for the counterfactual

Every conservation claim should complete one sentence: compared with what?

A forest inside a reserve may still lose trees. The reserve can be effective if comparable unprotected forest would have lost far more. A population can rise after intervention because rainfall improved across the region. A community programme can report income without showing who would have earned what under another arrangement. Before-and-after evidence alone confuses time with cause.

Look for untreated comparison sites, matched populations, historical trends, randomised placement where possible or a model that makes its assumptions visible. Ask whether monitoring began before the intervention and whether detection effort changed. When comparison is impossible, seek several independent signals pointing to the same mechanism.

The counterfactual lens protects both criticism and praise. It stops a project claiming credit for favourable weather and stops an observer declaring

failure because decline continued under overwhelming external pressure. Conservation acts in damaged systems. Slowing loss can be a real result. The question is whether the action made the outcome better than the plausible alternative, by enough to justify its costs and risks.

Map power, costs and benefits

Draw the social map beside the habitat map.

Who has legal title, customary rights, enforcement power and practical control? Who loses access, income, time or safety? Who receives tourism revenue, flood protection, carbon payments, prestige or cleaner water? Which benefits arrive later, and which costs occur this week? Conservation proposals often become unstable because diffuse public gains are built on concentrated private losses.

Then look within categories. Local people are not one interest. Neither are farmers, fishers, Indigenous Peoples, businesses or government. A compensation scheme can reach landowners and miss tenants. A tourism enterprise can employ some households while restricting others. A protected area can recognise a community council whose decisions exclude women or mobile users.

This lens does not require every participant to approve every rule. Some harmful activity must be limited. It requires that rights and distribution are treated as part of the mechanism. If people living with wildlife carry the cost while outsiders claim the benefit, resistance is predictable. Durable conservation gives affected people authority, credible safeguards and a stake in persistence rather than relying on goodwill under permanent sacrifice.

Prefer moves that keep options open

Under uncertainty, favour actions that preserve future room to manoeuvre.

Preventing habitat destruction usually keeps more options than attempting to rebuild it later. Protecting several populations spreads risk. Maintaining connectivity allows movement. Conserving genetic variation retains possible

responses to disease and climate. Acting before numbers collapse avoids the high cost and narrow choices of captive rescue. Securing rights and long-term finance keeps institutions from disappearing when a grant ends.

Reversibility matters too. A trial closure can be expanded after monitoring. A poorly planned translocation may be impossible to undo. An offset that permits destruction today in exchange for uncertain habitat decades later closes one option before the replacement exists. The same reasoning supports staged action when evidence is weak: begin where harm is limited, measure leading indicators and set clear triggers for change.

Keeping options open is not indecision. Delay can close options fastest of all. The lens asks which action protects the most biological, legal and social pathways while the future remains uncertain. It is the practical form of the book's central idea: do not let every problem mature into a last chance.

The limits

Conservation cannot freeze the living world. Populations have always moved, communities have always changed and disturbance has always rearranged habitats. Climate change accelerates that motion and can make a historical target impossible in its former location. Choosing what to retain, move or allow to change involves judgement that data cannot supply alone.

The field also operates inside larger political economies. A reserve cannot fully compensate for consumption, infrastructure and subsidies that drive loss elsewhere. Technical projects can become a way to manage symptoms while avoiding land reform, regulation or changes in production. Conservation finance can create dependence on markets that value carbon or tourism while ignoring species without a saleable service.

Intervention carries moral costs. Killing invasive animals may protect endemic species and raise serious welfare questions. Captive breeding can subject the last individuals to handling and confinement. Predator recovery can impose fear and loss on livestock owners. Strict protection can violate rights. There are cases where every available path harms something of value.

Evidence has limits as well. Many actions lack strong evaluation, and the studied cases are not a random sample of the living world. Results travel poorly between species and places. Adaptive management can reduce uncertainty, but some mistakes are irreversible. Honesty about these limits should improve decisions, not become a ritual performed after the plan is fixed.

The one thing to keep

Keep the options open.

A species becomes endangered before it becomes rare enough for a poster. It loses populations, places, genetic variation, movement and the ordinary margin that lets life absorb a bad year. Human institutions narrow in parallel: habitat is built over, rights are ignored, budgets lock in, expertise leaves and every remaining action becomes expensive.

Conservation is the work of interrupting that narrowing. Protect early. Diagnose the driver. Repair the bottleneck. Connect what has been divided. Share authority with the people carrying the outcome. Measure against the world without the intervention. Spend scarce resources in ways that preserve future choices rather than reward the loudest emergency.

The last animal is memorable because nothing remains behind it. The more important conservation achievement is a future with no last animal in sight, because enough populations, habitats, relationships and institutions remain for chance to be ordinary again.

Terms

Biodiversity

Variation within genes, among species and across ecosystems. It matters because conservation can preserve one level while losing another, and no single species count captures the whole living system.

Conservation

Deliberate action to maintain, recover or manage biodiversity and the conditions supporting it. The word covers protection, sustainable use, restoration, species recovery, law, finance and governance.

Extinction

The global loss of a species or other taxonomic group. Confirmation can take years because failure to find the last survivor is not proof that none remains.

Extirpation

Local disappearance from part of a range while the species survives elsewhere. Repeated extirpations shrink distribution, ecological function and the sources from which lost populations might be restored.

Population

Individuals of the same species living and breeding within a defined place. Conservation usually acts on populations because births, deaths, movement and threats occur locally before global status changes.

Metapopulation

A network of local populations connected by dispersal. Some patches may lose the species temporarily, but the wider system can persist if recolonisation and movement continue.

Genetic diversity

Variation in inherited material within and among populations. It can reduce inbreeding risk, record distinct lineages and retain possible responses to disease, climate and other future change.

Inbreeding depression

Reduced survival or reproduction when close relatives breed and harmful recessive variants are expressed more often. Small isolated populations face greater risk, though severity differs among species.

Allee effect

A fall in per-individual success when a population becomes sparse. Mate finding, pollination, group defence or cooperation may fail, causing rarity itself to accelerate decline.

Extinction vortex

A self-reinforcing interaction among small population size, chance events, inbreeding, poor reproduction and further decline. The term explains why late rescue becomes difficult even after the original threat weakens.

Red List

The IUCN system assessing global extinction risk through published criteria based on population, range and decline. Its categories guide attention but do not rank moral worth or funding automatically.

Threatened

In Red List usage, species classified Vulnerable, Endangered or Critically Endangered. The word has a technical meaning here and should not be applied loosely to every declining population.

Data Deficient

A Red List category for species lacking enough information to assess risk. It does not mean low risk; uncertainty may conceal security, serious decline or both.

Habitat

The conditions and resources a species uses for survival and reproduction. Habitat is species-specific: the same forest, river or grassland can be suitable for one organism and unusable for another.

Fragmentation

The division of continuous habitat into smaller, separated pieces. It reduces area, increases edges and can block movement even when much of the original cover remains visible.

Edge effect

A change near a habitat boundary, such as altered light, wind, temperature, predators or human access. Small fragments contain proportionally more edge and less sheltered interior.

Connectivity

The degree to which organisms, genes or ecological processes can move through a landscape or seascape. Functional connectivity depends on behaviour and survival, not visual continuity alone.

Corridor

A route intended to connect habitat patches. It may be continuous habitat, stepping stones, a crossing structure or a permeable working landscape, and its effectiveness must be tested.

Matrix

The land or water surrounding focal habitat patches. Its permeability can determine whether a reserve network functions as connected habitat or as isolated islands.

Protected area

A geographically defined place governed to achieve long-term conservation. Designation is only the legal beginning; location, rules, resources, rights, management and outcomes determine performance.

OECM

An other effective area-based conservation measure: a place not necessarily designated as a protected area whose governance delivers sustained biodiversity outcomes. The result, rather than the label, is decisive.

Key Biodiversity Area

A site meeting global criteria for importance to biodiversity, including threatened species, unique assemblages or ecological processes. KBAs help direct protection towards biologically significant places rather than convenient acreage.

Critical habitat

Habitat considered necessary for the survival or recovery of a threatened species under a legal or planning system. Definitions and regulatory effects differ among jurisdictions.

In situ conservation

Conservation of species, habitats and genetic diversity in their natural or functioning environment. It keeps organisms within ecological relationships and is the main route to lasting wild persistence.

Ex situ conservation

Conservation outside the usual wild setting, including zoos, aquaria, botanic gardens, seed banks, tissue collections and captive breeding. It buys security or time but cannot replace habitat indefinitely.

Translocation

Deliberate movement of organisms for conservation. It includes reinforcement, reintroduction and assisted colonisation, each carrying ecological, genetic, disease, welfare and social risks.

Reintroduction

Release of a species into part of its former range from which it disappeared. Success requires threat control, suitable habitat, appropriate founders, monitoring and local legitimacy.

Invasive alien species

A non-native organism whose introduction and spread threaten biodiversity. Alien does not mean harmful by definition; invasion requires establishment, expansion and damaging effects in the new setting.

Adaptive management

Structured decision-making under uncertainty: predict, act, monitor, compare and revise. It differs from improvisation because assumptions, measures and triggers for change are stated in advance.

Conservation triage

Explicit prioritisation of actions under limited resources. Sound triage compares goals, benefits, costs, urgency, success and equity while guarding against hidden bias and underfunding disguised as necessity.

Go Deeper

Michelle Nijhuis, *Beloved Beasts: Fighting for Life in an Age of Extinction* (2021)

The accessible history. Nijhuis follows the modern conservation movement from early species campaigns through international institutions and present debates, keeping scientists, organisers and political conflict in view. It is especially good on how conservation widened from beloved animals towards populations, habitats and biodiversity without ever escaping the pull of charisma. Read it after this book for the people and institutional history compressed here. The emphasis is strongest on North American and international wildlife conservation, so it works best as a critical history of a movement rather than a complete global account.

Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (1949)

The ethical source. Leopold's essays move from close observation to the land ethic, an argument that soils, waters, plants and animals belong within the community of moral concern. The book remains one of the clearest explanations of why conservation cannot be reduced to profitable resources or isolated species. Some ecology and social assumptions carry their period, and the landscape is predominantly American. Read the final essays slowly. Their value lies less in a policy programme than in the change of membership they demand: humans as citizens of a living community rather than conquerors standing outside it.

Emma Marris, Rambunctious Garden: Saving Nature in a Post-Wild World (2011)

The challenge to the baseline. Marris attacks the idea that conservation should always restore a pristine state before people arrived, and examines novel ecosystems, assisted migration, urban nature and forms of management often excluded from traditional wilderness thinking. She is deliberately provocative, and readers may reject parts of her optimism about heavily altered systems. That disagreement is useful. The book forces a conservation plan to say what it values, which historical reference it has chosen and why a changed ecosystem should count as failure, success or something requiring a different category.

William J. Sutherland and colleagues, eds., What Works in Conservation 2021 (2021)

The evidence manual. This open-access reference assesses more than 2,500 conservation interventions from published studies, organised by species groups, habitats and management problems. It is not a narrative read and should not be treated as a machine that supplies universal answers. Use it when a proposed action sounds obvious: nest boxes, predator control, grazing changes, fire, translocation or habitat creation. The summaries show what has been tested, where evidence is thin and how often attractive practice outruns evaluation. It is the practical antidote to conservation by anecdote.

Notes and Sources

Current statistics, policies and species-status material were checked against authoritative sources on 11 August 2026. Counts in conservation change as assessments, surveys and legal records are updated. The manuscript therefore gives dated figures where movement would matter and avoids false precision where evidence is incomplete.

Sources for the opening and reader case

Black robin. New Zealand's Department of Conservation records five birds and one breeding pair in 1980, the descent of all living black robins from Old Blue, and a total population of 445 in August 2025. The recovery used intensive egg and chick transfer to Chatham Island tomtits, repeated laying, translocation and habitat work. The same 2025 update identifies limited food, habitat and genetic variation as continuing constraints. The example is used to show that recovery moves bottlenecks rather than ending them at one numerical threshold.

Red List figures. IUCN Red List Version 2026-1 reports 175,909 species assessed and 49,505 classified as threatened. Threatened here means Vulnerable, Endangered or Critically Endangered. The statement that fewer than one in ten described species have been evaluated reflects the gap between the more than two million formally described species and those assessed globally. Assessment coverage is highly uneven among taxonomic groups, so the Red List is an indispensable but incomplete sample of life.

One million species. The estimate that roughly one million animal and plant species face extinction comes from the 2019 IPBES Global Assessment. It is a synthesis across assessed groups, extrapolations and multiple lines of evidence rather than a census of one million named species. The manuscript retains the scale and makes the uncertainty explicit.

Do interventions work? Langhammer and colleagues analysed 186 studies containing 665 trials and found that conservation improved biodiversity or slowed decline in about two thirds of comparisons with inaction. Outcomes differed by intervention, place and design. The result supports conditional confidence, not a claim that every action succeeds.

Sources for the seven ideas

Small populations and extinction processes. The treatment of demographic chance, inbreeding, Allee effects, genetic variation and extinction vortices follows standard conservation genetics and population biology, especially Frankham, Ballou and Briscoe. Neutral genetic diversity is not presented as a universal proxy for extinction risk. Its importance depends on demographic history, functional variation and the mechanisms affecting survival and reproduction.

Heath hen. The remnant Martha's Vineyard population recovered under protection to roughly two thousand birds before a sequence of fire, severe weather, predation, disease, habitat change, skewed sex ratio and low genetic variation contributed to renewed decline. The last known male disappeared in 1932. No single factor is treated as a complete explanation. Johnson and Dunn provide evidence that low genetic variation preceded extinction.

Direct drivers. The five major direct drivers, land and sea use change, direct exploitation, climate change, pollution and invasive alien species, follow the IPBES Global Assessment. They are used as categories that require further causal diagnosis. Examples such as longline bycatch, introduced island predators, altered water regimes and policy incentives illustrate distinct mechanisms rather than imply one standard remedy.

Protected areas and rights. Yellowstone was established in 1872 on lands used and inhabited by Indigenous Peoples. The National Park Service identifies 27 associated Tribes and documents forced removal and exclusion. The example is used to show that protected-area history includes both ecological protection and dispossession.

Thirty by thirty. Target 3 of the Kunming-Montreal Global Biodiversity Framework calls for at least 30 per cent of terrestrial, inland water, marine and coastal areas to be effectively conserved and managed by 2030 through representative, connected and equitably governed systems of protected areas and other effective area-based conservation measures. It

also addresses the recognition of Indigenous and traditional territories where applicable. The manuscript preserves these qualitative requirements because the target is often reduced to acreage.

Protected Planet figures. UNEP-WCMC and IUCN reported that 17.6 per cent of terrestrial and inland-water areas and 8.4 per cent of marine and coastal areas were protected or conserved in 2024. Under the report's connectivity indicator, 8.52 per cent of land was both protected and connected, and 32 per cent of Key Biodiversity Areas lay wholly outside protected and conserved areas. Reported site-level governance assessments covered 0.22 per cent of protected and conserved area on land and 0.001 per cent at sea, illustrating the much larger evidence gap around governance and effectiveness.

California condor and plant ex situ conservation. The United States Fish and Wildlife Service records 23 surviving condors in 1982, the capture of all remaining wild birds by 1987, releases beginning in 1992 and a total free-flying and captive population above 500. Recovery-programme material identifies lead poisoning from spent ammunition as the main known cause of death in the wild and the central obstacle to self-sustaining populations. Royal Botanic Gardens, Kew reported in May 2026 that 29 seeds had been collected from the last known wild *Dendroseris neriifolia* on Robinson Crusoe Island and that eight had germinated at the Millennium Seed Bank. The paired examples separate ex situ survival from removal of the bottleneck in the wild.

Law. CITES was adopted in 1973 and entered into force in 1975. It regulates international trade through appendices, permits and restrictions rather than banning every trade in every listed species. The United States Endangered Species Act was enacted in 1973. Its recovery framework aims to improve a listed species until statutory protection is no longer necessary, supported by listing, habitat protection, agency duties, prohibitions and recovery planning. The manuscript does not imply that legal text works without enforcement, finance and institutional capacity.

Corridors. Gilbert-Norton and colleagues' meta-analysis found higher

movement between habitat patches connected by corridors than between isolated patches, with an average increase of about 50 per cent. The authors also warned that evidence was taxonomically and geographically limited. The manuscript treats connectivity as a species-specific hypothesis and distinguishes recorded movement from survival, reproduction and gene flow.

Banff crossings. Parks Canada reports 38 underpasses and six overpasses along 82 kilometres of the Trans-Canada Highway in Banff National Park. Fencing and crossings reduced wildlife-vehicle collisions by more than 80 per cent, and by more than 96 per cent for elk and deer. Monitoring found species-specific preferences and a learning period of up to five years for some wary animals.

Indigenous lands. Garnett and colleagues estimated that Indigenous Peoples manage or hold tenure rights over at least 38 million square kilometres in 87 countries and politically distinct areas, more than a quarter of the world's land surface. Those lands overlapped about 40 per cent of terrestrial protected areas and ecologically intact landscapes. The study describes a conservative spatial estimate, not a complete map of all customary tenure.

Protected-area governance. Oldekop and colleagues' global assessment found that protected areas were more likely to show joint positive social and conservation outcomes when local people were empowered, livelihood costs were reduced, cultural benefits were maintained and governance was shared. This is an association across heterogeneous cases, not proof that every community-governed project succeeds.

Namibian conservancies. Namibia's 1996 legal reform devolved specified wildlife-use and tourism rights to organised communities on communal land. NACSO records the growth of communal conservancies and their use of wildlife monitoring, tourism, hunting income, employment and benefit distribution. The manuscript includes the case as an institutional alignment, while retaining its reliance on governance quality, markets, conflict management and outside support.

Values. Instrumental, relational and intrinsic value are used in the broad sense developed across conservation ethics and reflected in the 2022 IPBES Values Assessment. The categories overlap and do not supply an automatic ranking. Their purpose is to show why a single market price cannot represent every reason for conservation.

Prioritisation. The project-prioritisation logic follows Joseph, Maloney and Possingham: expected conservation benefit is considered alongside feasibility and cost, with goals and constraints stated explicitly. The manuscript adds urgency, equity, cultural obligation, uncertainty and the consequences of delay because practical triage is an ethical and political choice as well as an optimisation problem.

Harmful incentives. Target 18 of the global biodiversity framework calls for harmful incentives to be identified and eliminated, phased out or reformed, with reductions of at least 500 billion US dollars a year by 2030, while positive incentives are scaled. The figure is a negotiated global target rather than a measured total already achieved.

Offsets. The global review by zu Ermgassen and colleagues found that ecological outcomes under no-net-loss policies were often inadequately documented and that successful replacement could be delayed, partial or uncertain. The manuscript therefore keeps avoidance above compensation and rejects the assumption that distinct habitats and lineages are always exchangeable.

Operating sequence and evidence

Mauritius kestrel. BirdLife International and the Mauritius Wildlife Foundation record four confirmed wild birds in 1974, including one breeding pair. Major pressures included forest loss and degradation, introduced predators and DDT. Recovery combined egg removal to induce further laying, artificial incubation, hand-rearing, releases, food support, nest monitoring, predator-resistant nest boxes and habitat restoration. More than 300 birds were released, and the total rose to roughly 500 to 600 in the early 2000s. Monitoring and nest-box support were later reduced in the western population, partly because of funding constraints, after which decline contributed to the species being moved back to Endangered in 2014. Recent estimates are around 350 wild birds. The case is used as a connected operating sequence rather than proof that the same recipe fits other species.

Conservation as a field. Soulé's 1985 description of conservation biology as a crisis discipline is a key historical marker. Kareiva and Marvier's later formulation of conservation science reflects the field's expansion towards human welfare, economics, institutions and social-ecological systems. The manuscript treats this as widening, not replacement of population and habitat science.

Translocations. The distinctions among reinforcement, reintroduction and assisted colonisation, together with disease, genetic, welfare and social risks, follow the IUCN Guidelines for Reintroductions and Other Conservation Translocations. Moving organisms is presented as a risk-assessed intervention rather than a neutral delivery operation.

Counterfactuals and monitoring. Nichols and Williams argue that monitoring should be designed around conservation decisions rather than data accumulation. The manuscript's emphasis on comparison, detection, demographic rates and explicit predictions follows that principle. Randomised experiments are useful where possible, but many conservation questions require matched sites, time series, quasi-experiments, models and converging evidence.

Failed actions. Langhammer and colleagues include cases where conservation produced negative results. One involved physical removal of invasive algae in India, which fragmented the organism and helped it establish elsewhere. The example is retained because it shows why failure can improve practice only when the mechanism and outcome are measured.

Sources for misconceptions and lenses

Leaving nature alone. Protection from pressure is often effective, but passive recovery is not universal. Human-maintained habitats, invasive predators, altered fire or water regimes and populations below demographic thresholds may require active management. The reference to rewilding marks a boundary: process-led reduction of control belongs to that specialist title, while this book owns the wider conservation toolkit.

Captive breeding. Ex situ programmes can prevent immediate extinction and provide founders for release, but demographic success in captivity does not establish wild persistence. The condor, black robin and kestrel material supports the distinction between numbers produced and bottlenecks removed.

People and conservation. The correction rejects both fortress conservation and romantic claims that every local institution is sustainable or equitable. Evidence from Indigenous tenure, protected-area outcomes and community conservation supports rights, authority and benefit-sharing while preserving the need to examine internal power and ecological performance.

Evidence resources. *What Works in Conservation 2021* assesses 2,526 interventions using summarised studies and expert panels. The Conservation Evidence database contains study-level accounts across thousands of actions. These resources identify tested options and evidence gaps; they do not turn context-dependent findings into universal instructions.

Sources for glossary and further reading

Red List categories and protected-area terminology follow IUCN usage. OECM follows the Convention on Biological Diversity definition centred on sustained in situ biodiversity outcomes outside formal protected-area designation. Key Biodiversity Areas follow the global KBA standard. The terms translocation, reinforcement and reintroduction follow IUCN conservation-translocation guidance.

Publication details for the four recommended works were checked against publisher or library records. *What Works in Conservation 2021* was edited by William J. Sutherland, Lynn V. Dicks, Silviu O. Petrovan and Rebecca K. Smith and published by Open Book Publishers. The edition assesses 2,526 interventions and is freely available from the publisher.

Bibliography

Institutional, legal and original evidence

BirdLife International. *Mauritius Kestrel Falco punctatus Species Factsheet*. Cambridge: BirdLife International. Accessed 11 August 2026.

BirdLife International. “Alive as a Kestrel: An Emblem for Preventing Extinctions.” 19 May 2023.

Convention on International Trade in Endangered Species of Wild Fauna and Flora. *Text of the Convention and Appendices*. Geneva: CITES Secretariat. Current materials accessed 11 August 2026.

Convention on Biological Diversity. *Kunming-Montreal Global Biodiversity Framework*. Decision 15/4. Montreal: Secretariat of the Convention on Biological Diversity, 2022.

Conservation Evidence. *Conservation Evidence Database*. Department of Zoology, University of Cambridge. Current material accessed 11 August 2026.

Department of Conservation, New Zealand. “Karure / Kakarua / Chatham

Island Black Robin.” Current species account accessed 11 August 2026.

Department of Conservation, New Zealand. “More Habitat Needed for Black Robins.” 14 August 2025.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. *Global Assessment Report on Biodiversity and Ecosystem Services*. Edited by Eduardo S. Brondízio, Josef Settele, Sandra Díaz and Hien T. Ngo. Bonn: IPBES Secretariat, 2019.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. *Methodological Assessment Report on the Diverse Values and Valuation of Nature*. Edited by Patricia Balvanera, Unai Pascual, Michael Christie, Brigitte Baptiste and David González-Jiménez. Bonn: IPBES Secretariat, 2022.

International Union for Conservation of Nature. *Guidelines for Reintroductions and Other Conservation Translocations*. Version 1.0. Gland: IUCN Species Survival Commission, 2013.

International Union for Conservation of Nature. *IUCN Red List Categories and Criteria*. Version 3.1, 2nd ed. Gland and Cambridge: IUCN, 2012.

International Union for Conservation of Nature. *The IUCN Red List of Threatened Species*. Version 2026-1. Gland: IUCN, 2026.

Mauritian Wildlife Foundation. *MWF Annual Report 2024*. Mauritian Wildlife Foundation. Accessed 11 August 2026.

Namibian Association of CBNRM Support Organisations. *The State of Community Conservation in Namibia*. Windhoek: NACSO, selected reports and current programme material accessed 11 August 2026.

National Park Service. “Tribal Connections to Yellowstone.” Yellowstone National Park, current historical and consultation material accessed 11 August 2026.

Parks Canada. “Wildlife Crossing Structures and Research.” Banff National Park, current material accessed 11 August 2026.

United Nations Environment Programme World Conservation Monitoring Centre and International Union for Conservation of Nature. *Protected Planet Report 2024*. Cambridge and Gland: UNEP-WCMC and IUCN, 2024.

United States Fish and Wildlife Service. “California Condor, *Gymnogyps californianus*.” Current species and recovery-programme material accessed 11 August 2026.

United States Fish and Wildlife Service. *Endangered Species Act of 1973 and Recovery Planning Materials*. Current legal and programme material accessed 11 August 2026.

Royal Botanic Gardens, Kew. “Last of its kind: Critically Endangered tree clinging to cliffside finds hope at Kew and Logan Botanic Garden.” Press release, 29 May 2026. Accessed 11 August 2026.

Scientific and scholarly works

Frankham, Richard, Jonathan D. Ballou and David A. Briscoe. *Introduction to Conservation Genetics*. 2nd ed. Cambridge: Cambridge University Press, 2010.

Garnett, Stephen T., Neil D. Burgess, John E. Fa, Álvaro Fernández-Llamazares, Zsolt Molnár, Cathy J. Robinson, James E. M. Watson, Kerstin K. Zander, Beau Austin, Eduardo S. Brondizio, Neil French Collier, Tom Duncan, Erle Ellis, Hayley Geyle, Micha V. Jackson, Harry Jonas, Pernilla Malmer, Ben McGowan, Amphone Sivongxay and Ian Leiper. “A Spatial Overview of the Global Importance of Indigenous Lands for Conservation.” *Nature Sustainability* 1, no. 7 (2018): 369-374.
<https://doi.org/10.1038/s41893-018-0100-6>.

Gilbert-Norton, Lynne, Ryan Wilson, John R. Stevens and Karen H. Beard. “A Meta-Analytic Review of Corridor Effectiveness.” *Conservation Biology* 24, no. 3 (2010): 660-668.
<https://doi.org/10.1111/j.1523-1739.2010.01450.x>.

Johnson, Jeff A., and Peter O. Dunn. “Low Genetic Variation in the Heath Hen Prior to Extinction and Implications for the Conservation of

Prairie-Chicken Populations.” *Conservation Genetics* 7 (2006): 37-48.
<https://doi.org/10.1007/s10592-005-7856-8>.

Joseph, Liana N., Richard F. Maloney and Hugh P. Possingham. “Optimal Allocation of Resources among Threatened Species: A Project Prioritization Protocol.” *Conservation Biology* 23, no. 2 (2009): 328-338.
<https://doi.org/10.1111/j.1523-1739.2008.01124.x>.

Kareiva, Peter, and Michelle Marvier. “What Is Conservation Science?” *BioScience* 62, no. 11 (2012): 962-969.
<https://doi.org/10.1525/bio.2012.62.11.5>.

Langhammer, Penny F., James W. Bull, Jake E. Bicknell, et al. “The Positive Impact of Conservation Action.” *Science* 384, no. 6694 (2024): 453-458. <https://doi.org/10.1126/science.adj6598>.

Nichols, James D., and Byron K. Williams. “Monitoring for Conservation.” *Trends in Ecology and Evolution* 21, no. 12 (2006): 668-673.
<https://doi.org/10.1016/j.tree.2006.08.007>.

Oldekop, Johan A., George Holmes, W. Edwin Harris and Karl L. Evans. “A Global Assessment of the Social and Conservation Outcomes of Protected Areas.” *Conservation Biology* 30, no. 1 (2016): 133-141.
<https://doi.org/10.1111/cobi.12568>.

Soulé, Michael E. “What Is Conservation Biology?” *BioScience* 35, no. 11 (1985): 727-734. <https://doi.org/10.2307/1310054>.

Sutherland, William J., Lynn V. Dicks, Silviu O. Petrovan and Rebecca K. Smith, eds. *What Works in Conservation 2021*. Cambridge: Open Book Publishers, 2021. <https://doi.org/10.11647/OBP.0267>.

zu Ermgassen, Sophus O. S. E., Julia Baker, Richard A. Griffiths, Niels Strange, Matthew J. Struebig and Joseph W. Bull. “The Ecological Outcomes of Biodiversity Offsets under No Net Loss Policies: A Global Review.” *Conservation Letters* 12, no. 6 (2019): e12664.
<https://doi.org/10.1111/conl.12664>.

Books materially used

Butler, David, and Don Merton. *The Black Robin: Saving the World's Most Endangered Bird*. Auckland: Oxford University Press, 1992.

Leopold, Aldo. *A Sand County Almanac and Sketches Here and There*. New York: Oxford University Press, 1949.

Marris, Emma. *Rambunctious Garden: Saving Nature in a Post-Wild World*. New York: Bloomsbury, 2011.

Myers, Norman. *The Sinking Ark: A New Look at the Problem of Disappearing Species*. Oxford: Pergamon Press, 1979.

Nijhuis, Michelle. *Beloved Beasts: Fighting for Life in an Age of Extinction*. New York: W. W. Norton, 2021.