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OUR PLANET | ONE PLANET | FULL EPISODE

State of Nature and Human Impact

- The human population has more than doubled in the last 50 years since the first human venture to the moon.
- Approximately 10,000 years ago, human settlements thrived in a world abundant with life on land and in the sea.
- In the last 50 years, wildlife populations have declined by an average of 60%.
- For the first time in human history, the stability of nature can no longer be taken for granted.
- The natural world is resilient, and with human assistance, the planet can recover.
- Understanding the natural world's functionality and how to support it is crucial.

Interconnectedness of Ecosystems: Global Examples

Peruvian Coast: Seabird Colonies

- Seabirds congregate in colonies of millions along the Peruvian coast of South America for breeding.
- They fish in one of the richest seas on Earth, undertaking an astonishing daily migration of 5 million birds.
- Cormorants and boobies primarily seek anchovies.
- This abundance is due to the powerful Humboldt Current, which sweeps up from the Antarctic, bringing rich nutrients from the ocean's depths.

Oceanic Life and Terrestrial Connections

- 90% of oceanic life is found in shallow seas close to the coast.
- Away from land, seas are largely a "blue desert."
- Even distant waters can be enriched by an unexpected connection to land.
- Deserts, sometimes hundreds of kilometers from the ocean, provide raw materials for life.
- Every year, winds sweep up 2 billion tonnes of dust into the sky, with at least a quarter falling on the sea.
- This dust provides nutrients for microscopic organisms, which form the foundation of ocean life.
- Dolphins explore the vast open ocean, seeking riches nourished by distant deserts.
- A shoal of mackerel discovers a swarm of krill, small crustaceans that feed on the ocean's floating microscopic plants.
- The mackerel, in turn, are food for the dolphins.
- Dolphins drive mackerel towards the surface, into the range of shearwaters.
- Shearwaters use their wings to propel themselves 6 meters down through the water to feed.
- After birds pick off the top of the shoal, dolphins attack the underside.
- The stability of life relies on such connections between different habitats.

African Salt Pan: Lesser Flamingos

- Water evaporating from the sea condenses to form clouds, which eventually release freshwater as rain.
- Life-giving rains are not evenly distributed across land.

- A vast **salt pan** in **Africa** is all that remains of an ancient lake; it is totally waterless and oven hot, making it one of the most hostile places for life.
- Animal tracks across it indicate unsuccessful searches for water.
- Occasionally, this landscape is transformed by a huge deluge.
- Triggered by an unknown signal, flocks of **Lesser Flamingos** arrive from thousands of kilometers away.
- The algae that the flamingos feed on lie dormant as spores in the dust.
- Flamingos are primarily here to breed, under perfect conditions that might occur only **once in a lifetime or a decade**.
- They nest on an island far from the shore, building mud mounds to raise their eggs, keeping them marginally cooler than at ground level.
- The water surrounding the island is so salty that predators do not venture into it, ensuring nest safety.
- **30 days later**, thousands of chicks begin to hatch.
- Challenges for newly hatched chicks:
 - There is no shelter from the scorching sun.
 - The water that once protected their island has now dried up completely.
 - Unable to fly, the growing chicks must walk to find fresh water, guided by some adults.
 - They may have to trek for **50 kilometers**, and some cannot keep up as salt solidifies around their legs.
- Most chicks, despite everything and having walked for days, eventually reach fresh water.
- This is the end of a long journey, but only the first of the trials these flamingos will face due to the irregularity of the rains.

Serengeti Plains: Wildebeest Migration

- If rainfall is more predictable and certain, life can flourish more richly in both numbers and variety.
- The **Serengeti Plains** in **East Africa** support over **a million wildebeest**.
- The herds follow seasonal rains, grazing on the newly sprouting grass that comes in their wake.
- Each year, within a **3-week period**, females give birth to over **a quarter of a million calves**.
- Young calves, just a few days old, strengthen their legs through play for the long journey ahead.
- Calves must stay close to their mothers; without milk, they would starve.
- Herds are always traveling, following the rains across the plains to find fresh grazing, eventually reaching woodlands.
- **Hunting dogs**, year-round forest inhabitants, consider wildebeest calves a favorite prey.
- Calves must stay with their mothers, protected within the herd.
- The dogs possess incredible stamina, but the calf is defended by the herd, necessitating the calf to be isolated.
- A mother blocks the dogs, shielding her calf, which then runs for safety and manages to rejoin the herd.
- The future of this entire migration depends on the regularity of the rains and the continued existence of the great open grasslands across which the herds make their immense journeys.

Tropical Forests: Biodiversity Hotspots

- In places where rains fall abundantly throughout the year, forests grow.

- In the warmth of the tropics, these forests support an unparalleled richness of life, hosting half of all land-living animal species.
- The sheer diversity is breathtaking, with many species yet to be cataloged.
- The relationships between all species are multitudinous and complex.
- Plants often depend on animals for pollination.
- An example includes orchid flowers that produce trap-flowers shaped like buckets, each filled with an oily liquid dripping from above.
- Male orchid bees need a rich perfume to impress their females, which the orchids provide.
- The bucket is slippery, and the liquid into which the bee falls is sticky.
- The only way for the bee to escape is through a narrow tunnel.
- As the bee emerges, it is gripped tight, allowing the plant enough time to glue pollen sacs onto the bee's back.
- Thus, the orchid's pollen is taken to another plant, and the bee is rewarded with the perfume it uses to woo a female after recovering its strength.
- Rainforests lack pronounced seasons, producing food in one form or another year-round.
- This richness allows females of some birds to raise their young entirely by themselves, enabling males to spend all their time attracting females.
- There are over 50 different species of manakins, each with its own highly elaborate dance routine.
 - The Golden-collared Manakin clears its dance floor, rockets from one perch to another, and performs a "backflip with twist."
 - The Red-capped Manakin performs a different act, described as a "sliver with wing snaps."
 - The Blue Manakin has the most complex routine, with a lead male supported by 3 junior dancers, who practice together almost daily for perfect synchronization. During rehearsals, a young male in juvenile plumage stands in for the female.
- In a carousel of movements, each male takes his turn at the front, with the lead male performing the final move to impress a female.
- Tropical forests cover only 7% of the planet's land area.

Boreal Forests: Winter Survival and Migration

- Away from the tropics, where the weather is seasonal and cooler, forests are very different.
- The greatest of all is the boreal forest, which extends across North America and Eurasia.
- It cannot grow during the frigid grip of winter.
- These forests are a crucial refuge for the relatively few species able to survive here.
- As winter approaches, caribou grazing on the open tundra to the north head south to the forest for food and shelter.
- Out here, temperatures may fall below -40°C, and the forest provides some protection from the worst weather.
- The caribou are not traveling alone; wolves, which live in the forest year-round, specialize in hunting caribou in winter.
- Wolves must find the freshest tracks, moving fast by avoiding deep snow and sticking to hard-packed trails made by the caribou.
- A wolf finding fresh scent indicates caribou are close.
- The herd chooses to stop and rest on a frozen lake, where in the open, they can spot approaching danger.

- Wolves catch up and begin to test the caribou, probing for any weakness.
- On the open lake, caribou can outrun wolves, so the wolves drive them back into the forest.
- In the deep snow of the forest, progress is much harder and slower, and hidden by trees, wolves can get closer.
- The pack must decide which caribou to target and which trail to take.
- As the caribou scatter, a leading wolf takes a wrong turn, a crucial mistake that causes the wolves to abandon the chase.
- With the coming of spring, the caribou head north once more, leaving the wolves and the forest behind.
- They travel **600 kilometers**, crossing mountains to reach the tundra, where spring grass will be sprouting again, and they can give birth.
- These migrations are a shadow of what they once were; the herd has lost nearly **70% of its numbers** in the last **20 years**.
- The world, and all of our planet, is now changing fast.

Polar Regions: Impact of Global Warming

- At the furthest polar extremes lie the frozen wildernesses of **Antarctica** and the **Arctic**.
- Though seemingly remote, their stability is crucial to all life on the planet.
- In just **70 years**, things have changed at a frightening pace.
- Polar regions are warming faster than any other part of the planet.
- The **Arctic** in the north is a frozen ocean, and the sea ice on which all life here depends is disappearing.
- **Polar bears** specialize in hunting seals out on the frozen ocean, but their world is literally melting beneath their feet.
- Sea ice breaks up every year, but this is now happening earlier, shortening the bears' limited hunting season.
- This is already having a profound impact, with cubs growing up underweight, which reduces their chances of survival.
- Within the lifetime of these cubs, the Arctic in summer could be largely free of sea ice.
- Not only sea ice but also land ice is vanishing rapidly.
- **Greenland**, a vast expanse of ice **one-fifth the size of the United States**, is an example.
- This glacial ice, together with sea ice, protects our planet by reflecting solar radiation away from the surface, preventing Earth from overheating.
- The Arctic is warming dramatically.
- The leading edge of the **Store Glacier** may appear motionless, but glaciers can move at up to **45 meters a day**.
- Where this glacier meets the sea, it towers **100 meters above the water** and continues downward for another **400 meters beneath the surface**.
- Over the last **20 years**, Greenland has been losing ice, and the rate of loss is accelerating.
- Massive icefalls from the top of the glacier are just the beginnings of a far greater event.
- A **kilometer-long stretch** of the front face of the glacier begins to break away.
- Hidden ice from **400 meters beneath the surface** surges upwards.
- The breakaway of an iceberg the size of a skyscraper generates a colossal tidal wave.
- Within **20 minutes**, **75 million tons of ice** break free.

- Glaciers have always released ice into the ocean, but this is now happening nearly twice as fast as it did 10 years ago .
- Around the world, ice is now feeding vast amounts of freshwater into the sea, leading to:
 - Rising sea levels.
 - Changing salinity.
 - Disrupting ocean currents (e.g., without the **Humboldt Current**, the coast of Peru would fall silent, and the seabird spectacle would be no more).
- Crucial connections across our planet are being disrupted, leading to the loss of stability that we and all life rely upon.

Future Outlook and Call to Action

- Actions taken in the next 20 years will determine the future for all life on Earth.
- Preservation efforts are necessary to ensure a future where humans and nature can thrive.

OUR PLANET | FROZEN WORLDS | FULL EPISODE

Polar Regions: Ecosystems, Climate Change, and Global Impact

Polar Regions and Global Significance

- For the first time, humanity observed Earth from the moon **50 years ago**, after which the human population more than doubled.
- Polar regions, though seemingly remote, are significantly influenced by human activity.
- Changes in these frozen worlds affect not only the poles but the entire planet.

Antarctica: The Southern Polar Realm

- Characteristics of Antarctica
 - Antarctica is the southern end of the planet and the coldest place on Earth.
 - It has been frozen for **30 million years**.
 - In its center, the ice covering is **over 4 kilometers thick**, burying entire mountain ranges.
 - Each winter, **19 million square kilometers of ocean freezes**, more than doubling the size of the ice cap.
- Life Cycles and Adaptations
 - **Spring Melt and Life's Return**
 - As sea ice breaks up in spring, life returns to the continent's shores.
 - The Antarctic Peninsula, stretching north towards South America, is the first part to be released from winter's grip.
 - This area exhibits a greater variety of living creatures than any other part of Antarctica.
 - **Gentoo Penguins**
 - Gentoo penguins spend most of their lives at sea but come ashore to breed in spring.
 - They are the fastest of all penguins in water but move slower on land.
 - Reaching their nesting grounds is an uphill struggle, but penguins persist.
 - Their paths are carved by thousands of footsteps, leading to Antarctica's rarest commodity: bare rock.
 - **Less than 1% of Antarctica** is ice-free, and these rocky patches are the only places where gentoos can lay eggs.
 - Males present stones to females as gifts to improve nests and win favor.
 - Gentoo penguins, once rare in this part of Antarctica, are increasing in number as temperatures rise.
 - **Sub-ice Ecosystem: Algae and Krill**
 - Sea ice, while appearing flat and lifeless, harbors a vibrant underwater world.
 - Algae trapped within the ice all winter flourish as light filters through the melting ice.
 - This "upside-down world" is the polar equivalent of vast grasslands, with ice serving as the "soil" for plant life.

- Antarctic Krill, numbering in the trillions, swarm in these waters, grazing on algae while protected by the overhead ice.
- However, once the ice melts completely, krill lose their protection, and predators emerge.
- **Penguins and Krill Hunting**
 - Penguins, despite losing the ability to fly, form flocks for hunting.
 - Ruffling their feathers traps air, making their bodies more streamlined for diving.
 - The entire group dives down together, following krill to depths of **over 200 meters**.
- **Humpback Whales**
 - Humpback whales migrate **over 8,000 kilometers** from the tropics to feed in the Antarctic.
 - They employ various feeding techniques:
 - Individual feeding: A "part lunge, part pounce" technique used when krill are close to the surface.
 - Team feeding: As more humpbacks arrive, they work in teams, lunging together to ensure overspill from one mouth is collected by another.
 - Coordinated hunting: Some humpbacks work in a highly coordinated manner when krill are deeper, blasting air from their blowholes to create a "curtain of bubbles" that tightens into a spiraling net, driving krill together before the whales lunge upwards to collect them.
 - Almost all humpback whales in the Southern Hemisphere come to the Antarctic to feed on krill.
 - Their numbers have recovered dramatically since the ban on commercial whaling.
 - However, their food supply is now under threat, with **krill stocks in this part of the Southern Ocean having more than halved in the last 50 years** due to warming temperatures and disappearing sea ice.
- **Orca (Killer Whales)**
 - Orcas, Antarctica's top predators, patrol these polar seas, with **over half of the world's orca population** residing here.
 - Particular pods specialize in hunting penguins, shifting into stealth mode to hunt without sound.
 - While a single killer whale can be outmaneuvered, a penguin rarely escapes a pod.
 - Orca hunts, though seemingly cruel, are crucial for passing down important life skills across generations.
- Importance of Sea Ice
 - Sea ice is fundamental to all life in Antarctica, supporting everything from killer whales to krill.
- Nutrient Circulation and Global Regulation
 - The rough waters surrounding Antarctica draw nutrients from the deep, creating vast, rich fishing grounds.
 - Beneath the waves, currents transport these nutrients across the planet, fertilizing the oceans and helping to regulate global temperatures.
- South Georgia Island

- Location: South Georgia is far enough north to remain beyond the reach of sea ice, even in midwinter.
- Many animals reside here year-round.
- **Wandering Albatross**
 - Wandering albatross chicks spend the entire winter on their nests, entirely dependent on their parents for food.
 - They may wait days or even weeks between meals.
 - Chicks require a whole year to grow before their first flight, then spend several years at sea before returning to land.
 - Landing with 3-meter wings requires significant practice.
 - The female raising a chick for 6 months, with another 6 months remaining, faces challenges if her mate does not return with food.
 - Many albatrosses die entangled on longline fishing lines.
 - South Georgia, an ideal breeding ground, is experiencing a decline in returning adults, with the breeding population having declined by 40% in recent years.
 - For now, the chick on its nest is safe from land predators.
- **Leopard Seals**
 - Leopard seals overwinter in South Georgia to escape Antarctica's frozen oceans.
 - They sometimes delay their departure because the ice-free waters, rich with giant kelp, provide perfect ambush locations for prey like king penguins.
- **King Penguins**
 - King penguins returning to feed their chicks must navigate dangers, often becoming prey for leopard seals.
 - They rarely use porpoising (leaping out of the water) as it consumes more energy, but it is faster than traveling underwater and can be a strategy to evade predators.
 - Encounters with predators like leopard seals can result in exhausting standoffs.
- **Elephant Seals**
 - Female elephant seals are protective and do not tolerate disturbance.
 - The 4-ton males pose a greater threat as they fight for access to females.
 - Penguins must avoid being bulldozed by angry blubber.
 - In large nurseries, parents and chicks, even amidst a crowd of half a million, can recognize each other's calls to reunite.
- **South Georgia's Future**
 - South Georgia supports an extraordinary quantity of wildlife, all of which ultimately depend on the krill developing under the sea ice around the Antarctic Peninsula.
 - With sea ice disappearing, South Georgia's future is uncertain.

The Arctic: The Northern Polar Realm

• Characteristics of the Arctic

- The Arctic, unlike Antarctica, is not a continent surrounded by sea, but rather a frozen ocean ringed by land.
- The effects of climate change are felt more intensely here.

- The Arctic is warming twice as fast as anywhere else on the planet .
- Polar Bears
 - Polar bears, the planet's largest land carnivores, rely on the sea ice as their vast hunting ground.
 - Their diet consists primarily of seals.
 - A male polar bear must consume two-thirds of his annual food requirement before the ice melts and his hunting platform disappears.
 - Ringed seal mothers, historically building dens within ice ridges, are now forced to leave pups exposed on flat ice due to late freezing.
 - While these changes initially benefit bears by exposing pups, a long-term crash in their prey population is anticipated.
 - The new, flatter ice also makes hunting more difficult for bears, as there are no hiding places for stealth approaches.
 - The traditional "pounding technique" for finding seals in dens is becoming obsolete.
 - Polar bears are adaptable predators but are entirely dependent on sea ice for their survival.
- Narwhals
 - Narwhals are often considered the origin of the unicorn legend .
 - Their 3-meter tusk is, in fact, an overgrown canine tooth , whose exact function remains a partial mystery.
 - Each summer, narwhals migrate to specific parts of the Arctic, patiently waiting for "leads" (cracks) to open in the ice.
 - These leads provide passage to sheltered, shallow bays and new feeding grounds.
 - Narwhals are extremely timid and rarely filmed underwater, eagerly traveling down leads for safety from predators.
- Walruses
 - The retreat of sea ice forces walruses to haul out on land in mass gatherings.
 - The northeastern coast of Russia hosts the largest gathering, with over 100,000 walruses on a single beach , a desperate measure due to the ice retreating north.
 - In such crowded conditions, walruses climbing over each other can crush those beneath.
 - Some walruses struggle to climb 80-meter cliffs , an extraordinary feat for a 1-ton animal accustomed to sea ice.
 - Walruses have poor eyesight out of water and, in their desperation to return to the sea for food, hundreds fall from these heights.
 - These mass gatherings are now occurring almost every year.
 - Walruses, like polar bears and seals, are living at the "frontier of climate change" and suffering its consequences.

Global Implications of Sea Ice Loss

- Climate Regulation
 - Sea ice plays a vital role in determining the planet's climate.
 - A white surface acts as a protective white shield , reflecting most of the Sun's energy back into space and keeping the Earth cool.
 - Conversely, a dark surface absorbs over 90% of the Sun's energy , leading to global warming.

- Rate of Loss and Future Projections

- The historical balance of sea ice advance and retreat has been disrupted.
- Today, there is 40% less sea ice cover during summer months compared to 1980 .
- The Arctic is warming twice as fast as anywhere else on Earth.
- Projections indicate that by 2040, the Arctic Ocean will be largely ice-free during summer months .
- This loss of ice will inevitably have devastating consequences for all life dependent on it.

- Conclusion

- While the Arctic winter temporarily restores order by reforming sea ice, providing relief for many creatures, the long-term question remains about the persistence of these frozen worlds as a part of life on our planet.

OUR PLANET | JUNGLES | FULL EPISODE

Introduction to Tropical Forests

Global Significance

- Tropical forests, particularly rainforests, are the richest habitats on Earth.
- They cover just 7% of the world's land area but play a vital role in the health of the planet.
- Jungles store and capture more carbon than any other terrestrial habitat.
- They help cool the planet and provide food and medicines.

Biodiversity

- The exact number of species rainforests contain is unknown, but it runs into millions.
- New species are discovered weekly.
- Some species, like the clouded leopard, remain virtually unknown.

Congo Rainforest: Africa's Youngest Jungle

Key Features

- Located in the heart of Africa.
- It is the planet's youngest rainforest, approximately 18,000 years old.
- It possesses more large animals than any other jungle.

Inhabitants and Ecosystem Role

- **Gorillas**
 - Lowland gorillas are led by a **silverback**, the dominant male.
 - A silverback is as tall as a man but twice the weight, responsible for his family's survival and protection.
- **Forest Elephants**
 - Forest elephants have long, straight tusks that are highly sought after by poachers.
 - They follow established paths, searching for food.
- **Bais (Clearings)**
 - Open areas called 'bais' are a unique feature of the Congo jungles, with over 100 dotted throughout the forest.
 - Bais attract many jungle inhabitants.
 - Gorillas visit bais to feed on aquatic plants rich in salt, a crucial mineral scarce in the forest.
 - Elephants extract salts from mud using their trunks or drink mineral-enriched water.
 - **Mbele Bai** is a significant bai, used by nearly 200 gorillas and over 530 elephants.
 - For elephants, bais are vital social hubs, allowing them to meet others after roaming the vast forest interior alone.
 - Mbele Bai is well protected, serving as a refuge from poaching.
 - Elephants and gorillas act as the gardeners of the jungle, dispersing seeds, which many trees depend on for existence.

Threats

- Poaching for bushmeat has halved the Congo's gorilla population in the last 20 years, rendering them critically endangered.
- The loss of megafauna, such as elephants and gorillas, which are the main seed dispersers, could have a far-reaching impact on the future of the planet's second-largest rainforest.

New Guinea: Island of Unique Evolution

Geological Impact on Diversity.

- New Guinea is the world's largest jungle-covered island.
- Its turbulent geological past created a dramatic landscape of mountains and valleys.
- This geological process isolated species, leading to unique evolutionary paths.
- More than half of its plants and animals are found nowhere else on Earth .

Unique Species: Birds-of-Paradise

- From one crow-like ancestor, birds-of-paradise have evolved into 40 different kinds .
- Each corner of the island has its own version of these birds.
- **Male 12-wired Bird-of-Paradise**
 - The only bird in the world with tail ornaments used to tickle the face of a prospective mate.
- **Black Sicklebill**
 - Found in New Guinea's highlands, known for morphing into unbird-like shapes.
- **Western Parotia**
 - Males perform unique displays to attract mates.
 - They meticulously clear their court of debris daily, as females prefer tidy courts.
 - The male's courtship ritual is a precisely choreographed routine involving bows, flashing eye colors, fancy footwork, whirling movements, and a head poom shuffle with a spin.
 - The performance culminates in a flash of the iridescent throat patch, which is only visible from the female's perspective.

Borneo Jungles: Earth's Oldest Rainforest

Age and Geological History.

- The jungles of Borneo in Southeast Asia have existed for nearly 130 million years , making them the oldest on Earth.
- Limestone mountaintops, originally formed under the sea, have been shaped by time and rain into 40-meter towers .

Ancient Inhabitants

- **Velvet Worms**
 - Considered one of the oldest predators on Earth.
 - They have remained virtually unchanged since the age of the dinosaurs.
 - They detect insect prey through vibration and touch.

- They capture prey by "glue guns," ejecting sticky slime that hardens on impact.
- After trapping an insect, the velvet worm injects digestive saliva and sucks out its insides.

Fungi and Nutrient Cycling

- The high humidity of the forest floor supports a rich diversity of fungi and slime moulds.
- By decomposing dead matter, they recycle scarce nutrients.

Specialized Plant Species: Pitcher Plants

- Borneo's ancient jungles are exceptionally rich and diverse, with more kinds of plants in a few hectares than in the whole of Europe.
- There are 39 kinds of pitcher plants in Borneo, most of which are endemic.
- **Nutrient Acquisition Strategies**
 - To obtain necessary nutrients, pitcher plants rely on animals in surprising ways.
 - The **mountain tree shrew**, found only in Borneo, visits pitcher plants daily to lick sugary solutions from the lid hairs.
 - In return, the tree shrew defecates into the pitcher, providing nitrates that are flushed into the plant by rain, essential for its survival.
 - The ***A. gracilis* pitcher plant** attracts ants to the underside of its lid with nectar drops.
 - When it rains, raindrops dislodge the ants from the lid, causing them to fall into the pitcher, which acts as the plant world's only springboard trap. The plant feeds on the ant bodies.

Ecological Relationships

- The ***Hemsleyana* pitcher plant** has a symbiotic relationship with the **woolly bat**.
- The plant's broad back wall reflects the bat's ultrasound, guiding it to the pitcher.
- The tube-like pitchers serve as perfect roosting sites for the bats.
- The pitcher provides secure accommodation, and the plant is enriched by the bat's deposits.

Threats: Deforestation

- Relationships like these have taken millions of years to evolve but could disappear within a decade.
- In the last 50 years, Borneo has lost over half of its jungle.

Philippines: Last Refuge for Endangered Species

Deforestation Impact

- The Philippines has experienced even more severe deforestation than Borneo.
- 90% of its primary rainforest has been lost.
- The remaining forests serve as the last refuge for the world's rarest bird of prey, the mighty **Philippines eagle**.

Philippines Eagle: A Case Study

- **Early Life and Development**
 - Only 400 pairs of Philippines eagles remain.

- A 4-month-old chick, nearly a meter tall, shows increasing confidence but still relies on its mother for food.
 - Parents gradually reduce visits, forcing the chick to become independent.
 - The chick practices flapping to strengthen its flight muscles in 2-meter wings.
 - It faces challenges like a 70-meter drop from the nest, sudden wind gusts, and daily downpours.
 - The first flight from the nest tree occurs when confidence matches know-how.
 - It takes nearly a year for the chick to become fully independent.
- **Challenges for Survival**
 - Survival depends on finding a territory with large stretches of unspoiled jungle.
 - The fragmented forests of the Philippines offer too little prey for a supersized eagle.

Amazon Basin: Global Lung and Biodiversity Hotspot

Scale and Significance

- The Amazon Basin spans over 3,000 kilometers across.
- It is home to half of the planet's remaining rainforest.
- It is considered the jungle whose size is still legendary.

Challenges for Inhabitants: Salt Licks

- **Spider Monkeys**
 - Salt is in short supply in the Amazon's deep interior, necessitating visits to salt licks.
 - Spider monkeys only set foot on the ground at salt licks.
 - They require a lookout while feeding due to predators.
- **Predators**
 - The jaguar is the Amazon's top predator, rarely seen but a constant threat at salt licks.
 - Salt licks are as vital as an oasis in a desert, attracting many animals, which makes them risky due to predators.

Abundant Species: Frogs and Insects

- Every animal group in the Amazon has more species than anywhere else.
- Over 1,000 different kinds of frogs are thought to exist, with new ones still being discovered. Frogs indicate a healthy forest.
- Insects are the jungle's most important and numerous inhabitants, with over 2 million kinds estimated in the Amazon.

Ecosystem Dynamics: Leafcutter Ants

- **Colony Structure and Function**
 - A colony of leafcutter ants can number in the millions.
 - Each colony is a superorganism with a collective function: gathering leaves and carrying them to underground nests.
 - Within a colony's territory, as much as one-fifth of all new plant growth is harvested by the ants.

- They use specialized mandibles to slice leaves, producing high-frequency vibrations that stiffen the leaf for easier cutting.
 - Working together, they can strip a tree bare in 24 hours.
 - Ants clear their paths of debris to increase efficiency.
 - A leafcutter nest can be up to 8 meters deep with thousands of interconnected chambers.
 - Workers carry leaves to special rooms to create fungus gardens, which feed their larvae.
- **Symbiotic Relationships (Bacteria)**
 - Ants have teamed up with bacteria to control pathogens that would destroy their precious fungi gardens.
 - Scientists believe these bacteria could provide new solutions to human diseases.

Natural Checks and Balances: Cordyceps Fungus

- The rainforest's diversity depends on preventing any single species from dominating.
- The parasitic fungus **Cordyceps** infects ants and other numerous species.
- Infected ants are compelled to climb upwards and bite down, tethering themselves to vegetation.
- The fungus erupts from the ant's body, and its fruiting body bursts from the head, casting spores into the air to infect more victims.
- The more numerous a species, the more likely it is to fall victim to the Cordyceps fungus.
- Such checks and balances protect the jungle's incredible diversity by preventing domination.

Global Threats to Rainforests

Monoculture and Habitat Loss

- The diversity of the world's rainforests is declining at an alarming rate due to human activities.
- Up to 27 million hectares of virgin jungle have been replaced by a single species of tree: oil palm.
- Oil palm is one of the world's most productive crops, but these monocultures support only a fraction of the diversity found in primary rainforests.
- This transformation is pushing many animals to extinction.

Orangutans: Critically Endangered

- **Learning and Survival**
 - Found in the swamp forests of northern Sumatra, Indonesia.
 - A baby orangutan takes over 10 years to become independent, learning essential skills like bridging gaps between trees and understanding its forest patch from its mother.
 - They learn what is edible and how to eat it, including techniques like gathering ants tangled in fur.
 - Some orangutans, like Lisa, have learned to make tools from sticks to extract insects, a skill unique to those in this region.
- **Impact of Habitat Destruction**
 - This long education period makes orangutans particularly vulnerable to changes in their forest.
 - An estimated 100 orangutans are lost every week due to human activity.

- The current generation of orangutans could be the last wild ones.
- In the last four decades, the pristine lowland jungle critical for orangutans has declined by a staggering 75%.

Overall Impact of Deforestation

- Globally, tropical forests are being lost at a rate of nearly 15 million hectares every year.
- This loss destroys the planet's treasure trove of diversity.
- The ecological functions of jungles, such as carbon storage, climate regulation, and provision of resources, are critical and their destruction poses a grave peril.

OUR PLANET | COASTAL SEAS | FULL EPISODE

Ecological Significance of Coastal Seas

- The human population has more than doubled in recent decades, increasing pressure on natural resources.
- Coastal seas serve as the planet's primary fishing grounds, providing abundant food for both wildlife and humanity.
- **Statistical Importance**: The seas fringing land constitute less than a tenth of the world's oceans, yet they are home to **90% of all marine creatures**.
- **Superabundance**: This richness is attributed to the fact that the seafloor in these areas is within reach of sunlight.
- **Trophic Levels**: Small fish, such as **anchovies**, sustain larger predators like **giant trevally** and **mobula rays**. When these hunters cooperate, they become extremely efficient.

Key Coastal Ecosystems and Their Roles

Seagrass Meadows

- **Location**: Vast fields of seagrass carpet shallow tropical waters, exemplified by **Everglades National Park** in southern Florida.
- **Biodiversity Support**: Similar to savannas on land, these lush marine meadows support a wide variety of animal life.
- **Resident Species**:
 - **Stingrays** search for prey hidden within the seagrass.
 - **Bottlenose dolphins**, known as ingenious fishermen, use **echolocation** (a type of sonar) to find food.
- **Dolphin Hunting Strategy**: These dolphins herd schools of **mullet** into specific areas. One dolphin then stirs up a ring of mud, encircling the fish and causing them to panic and leap into the air, making them easier to catch.
- **Conservation within National Parks**: Commercial fishing restrictions within national parks ensure ample food for species like dolphins.
- **Climate Change Mitigation**: Seagrass absorbs **35 times as much carbon dioxide** as an equivalent area of rainforest, thereby reducing the impact of warming seas.

Mangrove Forests

- **Location**: Mangroves frequently border seagrass meadows.
- **Unique Adaptation**: These are the only trees capable of tolerating the fluctuating salinity of coastal waters.
- **Coastal Protection**: Mangroves protect coastlines from the destructive forces of hurricanes.
- **Carbon Sequestration**: Like seagrass, mangroves capture carbon dioxide.
- **Nursery Function**: Their tangled root systems provide safe nurseries for young fish, which later migrate to tropical coral reefs.

Coral Reefs

- **Statistical Importance**: Covering less than **1% of the seafloor**, coral reefs are home to a **quarter of all marine species**.

- **Foundation of the Ecosystem**: Corals provide the structural foundation, food, and shelter essential for the entire reef community.
- **Community Maintenance**: Every resident species contributes to maintaining the reef's health.
- **Role of Sharks (Top Predators)**:
 - Sharks maintain the health of the reef by regulating fish communities.
 - They hunt predators that feed on small grazing fish, allowing grazers to flourish.
 - Grazing fish keep corals free from seaweeds and parasites that would otherwise overgrow the reef.
 - A balanced community with sharks as top predators provides greater resilience against damage and disease.
- **Shark Behavior and Cooperative Hunting (French Polynesia)**:
 - In locations like **French Polynesia**, **grey reef sharks** are protected.
 - During the day, they allow small **wrasse** to clean their teeth in preparation for nocturnal hunting.
 - Sharks prefer to hunt at night, when their acute senses provide an advantage over prey.
 - Prey fish seek refuge in reef crevices during the night.
 - The slightest movement can alert sharks. Remaining motionless can help avoid detection.
 - **Whitetip reef sharks**, being more slender and agile, can access hiding places unreachable by other hunters.
 - When both **grey reef sharks** and **whitetip reef sharks** hunt together, they flush out prey, offering little respite even within the reef's complex structure.
 - Large numbers of sharks, once common worldwide, contribute to the reef's health.

Kelp Forests

- **Location**: Found in higher latitudes and cooler waters, such as off the coast of California.
- **Productivity**: Storm-lashed waters bring essential nutrients to the surface, and long summer days contribute to these being among the most productive seas globally.
- **Structure and Analogy**: Like rainforests on land, these magnificent submarine forests of **giant kelp** provide dense canopies that offer food and shelter for abundant marine communities.
- **Giant Kelp Growth**: In cool, rich seas, giant kelp can grow up to **50 meters high**, with air-filled floats lifting their fronds towards the sunlit surface.
- **Key Species: Sea Otters**:
 - **Sea otters** have the densest fur of any animal, which provides insulation in chilly waters, further enhanced by blowing air into their fur.
 - They require significant energy to stay warm, consuming up to a quarter of their body weight daily.
 - Their diet primarily consists of **sea urchins**.
 - **Crucial Ecological Role**: **Sea otters** are vital for the health of kelp forests because they control **sea urchin** populations.
- **Other Predators of Urchins**: **Sheephead wrasse**, with their powerful teeth, can tackle smaller purple urchins. Larger black urchins pose a greater challenge, requiring larger wrasse to flip them to expose their vulnerable undersides.
- **Impact of Unchecked Urchins**: If not controlled, sea urchins can spread like a plague, grazing on kelp stems and destroying kelp forests, leading to the disappearance of dependent animals.

- **Effectiveness of Protected Areas**: In California, kelp forests thrive abundantly in **Marine Protected Areas** where the entire marine community is shielded from human pressures, ensuring otters and fish keep grazers in check.

Major Threats to Coastal Marine Life

Overfishing

- **Shark Population Decline**: Relentless overfishing has reduced global shark populations by **over 90%**, with significant populations now only thriving in the remotest reefs.
- **Global Fish Stock Collapse**: Many of the world's fish stocks are in serious decline, with **one-third** having already collapsed.
- **Jellyfish Blooms**: In coastal seas, immense swarms of **jellyfish**, such as **compass jellyfish**, are becoming increasingly common, taking over waters once dominated by fish. This indicates a severe imbalance in shallow marine ecosystems.
- **Case Study: Alaska Herring Populations**:
 - Historically, herring populations in Alaska were so abundant that they "turned shorelines white with spawn" across the North Pacific (from Japan to California).
 - **Industrialized fishing techniques** have led to the over-exploitation of these breeding stocks, greatly reducing Pacific herring populations to a mere fraction of their former numbers.
 - Today, only a few places still support a surviving herring fishery.
- **Case Study: Atacama Coast Seabirds**: Fifty years ago, large seabird colonies on the **Atacama coast** in South America disappeared due to overfishing of local waters.

Climate Change Impacts on Coral Reefs

- **Rising Sea Temperatures**: Warming seas pose a significant threat to coral reefs.
- **Coral Bleaching**:
 - **Mechanism**: Microscopic plants living within coral tissues provide both color and nourishment. If sea temperatures rise by just one or two degrees, corals expel these plant partners.
 - **Consequences**: Corals lose their main food source, turn white (bleach), and will starve and eventually die if high temperatures persist for several weeks.
- **Case Study: Great Barrier Reef**:
 - Unusually warm seas have caused extensive bleaching on **Australia's Great Barrier Reef**.
 - **Impact**: During 2016 and 2017, **over 1,000 kilometers** of the Great Barrier Reef bleached, resulting in the death of many corals and the destruction of reef communities.
 - **Global Impact**: Globally, **half of all shallow coral reefs** have already died, and the remaining reefs could disappear within the next few decades.
- **Ocean Acidification**:
 - **Mechanism**: The absorption of carbon dioxide, which causes global warming, also makes the seas more acidic.
 - **Combined Impact**: No reef ecosystem can withstand both increased warming and acidification.
 - **Consequences**: Without living corals, many of the resident species dependent on the reefs will perish.

Conservation Successes and Future Imperatives

Recovery of Atacama Coast Ecosystems

- **Background**: The inland **Atacama Desert** is one of the driest in the world, yet its coast was historically rich.
- **Recovery Story**: After overfishing led to the disappearance of seabird colonies 50 years ago, controls were introduced, leading to the recovery of fish stocks.
- **Current Status**: Today, **3 million guanay cormorants** assemble annually to raise their young. These colonies are so vast they take over an hour to empty each morning.
- **Key Species Involved**: A multitude of hunters, including **Inca terns, Peruvian boobies, sea lions, and pelicans**, gather to feed on abundant **anchovies**.
- **Anchovy Abundance**: These small fish are so numerous that they support the planet's largest fishery, accounting for up to **a tenth of all fish harvested globally each year**.
- **Potential for Further Recovery**: If allowed to fully recover, anchovy populations could sustain the **25 million seabirds** they once did, demonstrating the astonishing riches coastal seas can support when given the opportunity to recover.

Raja Ampat (Misool) Sanctuary

- **Location**: The islands of **Raja Ampat** in Southeast Asia.
- **Background**: These seas were severely depleted of sharks and large fish due to years of unregulated fishing. A lagoon previously used as a shark fishing camp is now a nursery for baby sharks.
- **Conservation Measure**: The seas around **Misool** were fully protected in 2007.
- **Miraculous Recovery**:
 - There are now **25 times more sharks** than a decade ago.
 - **Turtles**, once hunted, now peacefully graze on seagrass.
 - Returning sharks help restore the balanced community on local reefs, increasing their resilience against coral bleaching effects.
 - **Ocean-going manta rays** (up to 7 meters wingtip to wingtip), which spend most of their lives in the high seas, are returning to this sanctuary for cleaning by **wrasse**.
- **Biodiversity Increase**: **Misool** is one of the few places on Earth where biodiversity is actively increasing, with **3 times more fish** than just 10 years ago.
- **Economic Benefits of Protection**: Fishermen in nearby waters benefit from the "overspill" from the protected area, now catching more fish with less effort.

Global Call for Marine Protection

- **Current Deficiencies**: There are currently too few marine sanctuaries, and commercial fishing is still permitted in many existing ones.
- **Proposed Action**: It is imperative to designate **a third of all coastal seas** as properly protected areas.
- **Anticipated Outcome**: Such measures would enable the planet's fishing grounds to recover, thereby sustaining both humanity and the natural world.

OUR PLANET | FROM DESERTS TO GRASSLANDS | FULL EPISODE

Earth's Natural Wonders and Conservation

- In the past 50 years, since humanity first ventured to the moon and observed Earth, the human population has more than doubled.
- This series highlights the natural wonders that remain and the crucial need for their preservation to ensure the thriving of both people and nature.
- Earth still possesses sanctuaries that occasionally host spectacular wildlife gatherings, providing vital space, but these are rapidly disappearing.

Deserts: Vital Refuges

General Characteristics

- One-fifth of the planet's land surface is covered by deserts.
- Despite appearing barren, deserts are of crucial importance to life.
- They offer a vital refuge for organisms that can overcome their inherent challenges.

Case Studies

- **Atacama Desert (South America)**
 - Recognized as the driest desert globally.
 - Contains areas where rainfall has never been recorded.
- **Arabian Desert**
 - **Socotra Cormorants**
 - Emerge in immense numbers from dust storms.
 - A congregation of 50,000 individuals, representing a quarter of the total population, was observed.
 - The emptiness of the landscape attracts them for undisturbed breeding.
 - Nesting is challenging due to temperatures that can reach 40°C (104°F).
 - Adaptations: Adults and their white chicks cool themselves by panting.
 - Feeding behavior: Adults are mobbed if they appear to have food; they only feed their own chick, which must be located by the adult. Chicks pursue adults into the desert for food.
 - Significance: The desert provides a secure refuge and abundant food.
 - Food Source: A shallow arm of the sea beside the colony is rich in food, fertilized by nutrients from dust blown from the Sahara Desert, demonstrating how the desert itself enriches the sea.
 - **Dhofar Mountains (Oman)**
 - During the summer monsoon, fogs from the sea billow over the mountains, providing just enough moisture for sparse vegetation.
 - This limited greenery becomes a focal point for life.
 - **Ibex**: Navigate near-vertical cliffs to access rare springs, exhibiting nervousness.
 - **Arabian Leopards**:
 - Fewer than 200 individuals survive in the wild.

- A male's territory can extend **over 350 square kilometers** across high mountains and deep wadis.
 - The southern Arabian Peninsula is one of the few remaining areas with sufficient prey to sustain a leopard population.
 - **Fewer than 60 individuals are estimated across more than 15,000 square kilometers.**
 - Historically rare, their numbers are further declining due to conflict with humans.
 - Conservation: Brief unions, such as a female tracking a male, are increasingly rare but are crucial for short-term survival; long-term survival depends on territory protection.
 - **Rub' al Khali (Empty Quarter)**
 - Located north of the Dhofar Mountains, characterized by immense emptiness.
 - **It is the largest sand sea globally.**
 - Parts of this region are untouched by human presence.
 - Only highly specialized desert creatures can survive here, such as the **Arabian Oryx**.
 - **Arabian Oryx:**
 - Possess **vast ranges, extending over 3,000 square kilometers**.
 - Were hunted to near extinction but have since reclaimed their ancestral territory with the aid of conservationists.
- **Namib Desert**
 - **This is the oldest desert on Earth.**
 - Characterized by dry riverbeds, which carry water for only 1 or 2 days annually.
 - **Desert Elephants:**
 - **Fewer than 150 individuals survive here.**
 - An adult elephant requires **up to 200 kilograms of food daily** to avoid starvation.
 - Survival entails an endless trek, guided by a matriarch (an old female).
 - Matriarchs lead their families to specific locations where food is available even during droughts, knowledge passed down through generations.
 - **Fewer than 20 matriarchs remain.** The loss of their accumulated knowledge could prevent elephants from living in this region.
 - A specific challenge: The matriarch led her herd to **Ana trees** for seed pods, a rich food source, but the crop failed that year, rendering the journey fruitless.
 - A potential solution: A bull elephant, **nearly 4 meters tall**, can reach into the tree canopy for leaves.
 - **Desert Lions:**
 - Are as rare as the desert elephants.
 - They typically allow elephant calves, protected by their mothers, to pass.

Desert Transformations

- Deserts generally cannot sustain large animal populations year-round, even for specially adapted species.
- On rare occasions, deserts undergo transformation, such as a **cloudburst (occurring approximately once a decade)**.

- A single cloudburst can cause the desert to turn green, a change visible from space (e.g., Southern California, where hundreds of square kilometers bloom).
- If such transformations become regular, new habitats like grasslands could develop.

Grasslands: Productive Ecosystems Under Threat

General Characteristics

- Grasslands are among the planet's most productive landscapes.
- They support the largest aggregations of large animals on Earth.

Case Studies

- **Serengeti**
 - Sustains herds exceeding a million wildebeest, which migrate following rains to graze newly sprouted grass.
 - **Cheetahs:**
 - Vast herds attract predators like cheetahs.
 - One of the largest coalitions observed consisted of five male cheetahs.
 - This coalition dominates a territory of 450 square kilometers, patrolling it together.
 - Hunting Strategy: Requires a change in strategy for successful hunting, involving cover and coordinated effort. Four cheetahs may stalk directly, while a fifth creeps from the side to get close before the final sprint.
 - Social Hunting: All five break cover, chasing different targets, but must work together to defend their prize, as a single cheetah is not strong enough.
 - Conservation: These ecological dynamics persist because the Serengeti has been protected for over 65 years.
 - Exception: The Serengeti's protected status is rare; grassland space is steadily diminishing globally.
- **North American Prairies**
 - Historical Context: Approximately 180 years ago, millions of bison grazed the Great Plains, which were 100 times larger than the Serengeti. This was known as the "true Wild West."
 - Bison Behavior: Males would roar challenges and engage in brutal fights for females during the summer rutting season.
 - Decline:
 - Today, most of the prairie is silent due to humans slaughtering the great herds.
 - Fewer than 30,000 wild bison remain.
 - 90% of the prairie has been lost, primarily converted to agriculture.
 - Future Implications: The methods of food production will determine the future of the planet's grasslands.
- **Hungarian Hay Meadows**
 - These ancient meadows are still farmed traditionally, offering habitats of extraordinary richness.
 - They are home to abundant butterflies, including the **Alcon Blue**, known for its complex life cycle.

- **Alcon Blue Butterfly Life Cycle:**

- Females lay eggs exclusively on **marsh gentian** plants.
- Hatched caterpillars are initially safe on the plants.
- The caterpillars then descend to the ground on silk threads, emitting a **scent mimicking ant larvae**.
- Ants respond by carrying the caterpillars back to their nests, depositing them in the colony's brood chamber.
- In the nest, the purple caterpillars mimic **queen ant sounds**, causing nurse ants to feed them abundantly and treat them like royalty.
- If food becomes scarce, ants will prioritize feeding the caterpillars over their own young.
- Caterpillars grow significantly, feeding underground for **nearly two years**.
- They pupate, and after a few weeks, an Alcon Blue butterfly emerges.
- The young adult spends **23 months in the nest** before crawling out and preparing to fly off to mate.
- Risk: This complex life cycle is risky; the Alcon Blue would face extinction if the ants or the marsh gentian plants disappeared.

- Threat: Only tiny fragments of these ancient meadows persist in Europe.

- **Eurasian Steppe**

- Historically, grasslands stretched for **one-fifth of the world, from Romania to China**.
- Some areas still exist for miles without roads or fences.
- **Eagles:** Nest on the ground in these treeless expanses.

- **Saiga Antelope:**

- These antelope are endemic and found nowhere else globally.
- Their **extraordinary noses are adapted to filter out dust** stirred up by immense herds.
- Currently **critically endangered** due to poaching and habitat loss.
- Conservation efforts have recently begun to make a positive impact, offering hope for these plains dwellers.

- **Mongolian Steppe (Przewalski's Horses):**

- The grasslands here remain largely intact.
- **Przewalski's Horses:**
 - **Declared extinct in the wild 50 years ago.**
 - Reintroduced through careful breeding from **12 surviving captive adults**.
 - Their numbers now **exceed 300**, securing their future in the wild.
 - A male horse (stallion) vigilantly protects its harem, defending the herd and chasing off bachelor males attempting to lure away mares.
 - Their recovery was made possible because the vast Mongolian steppe remained largely untouched.

- **Indian Grasslands**

- Home to **some of the tallest grasses globally**, capable of concealing elephants and making large animals appear small.
- Serve as a critical hiding place for the highly endangered **Greater One-Horned Rhino**.

- Despite being one of the most populous countries, India shows strong determination to protect these vital grasslands.
- **Tigers:**
 - The tall grasses provide concealment for tigers, whose stripes and shadows blend perfectly.
 - Hunting strategy requires the tigress to approach within 20 meters of her prey .
 - The thick grass, while offering cover, also hides prey from the tigress, demanding precise knowledge of their location.
 - Decline: Wild tiger numbers have declined by over 95% in the last 100 years.
 - Success Story: In India, despite immense pressure from poaching and a growing human population, tiger numbers are increasing .

Conclusion: The Imperative for Conservation

- Protecting the crucial space provided by grasslands and deserts facilitates the recovery of animal populations.
- It is imperative to change human ways and address environmental challenges collaboratively.
- Collective action is essential for the future of nature and humanity.

OUR PLANET | HIGH SEAS | FULL EPISODE

The High Seas: A Global Life Support System

- The high seas are defined as the ocean beyond the boundary of any country, largely ungoverned, wild, and lawless.
- These vast waters serve as the **life support system of our planet**, covering two-thirds of the globe's surface.
- Beyond their immense surface area, oceans are also incredibly deep:
 - **Average depth** is nearly 4 kilometers.
 - **Deepest point** exceeds 10 kilometers.
 - The deep ocean alone constitutes **95% of all available space for life** on Earth.

Blue Whales: Sentinels of the High Seas

- **Blue whales** symbolize humanity's relationship with the high seas.
- **Characteristics** :
 - Weigh up to **200 tons** and are **30 meters long**.
 - They are the **largest animals ever to have existed**.
 - Live far out to sea, roaming every ocean from the tropics to the poles.
- **Sanctuaries** : Special places where they come close to shore have been recently discovered, such as the **Gulf of California** on Mexico's Pacific coast.
- **Reproduction and Calves** :
 - A female blue whale gives birth only once every 2 or 3 years, making each calf extremely precious.
 - A newborn baby blue whale is already 8 meters long and weighs 6 tons at one month old.
 - Calves grow at an astonishing rate of **3 tonnes per month**.
- **Historical Decline and Recovery** :
 - Once, there were more than **300,000 blue whales**.
 - Relentless hunting in the last century reduced their numbers to only a few thousand.
 - Currently, **blue whales** are protected, and their numbers are slowly increasing.

Life in the Sunlit Shallows

- Most life in the open ocean is concentrated in a thin surface layer where sunlight has its greatest effect.

Spinner Dolphins and Ecosystem Interactions

- **Location** : Spinner dolphins gather in great numbers in the Pacific, off the coast of **Costa Rica**, Central America.
- **Social Structure** : They live in pods, which are groups of individuals linked by complex social relationships, communicating through clicks and whistles.
- **Symbiotic Relationship** : **Yellowfin tuna** shadow the dolphins, relying on them to find food.
- **Prey** : Both dolphins and tuna search for **lanternfish**, which are the most numerous fish on the planet.

- Lanternfish are small (no longer than a finger) and spend most of their time hiding in the deep.
- Despite their abundance, they are not fished by humans and continue to thrive.
- **Coordinated Hunting Strategy** :
 - Dolphin pods can grow to 10,000 strong , with many swimming below the surface.
 - Using echolocation (a type of sonar), dolphins detect lanternfish in the depths and drive them to the surface.
 - They patrol the underside of the shoal to prevent prey from escaping back to the deep.
 - After dolphins feed, **Mobula rays** swoop in, attacking in formation to maximize their catch.
 - This ecosystem thrives because lanternfish are not commercially fished, ensuring that hunters make only a small dent in the vast shoals.

Nutrient Cycling and Phytoplankton

- **Marine Manure** : Dolphins play a vital role in recycling nutrients from the deep to the surface through their waste products, which acts as marine manure.
- This fertilization fuels the basis of all life in the open ocean: **phytoplankton**.
 - **Definition** : Microscopic, drifting plants.
 - **Role in Food Chain** : They combine nutrients in seawater with energy from the sun to create the foundation of every marine food chain.
 - **Oxygen Production** : Phytoplankton produce half the oxygen in the air we breathe .
 - **Cloud Formation** : They play a vital role in cloud formation; moisture evaporating from the ocean condenses around tiny particles created by plankton, forming colossal clouds up to 20 kilometers into the atmosphere.
 - **Climate Regulation** : These oceanic clouds reflect the sun's energy back into space, helping to protect Earth from rising temperatures.
 - The oceans not only produce half our oxygen but also drive weather and climate, transporting life-giving fresh water globally.

The Deep Ocean: An Alien World

- Journeying to the deep requires special submarines capable of withstanding immense pressure.
- The deep sea makes up 95% of all space available for life , an alien world with mysterious creatures.
- **Light Conditions** :
 - Below 200 meters, there is insufficient light for plants to grow.
 - No light penetrates below 1,000 meters, leading to total darkness.
- **Food Source** : Deep-sea animals depend on marine snow , which is food sinking down from the surface.
- **Biodiversity** : Scientists now believe there are 10 times more animals living in the deep than previously thought, with many yet to be discovered.

Unique Deep-Sea Creatures

- **Oarfish**:
 - Can grow up to 10 meters long .

- Commute easily between the surface and depths by hanging vertically and using rhythmic waves along their dorsal fin.
- Were only known from occasional wash-ups until recently, rarely seen alive.
- **Crown Jellyfish:**
 - Drift with outstretched tentacles to ensnare prey.
 - Live in every ocean to depths of 7 kilometers.
 - Due to the vastness of the deep, they could be the most abundant of all jellyfish.
- **Cystisoma** (deep-water crustacean):
 - As clear as glass, allowing it to hide in plain sight in the twilight zone.
 - Has huge eyes to strain and see in the gloom.
- **Bioluminescence:** In the darkness below 1,000 meters, animals create their own light.
 - A glowing lure entices victims into the terrifying teeth of a **dragonfish**.
 - A deep-sea **anglerfish** uses its extraordinary array of sensors to detect even the faintest movement by prey tempted to its lure.

Deep-Sea Plains and Coral Reefs

- **Deep-Sea Plains :**
 - Cover more than half the Earth's surface.
 - We know more about the surface of the moon than these plains.
 - **Chimera**, an ancient relative of the shark (up to 2 meters long), lives here, moving slowly to conserve energy and using electrical sensors to find scarce prey in sediment.
- **Deep-Sea Coral Reefs (Lophelia) :**
 - Located in rocky outcrops, such as off the coast of **Florida** at 500 meters down, forming rare hotspots of life.
 - Contrary to previous beliefs, deep-sea reefs cover a greater area of the seafloor than their shallow-water relatives.
 - **Ecological Role :** These underwater forests provide shelter and food for rich marine communities and serve as vital nurseries for many deep-sea creatures.
 - **Structure :** Made up of many anemone-like individuals called **polyps**, which live in colonies connected by a hard skeleton.
 - **Feeding :** Polyps have stinging cells in their tentacles to snare passing prey, their only source of food.
 - **Slow Growth :** Like most deep-sea animals, these corals grow extremely slowly; some reefs may be 40,000 years old.
 - **Interactions :** A **bristle worm** lives within the coral, stealing morsels from the polyps' catches, but also defends the coral against urchins, which attack and eat them.
 - **Threats :** Despite being deep, these corals are vulnerable to deep-sea fishing nets (trawling), which reduce fragile reefs to rubble. Half of all deep-sea corals have already been destroyed, and recovery would take centuries.

Challenges and Threats to the High Seas

- The high seas, beyond national boundaries, are wild and barely protected.

The Southern Ocean and Seabirds

- The **Southern Ocean** is one of the wildest places, home to the **albatross**.
- **Albatross Characteristics** :
 - Live solitary lives far out to sea.
 - Can travel hundreds of kilometers a day for weeks, searching for food.
- **Scavenging Behavior** :
 - **Giant petrels** (known as **sea vultures**) are top scavengers, arriving first to rip open carcasses with powerful beaks.
 - **Black-browed albatross** have an extraordinary sense of smell, detecting scents from 20 kilometers away, but are bullied by aggressive giant petrels.
 - **Wilson's petrels** are too small to compete and pick off scraps; they are the most numerous of all seabirds, found in every ocean.
 - A **wandering albatross** (with a **3-meter wingspan**) is often the last to arrive and uses its size to dominate.
- Threats to Seabirds:
 - In recent years, albatross and other seabirds have been in decline.
 - Their need to travel vast distances exposes them to the dangers of a poorly regulated and overexploited ocean.

Bluefin Tuna: A Case of Overexploitation

- **Bluefin tuna** are ocean giants, growing over **3 meters long** and weighing **half a ton**.
- **Characteristics**: Streamlined to perfection and built for speed, they hunt in great packs hundreds strong.
- **Hunting Strategy**: They gently corral anchovies into a tight ball at the surface, then attack in a highly coordinated hunt, taking turns to strike and keep prey on the run.
- **Value**: They are one of the ocean's most impressive hunters and the most prized fish in the sea; a single bluefin can sell for **over a million dollars in Japan**.
- **Decline**: This high value has led to them being fished almost to extinction.

Broader Threats to Marine Ecosystems

- **Unsustainable Fishing Practices**:
 - Decades of unsustainable fishing have led to a serious decline in many fish stocks, with **a third having collapsed altogether**.
 - **Industrial overfishing** is considered far more dangerous than plastic pollution.
- **Shark Finning**: **100 million sharks** are killed every year just to make shark fin soup.
- **Loss of Apex Predators**:
 - **90% of all large ocean hunters have disappeared**.
 - Without them at the top of the food chain, the entire community of marine life is declining and changing beyond recognition.
- **Trophic Cascades and Imbalance (Squid Proliferation)**:
 - **Squid** are increasingly replacing fish, an indication of a serious imbalance in the oceans.
 - This occurs because their predators and competitors have been severely depleted.
 - Squid breed quickly and have many fast-growing young, allowing them to rapidly exploit gaps left by harvested fish.

- With drastic changes in the marine menu, predators are forced to adapt; **sea lions**, which prefer energy-rich prey like anchovies and sardines, now rely more on a diet of squid due to shortages.
- Humans will also be forced to change the seafood they eat if unsustainable fishing continues.

Hope for Recovery and Conservation

- If oceans are harvested sustainably, they can be marvelously productive and provide an abundance of food.
- There are already signs that the ocean has the power to recover astonishingly quickly.

Humpback Whales: A Success Story

- **Humpback whales** live in every ocean, traveling the high seas from their polar feeding grounds to the tropics where they breed.
- **Historical Decline**: Once, there were more than **100,000 humpbacks**, but hunting in the last century reduced them to just a few thousand.
- **Conservation Success**: A huge public outcry led to a ban on commercial whaling in **1986**.
- **Recovery**: Since the ban, humpback whale numbers have been steadily increasing, returning to ancestral feeding grounds, such as off the coast of **South Africa**.
- **Supergroups**: They form supergroups, hundreds strong, representing the greatest gathering of whales seen for a century.
- **Ecological Role**: Whales recycle nutrients that enrich surface waters, which in turn fuel the growth of phytoplankton, which then feed krill, creating a perfect self-sustaining cycle.

The Imperative of a Healthy Ocean

- A healthy community of great hunters—**whales, dolphins, tuna, and sharks**—is essential for a fully functioning ocean.
- A functioning ocean is vital to the health of the planet and humanity.
- The remarkable recovery of humpback whales, almost returning to original numbers, demonstrates the ocean's resilience.
- **Current State**: Despite this success, humanity has inflicted more harm on the oceans than ever before in history during the same period.
- **Call to Action**: Only with global cooperation will our oceans recover and thrive again. Just as whales were saved by international agreement, it is now time to save all oceans.

OUR PLANET | FRESH WATER | FULL EPISODE

Introduction to Freshwater Significance

- Human population has more than doubled since the first moon landing, which occurred approximately 50 years ago.
- **Freshwater** is essential for all terrestrial life, both animal and plant.
- Only 1% of the planet's freshwater is readily accessible to living organisms.

Freshwater Ecosystems and Phenomena

Ephemeral Deserts and Monsoon Influence: Central Australia

- The **Central Australia Desert** is one of the hottest and driest places on Earth, where sustained life is virtually impossible.
- **Transformation Event:** Once a decade, this vast desert is transformed by a chain reaction triggered **2,000 kilometers to the north**.
- **Monsoon Impact:**
 1. Each year, moisture-laden monsoon clouds build up in the north and eventually burst.
 2. Riverbeds, dry for years, suddenly fill with water.
 3. Torrents converge and race towards the interior, reaching the lowest land on the continent.
 4. These waters flood the desert, creating **Australia's largest lake, Kati Thanda (Lake Eyre)**.
- **Wildlife Response:**
 1. Huge numbers of fish swim down the wide waterways into the expanding lake.
 2. **Pelicans** arrive from Australia's coasts, flying **hundreds of kilometers**. The mechanism by which they detect the lake's formation and navigate to it remains a mystery.
 3. The abundant food in these new waters triggers breeding among the birds. Chicks must grow quickly to become strong enough to leave within weeks.
- **Temporal Challenge:** The lake will soon dry, and water may not return for another decade, creating a **boom-to-bust transformation**.
- **Global Implication:** This exceptional event highlights the increasing unpredictability and uncertainty of freshwater availability worldwide.

Glacial Meltwater Systems: Poles, Himalayas, and Andes

- **Frozen Freshwater Reserves:**
 - **Almost two-thirds of the planet's freshwater is locked away as ice around the poles**.
 - This ice can be **several kilometers thick** and may have accumulated over millions of years.
 - Away from the poles, much of the land's freshwater also freezes each winter.
- **Glacial Melt and River Formation:**
 - Every summer, some polar ice melts and carves paths into the heart of regions like the Himalayas.
 - *Glacial ice caves* are beautiful but dangerous due to the constant movement of glaciers.
 - In spring, the vast snowy reservoirs melt, initiating a great journey of water.
- **Andes Rivers (South America):**

- Ice-cold waters racing down steep mountain slopes collect **oxygen**, a crucial life-giving ingredient.
- **Torrent ducks** are adapted to cope with the powerful currents in these chilly, oxygen-rich but nutrient-poor headwaters.
- **Prey Adaptations:**
 - **Stonefly and mayfly larvae** possess gills to extract oxygen and flattened bodies to resist the current.
 - **Black fly larvae**, a favorite prey of ducks, have specialized mouthparts to filter food and hooks at their rear to anchor to rocks. They also possess a safety line to pull themselves back if dislodged by strong currents.
- **Pacific Salmon Migration:**
 - **Salmon** spend most of their lives in the Pacific Ocean and return to specific North American rivers to lay eggs.
 - They possess an **extraordinary ability to leap up waterfalls**.
 - **Human Impact:** Dams built by humans impede their migration, as salmon cannot cross them unaided.
 - **Decline and Ecological Ripple Effect:** Pacific salmon numbers have plummeted to less than 1% of their historical levels, impacting other animals. **Alaskan brown bears**, for example, rely on salmon to build fat reserves for winter hibernation, leading to fierce competition for prime fishing spots.
- **Unique Riverine Flora: Caño Cristales (Colombia):**
 - In nutrient-poor, hard-rock river sections, the plant **Macarenia** manages to flourish.
 - For a few months each year, when water levels are low enough for sunlight to reach the riverbed, the Macarenia bursts into bloom.
 - This phenomenon creates **Caño Cristales**, known as **Colombia's Rainbow River**.

Subterranean Freshwater Systems: Florida

- **Underground Reserves:**
 - 30% of the planet's freshwater lies beneath the surface, stored within porous rocks or as subterranean lakes and rivers.
 - Rain, slightly acidic, slowly dissolves limestone to create vast cave systems.
- **Florida's Subterranean Labyrinth:**
 - A complex network of passages and chambers underlies much of the state of Florida.
 - While most subterranean areas are barren, sections where water surfaces are teeming with life, including abundant fish and fish-eaters like otters.
- **Florida Springs and Manatees:**
 - Florida boasts the **greatest concentration of springs on Earth**, where freshwater bubbles to the surface.
 - These springs feed rivers and pools, supporting a variety of life, notably **manatees**.
 - **Manatees** spend summers in the sea but migrate up relatively warm rivers during winter, where they graze on abundant freshwater plants.
 - **Human Impact:** Due to **excessive water extraction from springs and widespread pollution**, manatees are losing their critical winter habitats.

Riverine Ecosystems and Life Cycles

Tisza River, Hungary

- Rivers, being comparatively shallow, warm quickly.
- In spring, rising temperatures across Europe trigger a sudden surge of life.
- **Giant Mayfly Life Cycle:**
 - On Hungary's Tisza River, giant mayflies emerge after living three years underwater as larvae.
 - Within just three hours, millions of winged adults participate in a mass dance and mate before they die.
- **Decline and Recovery:**
 - This extraordinary spectacle was once common in Eastern Europe.
 - However, stabilized riverbanks and severe pollution have caused a significant decline in mayfly populations.
 - When rivers are cleaned, wildlife such as the kingfisher and osprey quickly returns.

Iguazu Falls, Brazil/Argentina

- The Iguazu Falls, located on the frontier between Brazil and Argentina, are the largest waterfalls on the planet.
- Thousands of tons of freshwater thunder over them every second.
- **Rainforest Connection:**
 - Much of Iguazu's water originates from the Amazon rainforest, located 1,000 kilometers away.
 - Water rises as vapor from the jungle canopy; a single tree can release 1,000 liters a day.
 - This vapor condenses into clouds, with 20 billion tonnes of water leaving the forest daily, a volume exceeding that flowing down the Amazon River itself.
- **Consequence of Deforestation:** The destruction of the rainforest would break this vital life-giving hydrological cycle.

Pantanal, Brazil (Wetland)

- As clouds from the Amazon travel across the continent, they release their water, irrigating farmland and forests.
- On the plains of Brazil, they create the Pantanal, the largest tropical wetland on Earth.
- **Seasonal Changes:** Each year, seasonal changes reduce river flow, causing the Pantanal to shrink into a few river channels.
- **Jaguar Predation:**
 - This seasonal change benefits the jaguar, a competent swimmer that prefers dry land for its killing pounce.
 - During the dry season, riverbanks become crowded, presenting hunting opportunities for jaguars targeting prey like capybaras (which have acute hearing) and caimans.
 - Hunting a caiman is risky, requiring the jaguar to bite its neck and hold on from directly above to prevent the caiman from retaliating or attempting to drown it.
 - A jaguar might endure a 20-minute struggle to secure a caiman, often near exhaustion.

Mekong River, Southeast Asia

- The **Mekong River** is 4,000 kilometers long and features the widest waterfalls globally.
- Over 60 million people depend on it for their livelihood .
- **Monsoon Flooding:**
 - Monsoon rains create a colossal surge of water, causing the falls to almost disappear.
 - The water is laden with sediment collected during its long journey from the Tibetan Plateau.
 - Before the main flood, water covers vast areas, indicated by exposed roots that show the expected rise in water level.
 - During the flood, trees are submerged up to their branches.
- **Breeding Grounds and Adaptations:**
 - The floodwaters create the planet's greatest breeding grounds for freshwater fish for a few months.
 - The Siamese fighting fish has an ingenious solution for living in shallow, oxygen-poor water: the male gulps air from the surface.
 - **Reproduction:** During breeding season, the male uses this ability to build a raft of bubbles (bubble nest). After mating, the female releases eggs, which the male fertilizes. The mother carefully collects the eggs and blows them into the bubble nest, where they receive enough oxygen from the bubbles to develop in the otherwise stagnant waters.
- **Tonle Sap Lake Expansion:** The climax of the flood causes the Tonle Sap Lake to expand to five times its dry season size .
- **Fishery Significance:**
 - Vast numbers of fish swim into these new feeding grounds, a seasonal event harvested by people for millennia.
 - The Mekong supports the largest inland fishery in the world .
 - One-fifth of all freshwater fish caught globally comes from this single river system .
- **Future Risk:** The future of the Mekong, like many other rivers worldwide, is increasingly at risk.

East African Rivers (Ruaha, Tanzania)

- In Ruaha, Tanzania, elephants search for water, needing 200 liters daily . In emergencies, they consume large quantities of moisture-rich baobab wood.
- Lions also require water and often find prey gathering at river sources.
- **Historical Change and Human Impact:**
 - Until 30 years ago , rivers in this part of Africa never ran dry.
 - Now, upstream agriculture consumes vast quantities of water , causing rivers to shrink into isolated pools during the dry season.
- **Wildlife Struggles:**
 - Hippos , which rely on flowing water for cooling, are forced into shrinking mud pools, leading to cramped conditions and heightened aggression.
 - Buffalo , needing daily water, are driven to waterholes despite the risks posed by predators like lions. Weakened by drought, they become more vulnerable.
- **Elephant Adaptation:**
 - Elephants possess an extraordinary sense of smell that allows them to detect open water from kilometers away and locate underground water closest to the surface.
 - They use their trunks to dig wells in the sand of dry riverbeds, which serve as lifelines during severe droughts.

- **Increasing Droughts:** While dry season hardships have always been part of life on East Africa's plains, droughts are becoming more frequent and severe due to a warming planet and human water consumption.

Platte River, Nebraska, North America

- The **Platte River** in Nebraska is a crucial staging post for **Sandhill Cranes** during their northward migration across America.
- **Historical Conditions:** The river once flooded the prairie for **a mile in all directions**, providing ideal feeding and resting grounds for cranes.
- **Human Impact and Conservation:**
 - Humans have **dammed the river and diverted much of its water**, leaving little space for the cranes.
 - However, **conservationists now manage the river's flow** to specifically create the sandbanks necessary for the cranes.

Large Freshwater Lakes: Lake Tanganyika, Africa

- Lakes collectively contain **40 times more water than all the world's rivers combined**.
- **Lake Tanganyika**, Africa, holds **almost a fifth of all accessible freshwater on Earth**.
- **Depth and Oxygen Distribution:**
 - The lake is **almost 1.5 kilometers deep**.
 - However, the bottom waters are largely stagnant and devoid of oxygen, limiting life.
 - Life flourishes abundantly only in the **top 150 meters**, where sufficient oxygen is present.
- **Biodiversity and Adaptations:**
 - **2,500 species of cichlid fish have evolved here**, many of which are endemic to the lake.
 - Competition in these crowded waters is intense.
 - A male **Chalyptorus cichlid** collects shells to attract females; the more shells, the more successful he is. Shells also serve as cradles for eggs.
 - During breeding, a female lays eggs inside a shell, which the male fertilizes. She then guards the eggs for **up to a fortnight** until they hatch.
 - The **Emperor cichlid**, the largest cichlid in Tanganyika at **almost a meter long**, raises its young in the open, requiring constant guardianship from both parents.
- **Future Uncertainty:** The future of these fish is uncertain as **Lake Tanganyika is warming due to rising global temperatures**. This warming reduces water mixing, leading to a shrinking oxygenated layer at the surface.

Challenges and Human Impact on Freshwater

- **Global Unpredictability:** The availability of freshwater is becoming increasingly unpredictable and uncertain globally.
- **River Flow Alteration:** **More than two-thirds of the planet's longest rivers have had their natural flow changed**, largely due to dam construction, causing many rivers to no longer flow naturally.
- **Pollution:** Widespread pollution severely impacts riverine ecosystems and species (e.g., mayflies).
- **Over-extraction:** Excessive withdrawal of water from springs and upstream agricultural practices deplete freshwater sources, affecting dependent species (e.g., manatees, African wildlife).

- **Habitat Loss:** Human activities lead to the destruction or degradation of critical habitats (e.g., manatees losing winter homes, reduced space for cranes on the Platte River).
- **Species Decline:** Dams have contributed to a drastic reduction in Pacific salmon populations (less than 1% of historical numbers).
- **Deforestation:** Destruction of rainforests disrupts the atmospheric water cycle, with global consequences.
- **Climate Change:** Rising global temperatures are causing lakes like Tanganyika to warm and droughts to become more frequent and severe, exacerbating existing challenges.

Conservation Efforts and Future Outlook

- **Ecosystem Restoration:** When rivers are cleaned, wildlife is quick to return, demonstrating the potential for recovery.
- **Managed Conservation:** Conservation efforts, such as managing river flow on the Platte River, can create necessary habitats for endangered species like Sandhill Cranes.
- **Human Responsibility:** Humanity possesses the ability and responsibility to ensure the continued flow of the world's freshwaters and to determine how they are equitably shared.

Forests: Earth's Vital Ecosystems and Resilience

Global Significance and Human Impact

- In the last 50 years, the human population has more than doubled since humanity first viewed Earth from the moon.
- Forests are crucial for celebrating natural wonders and ensuring the thriving of both people and nature.
- Over half of the world's trees, both evergreen and deciduous, are found in these vast assemblies.
- Forests are fundamental to Earth's climate and serve as home to countless unique species.
- Historically, forests have been destroyed without hesitation, yet they possess an astonishing ability to recover.

Boreal Forests: Ecosystems of the Far North

Geographic Extent and Characteristics

- The boreal forest, also known as the taiga, dominates the far north.
- **Geographic Span:** It stretches eastwards across Russia for thousands of kilometers, extending across Europe to North America.
- **Scale:** It contains 750 billion trees.
- **Climate Regulation:** It stores over 40% of the world's carbon, making it a vital element in the fight against climate change.
- **Winter Conditions:** During winter, days are short, and temperatures are low, halting growth.
- **Biodiversity:** Compared to tropical rainforests, these far northern forests support fewer animal species.

Wildlife and Adaptations

- **Siberian Tiger**
 - **Rarity:** It is an extremely rare animal, almost mythical, with less than 600 individuals remaining.
 - **Territory:** A male Siberian tiger patrols a territory of almost 2,000 square kilometers to find enough prey.
 - **Diet:** In this impoverished land where food is scarce, they hunt wild boar which depend on pine nuts for vital energy.
 - **Conservation Status:** Poaching has brought the Siberian tiger to the brink of extinction.
 - **Recovery:** Their numbers have slowly increased since the 1980s.
 - **Habitat Need:** Their future relies on vast areas of forest for hunting.
- **Alaskan Salmon Ecosystem**
 - **Migration:** In spring and autumn, salmon leave the ocean and swim up rivers to reach their ancestral spawning grounds in western Alaska.
 - **Nutrient Transfer:** This journey represents the greatest transfer of nutrients from one habitat to another on Earth.
 - **Food Source:** Salmon are crucial seasonal food for all predators in the forest.

o Bald Eagles

- **Residency:** They live here year-round and nest close to the river.
- **Juvenile Behavior:** Young eagles, lacking white heads, spend their first years foraging in the forest.
- **Competition:** As they mature (e.g., a 4-year-old female), they attempt to claim a spot on the river, initially getting scraps and facing intense competition, especially as rivers freeze over.
- **Survival Advantage:** Females, even when young, are larger than males, which is an advantage in this competitive environment.
- **Winter Challenge:** Young and old eagles must endure intense cold. Survival grants them a place in one of Earth's greatest and harshest forests.

Redwood Forests: Ancient Giants of the Pacific Northwest

Geographic Location and Decline

- The last of the great redwood forests stand a little further south from the boreal region.
- **Historic Range:** Not long ago, these trees grew throughout the Pacific Northwest.
- **Current Status:** Only 5% of them remain today.

Climate and Biodiversity

- **Climate:** Conditions are less harsh due to warm, humid air from the Pacific Ocean.
- **Growth:** This allows trees to grow year-round.
- **Underworld:** The moist forest floor supports a richly populated underworld.

Life Cycle and Resilience

- **Rough-skinned Newt**
 - o **Migration:** Every spring, males are driven by an urge to return to the pool where they hatched.
 - o **Mating Competition:** Many males gather, searching for females. Trekking across hundreds of meters of old-growth forest is difficult, leading to strong competition.
 - o **Mating Behavior:** Once paired, the male maintains his grip, as the female may take hours to discharge her eggs. Other males attempt to displace them.
 - o **Extreme Competition:** Competition is so vigorous that females in the center of "writhing balls" of males have been known to drown from lack of air.
 - o **Reproduction:** Within weeks, their tadpoles hatch.
- **Forest Fires**
 - o **Seasonal Change:** By late summer, the sun bakes the forest, making it tinder-dry.
 - o **Intensity:** Strong winds drive flames, and temperatures can rise to 700°C.
 - o **Initial Aftermath:** The aftermath appears to be total destruction, with dust devils of ash scouring the newly exposed forest floor.
 - o **Rapid Recovery:** However, the forest is far from dead. Within months, flowers and tree seedlings emerge.
 - o **Fire-Dependent Germination:** Many seeds require a "baptism of fire" to germinate.
 - o **New Growth:** Light streaming through the newly opened canopy provides energy for a surge of new growth.

- **Redwood survival:** Older, established redwoods survive due to their **thick, fire-resistant bark**.
- **Natural Resilience:** This natural resilience is essential for the continued health of these forests.

Forests and Interdependence: Diverse Ecosystems

India's Western Ghats

- **Global Importance:** This habitat is globally important, containing **one-third of all animal species** found in India.
- **Lion-tailed Macaques**
 - **Diet:** They feed on the fruits of many tree species.
 - **Seed Dispersal:** In doing so, they distribute seeds that emerge unscathed in their droppings. However, these monkeys do not travel very far.
- **Great Hornbills**
 - **Long-Distance Seed Dispersal:** With wings almost **2 meters across**, they travel long distances, distributing indigestible seeds from about 40 different tree species across the Western Ghats.
 - **Diet:** Hornbills eat large quantities of figs, which are tasty but not very nutritious.
 - **Male Competition:** A single fruiting fig tree attracts many hornbills, leading to intense competition among males.
 - **Aerial Jousting:** Males engage in aerial jousting, which demonstrates strength and skill to visiting females, indicating keenness to ingratiate themselves.
 - **Lifelong Bonds:** Hornbills establish lifelong pair bonds.
 - **Forest Benefit:** Even defeated hornbills contribute to seed dispersal over wide areas as they search for their next meal.

Africa's Miombo Forest

- **Largest Forest:** This is Africa's largest forest, named after one of its common trees.
- **Geographic Extent:** It stretches for over **1,000 miles** from Angola in the west to Mozambique in the east.
- **Seasonal Attraction:** At the height of the dry season, the Miombo attracts animals from across southern Africa.
- **Elephants**
 - **Diet:** They prefer nutritious grass but browse on abundant Miombo leaves and branches when grass is unavailable.
 - **Consumption:** A hungry elephant can consume **200 kilograms** of vegetation in a day.
 - **Ecological Role:** Their destruction shapes the forest by opening it up, which benefits other endangered animals.
- **Mopane Worms (Caterpillars)**
 - **Mass Hatching:** They hatch simultaneously in huge numbers just as the forest produces new leaves.
 - **Voracious Feeding:** They feed so voraciously that they increase their size **40 times in just 6 weeks**.
 - **Defoliation:** A "million-strong army" can strip the entire forest of its foliage.

- **Forest Recovery:** The Miombo bounces back, producing a second growth of leaves after the caterpillars are gone.
- **African Hunting Dogs**
 - **Preferred Habitat:** These open forests are their preferred habitat, though they are often seen on grasslands.
 - **Benefit from Elephants:** Browsing elephants open up the forest, attracting the animals on which the dogs prey.
 - **Hunting & Rearing Grounds:** The Miombo forest is excellent hunting country and an ideal place to raise pups.
 - **Social Development:** Playing is crucial for pups to establish the social bonds needed for team hunting.
 - **Conservation Significance:** The Miombo is vital for this endangered species, providing both prey and refuge. Their survival depends on the presence of other creatures that create their needed habitat.

Madagascar's Unique Forests: Evolution in Isolation

Island Isolation and Biodiversity

- **Geological History:** Madagascar has been isolated for over 80 million years.
- **Unique Evolution:** This long isolation has led to the evolution of animals and plants found nowhere else, making these forests among the most precious on Earth.
- **Dominant Trees:** The island has forests uniquely dominated by **Baobab trees**.
- **Lemurs**
 - **Diversity:** There are at least 40 different kinds of lemurs, all unique to Madagascar.
 - **Conservation Status:** All lemur species are endangered.
 - **Ecological Role:** Lemurs are crucial to the forest; without them, some tree species cannot survive.

Predator-Prey Dynamics

- **Fossa**
 - **Top Predator:** Madagascar's top predator, its presence causes alarm among other animals.
 - **Physical Characteristics:** It can grow up to 1.5 meters long.
 - **Solitary Nature:** For most of the year, fossas are solitary.
 - **Unique Mating Behavior:** During breeding season, mature females take up residence in a special mating tree, attracting several males. Engagements can last all night.
 - **Population Decline:** One-third of Madagascar's fossas have disappeared in the last 20 years, primarily due to continued forest destruction by humans.
 - **Habitat Loss:** Since these observations, this forest and its unique life have disappeared, with only 3% of Madagascar's dry forest remaining.
- **Immature Leaf Bugs**
 - **Endemic Species:** A species found only in Madagascar, known for its extraordinary shape.
 - **Diet:** They feed on tree sap, excreting the excess as a sweet liquid called "honeydew."
- **Grey Mouse Lemur**
 - **Size:** At only 15 centimeters long, it is one of the smallest primates in the world.

- **Diet:** It is very active and needs energy-packed food, feeding on the honeydew produced by leaf bugs.
- **Behavior:** It retreats to a nest hole to sleep during daylight hours.

Forest Destruction and Resilience: A Global Perspective

Global Forest Loss

- **Magnitude:** Worldwide, over half of the forests that once flourished on our planet have been destroyed.
- **Consequences:** This leads to not only the loss of animal species but also changes the global climate.

Case Study: Chernobyl Exclusion Zone

- **1986 Nuclear Disaster**
 - **Event:** In 1986, one of the four reactors at the **Chernobyl nuclear plant exploded**.
 - **Immediate Impact:** This turned a utopian vision of the future into a ghost town, with over 100,000 people immediately evacuated, never to return.
 - **Exclusion Zone:** The fallout zone was declared uninhabitable for the next 20,000 years.
- **Remarkable Recovery**
 - **Vegetation Re-establishment:** Despite the radiation, a remarkable recovery occurred. Within only a decade, vegetation began to germinate in the ruined city, and the forest re-established itself.
 - **Wildlife Return:** Animals began to appear, initially thought to be rare visitors, but it soon became clear that a thriving wild community occupied the former city.
 - **Population Growth:** Within 20 years, science recorded animal populations similar to those in the wilder parts of Europe.
 - **Ro-deer:** Now a common sight wandering through the suburbs.
 - **Przewalski's Horse:** Herds of this endangered species roam freely through the once busy city.
 - **Wolves:** The top predator of these forests reappeared.
 - **Indicator of Health:** Their return signifies a thriving prey base and surrounding forest.
 - **Population Density:** Studies show 7 times more wolves inside the exclusion zone than outside it.
 - **Paradox of Exclusion:** While the zone poses a lethal risk to unprotected humans, the radiation, by driving people out, created space for wildlife to return.
 - **Proof of Resilience:** The dramatic recolonization of Chernobyl in just 30 years is proof of forests' extraordinary resilience.

Conclusion and Call to Action

- If given the chance, Earth's forests are unbelievably resilient and could reclothe the planet with rich and varied communities of animals and plants.
- A future with more forests is key to the resilience of our planet.
- It is not too late if humanity changes its ways and connects the dots to solve environmental problems.