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9. Biodiversity Loss

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Abstract:

The most distinctive feature of Earth is the presence of diverse forms of life. An approximate number of 9 million species of plants, animals and microbes etc. inhabit in this planet. The term Biodiversity represents all the variety of life forms on earth & interactions among them. Each and every species has their own significance for the sustenance of life on the Earth. The reduction or disappearance of this biological diversity from biosphere is referred to as biodiversity loss. Not just the extinction of species but a sudden decline in population of a species is also alarming for the health of ecosystem. Natural causes of biodiversity loss can be temporary ones like seasonal cycles or more lasting ecological changes caused by natural calamities. The impact of anthropogenic activities on biodiversity is more severe as compared to natural reasons. Uncontrolled population growth & industrialization has led to overexploitation of resources and destruction to natural habitats causing disturbance to ecological equilibrium. Biodiversity is crucial for the survival & maintenance of the ecosystem. A combined effort from government, non-government bodies & all the stakeholders is needed to formulate policies that incentivize eco-friendly practices. Stringent measures must be taken to check the activities that lead to ecosystem destruction.

9.1 Introduction:

The only planet in the known cosmos where life exists is Earth. It is teeming with various living kinds. The term Biodiversity means the diversity of life which refers to all living things, including plants, microbes, animals, and humans, and is described as the tremendous variety of life on Earth in all its forms. This planet is home to over 9 million species of plants, animals, microorganisms, and other living organisms. However, only about 1.2 million species have been recognized and described, while millions of other organisms remain undiscovered. An ecosystem is made up of a diverse group of creatures. For example a small grassland, is a home for large number of organisms, from minute insects to snakes and birds. Ecosystems can also house species that are too small to notice with the human eye. Using a microscope to examine soil or water samples reveals an entire universe of

bacteria and other small organisms. To preserve balance and support life, each of these species interacts with one another and works together like an intricate web. This complexity of life on the Earth determines the capability of nature to provide resources required for human existence such as food, clean water, medicine, and shelter. Ecosystems having most biodiversity are known to be an ideal environment for growth & sustenance of lifeforms. A healthy ecosystem supply us with many indispensable things that we take for granted. Plants convert light energy of the sun & make it available to other life forms. Microbes decompose organic matter into nutrients and provide it to plants with healthy soil to grow in. Various insects and other organisms are essential in plant reproduction as a pollinator which assures our food production. In a nutshell, each species, no matter how large or little, plays a crucial role in the environment &biodiversity ensures that every component works in coordination for a balanced ecosystem. It also assists us in combating climate change and adapting to it, as well as reducing the impact of natural disasters.

In few decades, the world's population increased from 3.7 billion to 7.3 billion. As humans place more demands on the world, using and consuming more resources than ever before, there is a risk of disrupting ecosystems and reducing biodiversity. Since 1970, worldwide populations of mammals, fish, birds, reptiles, and amphibians have declined by an average of 60% (WWF's 2018 Living Planet Report.) According to the Intergovernmental Platform on Biodiversity and Ecosystem Services' historic Global Assessment Report from 2019, one million animal and plant species are now threatened with extinction, the largest number in human history.

9.2 What is Biodiversity Loss?

The decline in the number, genetic variability, and variety of species, as well as the biological communities in a given area, is referred to as biodiversity loss. The loss of diversity of life can lead to the improper functioning of the ecosystem. Because the concept of biodiversity is most often associated with species richness, biodiversity loss is frequently viewed as species loss from an ecosystem. As all living organisms interact with each other in dynamic ecosystems, the extinction of one species can have far-reaching consequences for the food chain. It is impossible to predict the effects of mass extinctions on humans, but we do know that for the time being, the diversity of nature allows us to thrive.

Scientists cautioned in a UN report issued in 2019 that one million species are endangered with extinction, with many extinctions occurring within decades. Some scientists believe we are currently experiencing the sixth mass extinction catastrophe in Earth's history. Known mass extinctions have wiped out somewhere between 60% and 95% of all species. Ecosystems need millions of years to recover from such a disaster. In a few decades, more than half of all birds, mammals, reptiles, amphibians, and fish have vanished.

According to the IUCN Red List of Threatened Species, 41 percent of amphibians, 25 percent of mammals, 34 percent of conifers, 13 percent of birds, and 31 percent of fish are at risk of extinction. 33% of reef-building corals and 27% of crustaceans are threatened with extinction. Freshwater species are declining at twice the pace of other species on land or in the ocean. Due to non-ecological farming techniques; earthworms have experienced a significant reduction (of over 80% on average). According to a study financed by Birdlife

International, 51 bird species are highly endangered, with 8 potentially extinct or in risk of extinction.

9.2.1 Natural Biodiversity Loss:

Natural cycles cause biodiversity to changes in a given area. Seasonal changes, such as the arrival of spring, provide chances for feeding and mating, resulting in increased biodiversity as many species' populations grow, while the winter decreased an area's biodiversity briefly when warm-adapted insects die and migrating animals leave. In addition, the biodiversity of an area is determined by the yearly rise and fall of vegetation and invertebrate populations, which provide food for various life forms. Ecosystems, landscapes, and the global biosphere all experience more persistent ecological changes as a result of biodiversity loss.

9.2.2 Natural Calamities:

Natural ecological disturbances such as wildfires, floods, and volcanic eruptions severely alter ecosystems by eradicating certain species' local populations and changing entire ecosystems. Floods are common in damp tropical climates including central Africa, eastern and northern Australia, and parts of South America, inundating most of the ground flora, trapping a huge number of animals and draining soil nutrients. Both animals and plants are affected in this environment. Forest fires and earthquakes both destroy a substantial number of plant and animal species to ashes in thickly forested areas. Volcanic eruptions have the potential to obliterate plant and animal life in their immediate surroundings. Likewise, Epidemics can wipe out vast swaths of a natural population.

9.2.3 Human-Driven Biodiversity Loss:

Biodiversity has been rapidly declining in recent years, owing mostly to human activity. Biodiversity losses induced by human disruptions are usually more severe and continue longer. Humans, their crops, and their domestic animals are occupying a larger portion of the Earth's land surface. Half of the world's habitable land has been converted to agriculture and being used for grazing by cattle, sheep, goats, and other livestock. Since long time, this huge conversion of forests, marshes, grasslands, and other terrestrial ecosystems has resulted in a huge drop in vertebrate populations globally, with the highest losses in freshwater environments (about 83 percent) and terrestrial ecosystems (about 60 percent). According to many researches, the present pace of species extinction is between 100 and 10,000 times that of the background extinction rate. Furthermore, according to a 2019 report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, human activities are threatening the extinction of up to one million plant and animal species.

9.2.4 Important Drivers of Biodiversity Loss:

Habitat loss: Habitat loss and degradation is defined as any thinning, fragmentation, or outright destruction of a natural habitat that diminishes or eliminates food resources and dwelling space for most species. Species that are unable to move are frequently wiped off.

Deforestation, overcrowding, pollution, global warming changes in farming methods diminishes resources such as food, water and air quality. Mining, logging, fishing activities and disruption of ecological process, all contribute to habitat loss.

Habitat loss has a greater impact on species that are physically huge and live in forest or oceans. It is a serious problem for both wildlife and humans.

According to some estimates, nearly 30% of all species on the planet will be extinct by 2050. Globally, one-third of all known species are threatened with extinction, according to the International Union for Conservation of Nature (IUCN). Within the next 20 years, it is anticipated that 25% of all mammals will become extinct. Habitat fragmentation is another major issue that has occurred as a result of human activity. Humans turn enormous natural areas into tiny shards of land for the goal of development and to meet the never-ending drive to expand, even if it means extinction of their own species. These fragmented areas degrade animal and plant habitats, isolate animal groups, and reduce genetic diversity.

As the population grows, due to the need for greater space, destructive human activity continues to encroach on natural areas, resulting in the extinction of numerous species' habitats. Cities, infrastructure, and cropland are spreading and merging into one another as our population grows, fragmenting remaining habitat and creating isolated "islands" of natural populations of plants and animals that are too small to sustain. According to IPBES only a quarter of land areas and a third of oceans are relatively unaffected by human activities.

Agricultural practices: To feed our massive population and meet the unsustainable consumption patterns of people, humanity has devised agricultural systems based on monocultures, artificial fertilizers, and pesticides. Monocultures are becoming more disease-prone, necessitating massive pesticide use, which decimates insect populations. Intensive farming depletes soils nutrient, and farm runoff pollutes water bodies, causing severe algal blooms and extinction of the fish stocks.

Invasive species: The United Nations Development Program (UNDP) has declared invasive alien species as the world's second leading source of biodiversity loss. They prey on native species, compete for food, hybridize with them & introduce parasites and diseases. In the absence of natural defences against the invaders, the natives may be wiped out quickly. The non-native species alter or disrupt the ecosystems they occupy, leading to native species population reductions. Even if a single component of an ecosystem fails, the balance of the system is challenged. Usually the invasive species would be kept out of an environment due to the presence of natural barriers. Due to the removal of these barriers, alien species invade the ecosystem & eliminate the native species. Human actions have been a major contributor to the spread of invasive species. Invasive species may spread through natural migration or human introduction into new areas. Human movement has also facilitated the spread of invasive species, both accidentally and deliberately. The introduction of non-native animals to some locations, such as rabbits and cats in Australia, goats on St. Helena, and American mink in the United Kingdom has put many sensitive ecosystems at risk by harming the native species and reducing biodiversity.

Overexploitation: Overexploitation refers to the removal of species from their natural habitat at a rate that exceeds what native populations can recover. It comprises of overhunting and overfishing which is the practice of harvesting an excessive number of aquatic or terrestrial animals, excessive logging and illegal trade of wildlife, resulting in the depletion of certain species' populations and the extinction of others. It is currently putting about a third of the world's vertebrates at risk of extinction & has resulted in the extinction of passenger pigeons, which were once fairly common. Hunting activities place a significant strain on wildlife, causing massive population declines and disrupting ecosystems. Likewise, many plants and animals are collected to be used as pets, trophies, or souvenirs. Such gatherings are unlawful and are sometimes referred to as poaching. Overexploitation of medicinal plants has resulted in their extinction in their natural environments. Many plants are persistently searched and harvested for academic tutoring and laboratory research. Likewise, a variety of orchids has been overexploited. The uncompromising consumption of resources such as timber, oil, and minerals by humans is destroying natural habitats all over the world. We are also putting immense strain on wild species populations, both through bush meat hunting in developing countries and large-scale industrial fishing in our oceans. Many species, including rhinos, tigers, and pangolins, are still threatened by wildlife poaching and trafficking.

Pollution: Pollution contributes to biodiversity loss by causing many health issues to exposed creatures. Pollution is defined as the introduction of any substance into the environment at a pace quicker than it can be dispersed, diluted, decomposed, recycled, or stored in a harmless form. In some situations, exposure might result in dosages that are lethal or cause reproductive issues, putting the species' survival in jeopardy.

When we think of pollution, we often think about air, water or soil pollution but biodiversity is also impacted by noise and light pollution. All these represent a major threat to biological systems by releasing hazardous compounds and chemicals into the environment, harming animal and plant habitats. The quality of food, water, and other habitat resources degrade in a polluted area, at times to the point that certain species must move away or perish if the pressure is too high. For example, a 2014 research conducted in the aftermath of the 2010 Deepwater Horizon oil disaster in the Gulf of Mexico estimated that 12 percent of brown pelicans and more than 32 percent of laughing gulls in the spilled area had perished. According to another study from 2014, up to 800,000 birds may have died. As a result of such large population losses, it's easy to see how genetic diversity of a species in a given area could be lost. Whole species may be lost as a result of a huge single pollution event or the combined pressure of multiple pollution events in a given area. Genetic pollution, such as uncontrolled hybridization and gene swamping, can also endanger species. For example, abundant species may interbreed with uncommon species, resulting in a gene pool swamping.

Some severely polluted areas have become dead zones, as the conditions are inhospitable to any form of life. In addition to habitat damage, pollution has long-term cumulative effects on the health of the species, contributing to their eventual extinction. It has the greatest impact on marine and freshwater life. Thus biodiversity, which is essential for the survival of life on Earth, is threatened by a variety of human-caused problems. It is critical to act now to safeguard our planet's incredible biodiversity.

Climate change: Climate change has an impact on biodiversity on several levels, including species distribution, population dynamics, community structure, and ecosystem functions. Industry and other human activities contribute to climate change, which is defined as the alteration of the Earth's temperature as a result of the burning of fossil fuels. Fossil fuel combustion emits greenhouse gases, which enhance the atmosphere's absorption of infrared radiation and trap it, impacting temperature (Global warming) and precipitation patterns. Climate change and global warming have a direct impact on physical environmental variables that are necessary for a healthy ecosystem. Coral reefs, which are biodiversity hotspots, would vanish in several years if the current rate of global warming continues. Every half-degree increase in temperature has a major impact on ecosystems, with mobile species running out of places to go to and temperature-sensitive animals like corals experiencing large die-offs.

When keystone species such as reef-building corals become extinct, so do the rich and complex ecosystems they sustain. Similarly, the wildlife in the mountain regions that requires cool temperatures of high elevations such as the rock rabbit and mountain gorillas may in the near future run out of habitat due to global warming. If global warming and climate change continue, 10% of the entire world species might go extinct by 2050.

Climate change and biodiversity are inextricably linked. Despite the fact that the temperature has changed over the course of the earth's history, with ecological communities and species evolving and extinctions, accelerating climate change disrupts ecological systems and species' ability to adapt, increasing biodiversity loss. Climate change is hastening biodiversity loss, putting human interests and security at jeopardy. Clean water, air, medicines, and other natural resources we rely on would be difficult to obtain due to diminished or disappearing flora and fauna from which they are derived. Climate change, along with other factors such as habitat loss, land degradation, hunting, overexploitation of specific species, and so on, is emerging as a serious danger to the planet's biodiversity.

As the human population grows, so does the amount of carbon dioxide released into the atmosphere. Because of our unending creation of greenhouse gases such as carbon dioxide and methane, our world is on the approach of a climate calamity.

9.2.5 Effects of Biodiversity loss:

The loss of biodiversity has numerous consequences, not only for the environment, but also for humans in terms of economics and health. David Cooper, the Deputy Executive Secretary of the Convention on Biological Diversity, used the opportunity at the presentation of the IPBES report to warn against this in the midst of the COVID-19 crisis: "As ecosystems deteriorate, the probability of future pandemics rises."

"Human health is strongly linked to the health of ecosystems, which meet many of our most critical needs."

Maria Neira, Director of WHO's Department for the Protection of the Human Environment

Ecological effects: Biodiversity is essential for the health of ecosystems. Both the productivity and quality of an ecosystem services are affected by reduction in biodiversity, which often include maintenance of the soil, purifying water that runs through it, and supplying food and shade, etc. Biodiversity loss has the greatest impact on species whose populations are declining.

The loss of genes and individuals poses a challenge to a species long-term survival, as mates become rare and the chance of inbreeding increases when closely related survivors' mate. The chance of a species going extinct rises when populations are decimated in large numbers.

Biodiversity depletion also jeopardizes the ecosystem's structure and function. Although all ecosystems have ability to adapt in pressures associated with reduced biodiversity to some extent, biodiversity loss diminishes the complexity of an ecosystem by reducing the roles of numerous interacting species or multiple interacting individuals to fewer or none. The ecosystem's ability to recover from a disturbance decreases as portions are gone. The ecosystem can become disturbed and collapse if species are removed or reduced beyond a critical limit, means it ceases to be what it once was and undergoes a rapid restructuring, transforming into something else such as cropland, a residential subdivision or, barren wasteland, etc. Reduced biodiversity also results in "ecosystem homogenization" between regions and the biosphere as a whole. When conditions change, species that are adapted to limited habitat or other specific environmental conditions (specialist species), are often the most vulnerable to significant population losses and extinction. In ecosystems abandoned by specialist species, generalist species that are adaptable to a wide variety of habitats, food supplies, and environmental conditions and species favored by humans become the primary participants. As the structure of their food chains and nutrient-cycling mechanisms become increasingly identical, the individuality and complexity of the ecosystems loses in the area, as unique species are lost across a vast area. The capacity of forests and oceans to absorb CO_2 decreases if their ecosystems are adversely affected.

Economic and societal effects: Our economy and society are highly dependent on ecosystem and biodiversity they contain. The loss of biodiversity has ramifications for economic systems and human society. Ecosystem not only provide us raw materials for production of goods and energy but also works as a sink to absorb pollution and waste generation. Plants, animals, and other species provide food, construction materials, and medicines to humans, and their availability as commodities is vital to many societies. The loss of biodiversity in these vital natural resources jeopardizes global food security as well as the development of new medications to combat future diseases. Ecosystems that are simplified and homogenized can also be unappealing. Most of food crops have gone extinct in several decades, due to an overreliance on a small number of high-yielding agricultural crop varieties, because these varieties may be prone to disease and pests, invasive species, and climate change. The lack of diversification among crops may pose a challenge to food security. Similarly, high-producing cattle and poultry varieties are preferred over lower-producing, wilder breeds in livestock production. The compounds of uncommon organisms can be used to make traditional medicines, therefore lost species mean lost potential to heal and cure. For example, several types of fungi found on the hairs of three-toed sloths, are used to create drugs that are effective against malaria and Chagas disease, as well as human breast cancer. The loss of biodiversity has a number of negative consequences for human

health, such as the extinction of therapeutic plants which are widely used for therapeutic purposes. About 70 to 80 percent of people globally using plant-based medicine as their major source of healthcare. In developing countries, this reliance on plants for therapeutic purposes is especially prevalent. Local knowledge of medicinal plants is helpful in the search for new herbal medicines that could be useful in the treatment of sickness. Communities that have lived in a same geographic location for a long period create, communicate, and use widespread information about the area's medical resources.

Solutions to biodiversity loss

Biodiversity Conservation: Biodiversity conservation is one of the most significant responses to prevent biodiversity loss by implementing appropriate conservation techniques. Biodiversity protection encompasses a broad range of activities. Protecting habitats is a crucial biodiversity conservation activity that involves identifying and eliminating threats to habitats in order to preserve the natural environment. The conservation of biodiversity also includes limiting and changing agricultural activity. This can be accomplished by water conservation in wetlands and lowering irrigation, as well as by managing cattle grazing through grazing management systems.

Restructuring Business Plans: There is a fundamental Business risk due to ecosystem failure. This is a concept that must be addressed, as well as the recognition that unsustainable supply chains pose reputational risk. Some commodities, such as cocoa and coffee, are essential to an economy, but they also rely on the fragile ecosystem for their growth. Such commodities require a stable ecosystem that is adapted to their requirements. As a result, firms must incorporate these factors into their risk assessments and allocate capital expenditure accordingly.

Government restrictions and policies: In order to solve the problem of biodiversity loss, governments should provide a framework that protects the natural variety of animals and plants. Governments must create, pass, and enforce legislation that protects biodiversity. All nations should work to create an atmosphere that encourages intergovernmental organizations and international politicians to collaborate on biodiversity advocacy. Biodiversity loss can also be caused by unsustainable food production. As a result, governments can ensure that business policies are in place to encourage more sustainable practices. They can also use legislation to safeguard national parks and other regions with flora and fauna, as well as providing incentives and subsidies to farmers to encourage sustainable land use.

Substitute Products: Obtaining the resources needed to make the items we consume has a significant negative impact on biodiversity. Meat consumption, baked products containing palm oil, mass-produced-cheap apparel, and the use of plastic straws are just a few examples. Substituting items with sustainable and ecologically friendly alternatives is one of the most basic solutions to biodiversity loss.

Education: Public awareness is one of the important agenda towards the protection of biodiversity. Without an awareness of the importance of biodiversity to human well-being people are not likely to take necessary actions to protect it. People should be educated in

the early school age that how preservation of biodiversity is important for the planet as well as for humanity, so they can adopt their behavior into adulthood.

Stop deforestation: About 31 percent of the land is covered by the forest. Forests are the habitat for a large number of life forms thus deforestation leads to the habitat loss, which is one of the major cause of biodiversity loss. Forest fire, cutting of trees and over exploitation of forest should be prevented to preserve the biodiversity.

Prevent overhunting and overfishing: Because many animal populations are declining at an alarming rate, we should safeguard them by imposing rigorous hunting and fishing restrictions. As a result, we can ensure that populations can breed and are not in risk of extinction.

Prevent species invasions: Invasive species may become a major threat to local species because compete with native species for food, shelter etc. they can bring illnesses that local species may not be able to handle well and whipped out. Invading species may displace native species, leading to the extinction of a portion of the local variety.

Stop pollution: Pollution has negative impact on ecosystems resulting in the loss of biodiversity; it is a big responsibility for humanity is to reduce all kinds of pollution. Many species that unable to adapt in growing pollution may eventually become extinct.

9.2.6 International Actions:

According to conservation biologists, biodiversity loss might be addressed by a combination of public policy and economic solutions, as well as continued monitoring and education. Governments, non-governmental organizations, and scientists must work together to create incentives for natural habitat conservation and the protection of species within them from unnecessary exploitation, while discouraging behavior that contributes to habitat loss and degradation.

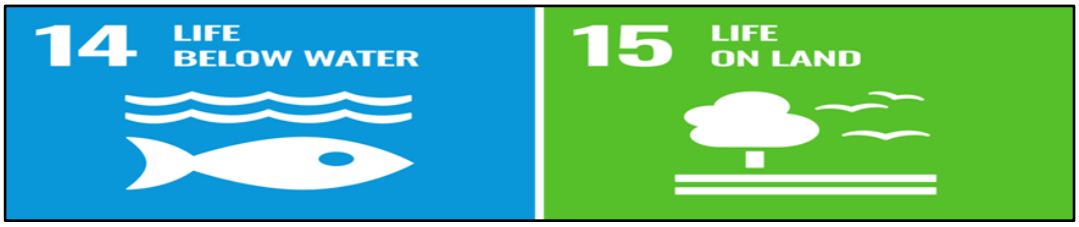
Efforts to monitor the status of individual species, such as the Red List of Threatened Species maintained by the International Union for Conservation of Nature and Natural Resources (IUCN) and the United States Endangered Species List, remain important tools for assisting decision-makers in prioritizing conservation efforts. A handful of places with high concentrations of rare species have also been selected as habitat preservation priorities. These "hot spots" are high-endemism locations, which mean the species found there are unique.

In order to maintain biodiversity, countries around the world must work together. Under the Convention on Biological Diversity (CBD), a number of national governments have pledged to protect portions of their territories. The Aichi Biodiversity Targets, a list of 20 biodiversity targets, were announced during the CBD meeting in Nagoya, Japan, in October 2010. The list's goal was to make biodiversity issues mainstream in both economic markets and society at large by 2020, and to promote biodiversity protection. Many organizations, such as the International Union for Conservation of Nature and Natural Resources' (IUCN) Red List of Threatened Species and the United States Endangered Species Act, are

dedicated to the cause of prioritizing conservation efforts. Norman Myers, a British environmental scientist, and his colleagues have discovered 25 terrestrial biodiversity hotspots that could serve as habitat protection priorities. The Convention on Biological Diversity (CBD), an international pact signed in 1992–93, has resulted in several governments around the world conserving portions of their lands. The CBD's Strategic Plan 2011–2020 included the 20 Aichi Biodiversity Targets, which were published in 2010.Only six of the 20 biodiversity targets set out by the Aichi Biodiversity Targets in 2010 were "partially fulfilled" by the 2020 deadline, according to the UN's Global Biodiversity Outlook report. Since 2010, nearly 164 countries have produced strategies to meet their conservation goals, which include protecting 17% of terrestrial and inland waters and 10% of coastal and marine ecosystems.

By January 2019, various national governments had conserved 7.5 percent of the world's seas (including 17.3 percent of the marine environment in national waters) and 14.9 percent of terrestrial regions.

According to a report released in 2021 by scientists from the IPBES and the IPCC, biodiversity loss and climate change must be addressed together because they are inextricably linked and have similar effects on human well-being. Pamela McElwee, a human ecologist and report co-author, says "People are increasingly feeling the effects of climate change in their own lives, whether it's wildfires or hurricane danger. Biodiversity loss has a similar impact on human well-being, according to our report."



SDG 14. Life Below Water- Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

SDG 15. Life on Land Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

9.3 Conclusion:

The impact of people on the natural environment is the primary cause of biodiversity loss. Pollution, overhunting, overfishing, invasive species, habitat loss and degradation, exploitation of natural resources, are all conducive to biodiversity loss. The loss of biodiversity has a significant negative influence on all living organisms, including humans. It is up to us to safeguard our world and take certain critical steps to avert biodiversity loss. This is critical if we want to ensure a habitable Earth for future generations as well as all plants and animals. The scientific community should work harder to figure out what causes nonlinearities and thresholds in environmental and social processes' responses to changes

in biodiversity. At all phases of land-use planning, managers should address the ecological and socioeconomic impacts of biodiversity change. With adequate design, management, and adaptive responses, managed landscapes can support a substantial share of regional biodiversity.

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