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NUTRITIONAL (HEALTH) AND OTHER VALUES OF PLANTS: OVERVIEW OF CONSERVATION AND STRATESGIES FOR PROTECTING ENDANGERED SPECIES

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Article Info

Abstract

The paper discusses plant conservation strategies for protecting endangered species. It highlights the importance of plant biodiversity, its significance, and the consequences of its loss. The abstract also outlines various conservation techniques, including in-situ and ex-situ protection, specific management systems, and biotechnological methods. Additionally, it touches on the causes of extinction risk to plant biodiversity, such as habitat destruction, climate change, overexploitation, invasive species, and pollution. The abstract emphasizes the need for conservation efforts to protect endangered plant species and preserve biodiversity. The following items were explained: 1. Plant biodiversity is essential for ecosystem functioning and human well-being, 2. Human activities, such as habitat destruction, climate change, and overexploitation, threaten plant biodiversity, 3. Conservation techniques, including in-situ and ex-situ protection, specific management systems, and biotechnological methods, can help protect endangered plant species, 4. Community awareness and participation, research, and monitoring are crucial for effective conservation, 5. The loss of plant biodiversity can have severe consequences, including reduced food security, decreased ecosystem resilience, and negative impacts on human health.

Keywords:
Health, plant, diversity, values, nutrition, endangered

Introduction

In this earth, plants are vital components of biological biodiversity, and serve very essentially for providing diverse resources essentially for providing diverse resources on the planet. Some plants are used as food crops for providing food and fibre, for various economic, traditional or cultural needs (Behera & Bhadra, 2025). Plants are used as clothing, medicines, fuel, and in many more applications. Plants are of great ecological or ecosystem importance, albeit, nowadays few plants were identified due to human inability, there are at least 300, 000 plants known. Among the known plants, some of them are considered on the verge of extinction because they are threatened by human methods that cause destructive, therefore there is need to halt this trend (Cavender-Barres et al., 2021).

In general, biodiversity consists of life in various forms dwelling on earth, such as variety of genes, varied species, varied ecosystem, various ecological processes (Heydari et al., 2020). Plant biodiversity is one of the forms of biological biodiversity on earth. It is a vital key component of ecology, environmental protection, and sustainable human development as well. Biological diversity may be explained as variability existing among living organisms from all sources including, terrestrial, marine, aquatic sources and ecological complexes (diversity of species, genes, as well as ecosystem). Biodiversity is also considering three tiers or levels or categories, namely, genetic diversity, species diversity, and ecosystem diversity (Heydari et al., 2020; Diaz & Malhi, 2022).

However, humans are megafaursl omnivorous and efficient competitors, the Homo sapiens species has continuously act to affect biodiversity in the ecosystem either positively or negatively. The concern is about all the effects, positive effects are needed to be encouraged, while the negative effects are needed to be discouraged. Humans efforts on the ecosystem such as hunting, transportation, transportation of species across locations, use of fire, urbanization, deforestation, and many other things are being done by man (Kumari et al., 2021; Diaz & Malhi, 2023). The aim of this paper is to describe plant conservation strategies protecting endangered species.

Plants as Major Source of Foods and Implication for Health

Majority of the healthy foods around the various parts of the world come from plants. Plants provide majority of the food groups that being taken by humans or animals, about 3 food groups or more are coming from plants directly (Bashar, 2025). Therefore, the role of plants in the entire nutritional framework using other preparation or handling; in humans is emphatic. (Rizzo et al., 2021). The vegetables, fruits and grains and cereals, are major food groups directly coming from plants. Vegetables are cooked or taken raw or frozen or through other preparations; where they provide vitamin C, vitamin E, potassium, folate, sodium, and other nutrients (EU, 2015). Human Fruits provides vitamin C, vitamin A, potassium, sodium, and other nutrients needed for functioning of the human body (Michigan WIC Program, 2019). Fruits of nutritional importance include, mango, guava, orange, watermelon, sweat potato, and Papaya. Other fruits include, straw berries, rasp berries, grape fruits, pears, figs, can berries, kiwi fruits, pineapple, bananas, lemon, apples. (Mateljan. 2010). The cereals, and grains include the rice, wheat, maize, millet, guinea corn, oats, etc. Their role includes provision of energy, protein, vitamin B2, invisible fat, vitamin B1, iron, folic acid, and fibre. Other examples of cereals and grains include, buckwheat, rye, brown rice, quinoa (Mateljan, 2010). Pulses and legumes are plant-based food groups such as cowpea, peas, beans, soybeans, green gram, red gram, etc providing energy, invisible fat, fibre, fat, protein, vitamin B2, vitamin B1, iron, folic acid, etc. Nuts and seeds of importance are obtained from plants including, pumpkin seeds, sunflower seeds, flax seeds, cashew, almonds, walnuts, peanuts, sesame seeds. The major benefits of plant-based foods (creals, fruits, vegetables, seeds) are as follows:

- They are health-promoting foods, because they contain nutrients (such as carbohydrates, fats, proteins) that are metabolized for energy, and micronutrients (minerals and vitamins) that are needed for proper metabolic and physiological dealings. Likewise, the phytochemicals act to reduce tendency to oxidative stress and inhibit growth of disease causing microbes in the consumers (Mateljan, 2010; Baroni et al., 2024). Spinach (a vegetable) contains vitamins (C, B2, A, K), copper, beta-carotene,

omega-3-fatty acids, iron, folate, magnesium, zinc, and vitamin B3 among others. Romaine lettuce contains vitamin K, vitamin A, vitamin C, vitamin K, fiber, molybdenum, omega-3-fatty acids, manganese, chromium, iron, beta-carotene, calcium, tryptophan, phosphorus.

- They promote energy production in an efficient format, because the micronutrients (vitamins and minerals) they provide ae required by enzymes to carry out metabolic reactions. Lack of micronutrients lead to poor energy metabolism and consequences such as obesity, overweight, hypertension, etc (Mateljan, 2010).
- They promote liver health, balance sugar level, kidney health
- They have low glycemic index
- They have presence of antioxidants that help in reducing the risk of inflammation and oxidative stress
- They provide maximum nutrients and minimum energy (Mateljan, 2010).

Plants undertake series of processes to obtain food substances that are utilized to produce energy for growth, physiological functions, reproduction, an d health. Plants follow photosynthetic pathways using chloroplasts, sunlight, water, and carbon dioxide to make high energy (energy-rich) compounds containing sugars. Plants store the sugars produced in body parts such as seeds, roots, stems, fruits, and leaves. In this vein, sugars obtained through photosynthesis are utilized to make oil, cellulose, amino acids (proteins), sucrose, and glucose. Therefore, the glucose is utilized to make many biological processes. Likewise, oil is used to make the food chain. Cell membranes, starch is stored in seeds, and tubers, proteins are used to make enzymes, hormones, and cell structures. In similar vein, plants require nutrients such as Sulphur, nitrogen, potassium, iron, magnesium, calcium, and other nutrients. Therefore, the uptake of these nutrients allow their incorporation and consequently allowing the animals to obtain hem through food chain (Michigan WIC Program, 2019).

Plants Diversity

Generally, biodiversity is initially denoted as biological biodiversity. It is a term describing the number, variety, and variability of living things. Biodiversity explains genes, ecosystems, species, that are corresponding to the three major levels of biological organization (genetic diversity, ecosystem, diversity, species diversity) (Adom et al., 2019). Genetic diversity refers to total genetic information present in the genes of individual plants involved. Every species serves with a repository of large amount of genetic details. Species biodiversity refers to the variability in population pertaining the reproductive differences of every of the individuals. Ecosystem diversity describe the various inhabitants, biotic communities, as well as ecological processes in the biosphere, and the available diversity in the ecosystems. However, only little information about biodiversity had been known die to human's inability (Turnbull et al., 2016; Heydari et al., 2020; Behera & Bhadra, 2024).

Table 1: Showing total number of some species that are threatened as well as endangered globally (adapted from Santra, 2017)

Group	Species endangered	Threatened	Total
Flowering plants	572	142	715
Ferns and allies	24	2	26
Fishes	87	62	149
Mammals	324	33	357
Lichens	2	0	2
Birds	251	21	272
Amphibians	21	11	32
Snails	25	12	37
Insects	51	10	61

Significance of Plant biodiversity

Biodiversity is valuable and significant, some of the values of plant biodiversity are as enumerated in Table 2.

Table 2: Values and significance of plants biodiversity

No.	Value	Level of operation
1	It has commodity value in the sense that, humans utilize plans as foods, medicine	Species and population biodiversity
2	Amenity value in the sense that, humans visit, view, and learn, about the natural plants communities	Species and ecosystem diversity
3	Ecologically, the plant biodiversity is useful in maintaining the functional system of the ecosystem	Functional diversity
4	Ethically, there is moral obligation to preserve plants against extinction	Species, as well as ecosystem diversity
5	The biodiversity gives humans more options for utilization of plants in future	Genetic and population values

However, some of the estimated benefits of plant biodiversity are prepared and presented in terms of economic values or benefits in Table 3.

Table 3: Estimated benefits of plant biodiversity

Activity	Diversity	World economic benefit (X USD 10^9/yr
Waste recycling	Plants-related organism such as algae, fungi, are involved in waste recycling	760
Soil making	Fungi and others	25
Bioremediation	Biodiversity of plants is utilized in remediating waste water and soils	121
Biotechnology	Plants are used for making useful products such as biogas	6

Origin of Biodiversity

Basically, two events spur the biodiversity in plants populations. The Table 4 shows some records of rates of extinction of species.

Table 4: Estimated rates of extinction as adapted from Santra (2017) albeit adapted from other prior authors.

Estimate	% of global loss per decade	Method of estimation
One million species between 1975 and 200	4	Extrapolation of past exponentially increasing trend
15-20% of species between 1980 and 2000	8-11	Estimated species-area curve; forest loss based on global 2000 projections

50% of species by 200 or soon after 100% by 2010-2025	20-30	Many assumptions
9% extinction	7-8	Estimated according to Lovejoy's calculations using Landly's (1982) estimates of forest loss
2-13% loss between 1990 and 2015	1-5	Species-area curve 90.15<z<0.35); range includes current rate of forest area
2000 plant species per year in tropics and subtropics	8	Loss of half the species in area likely to be deforested by 2015
25% of species between 1985 and 2015	9	Loss of half the species in area likely to be deforested by 2015

Loss of Plant biodiversity

According to Darwin's theory, some species become extinct of they lose the struggle to survive and new species are emerging overtime, based on natural forces. However, human activities have eventually led to loss of species through habitat destruction. Table 5 shows the estimated rate of species lost over time in the last year's. Mostly, habitat is lost due to human efforts, such as hunting of wildlife, habitat destruction, introduction of new species, trading of biotic resources, catastrophic processes, accidental events, etc. The more the human population and development increase or rise, the more the extinction of species (Rawat & Agarwal, 2015; Heydari et al., 2020).

Table 5: Record showing some extinct species including vertebrates and plants (adapted from Santra, 2017)

Organism	Species extinct	Threatened	Total	Percentage extinct	Percentage threatened
Plants	90	5,611	250,000	0.04	2.2
Mammals	87	1,130	4,600	1.9	24.6
Fishes	91	750	19,100	0.5	3.9

Conservation Techniques (Strategies) For Biodiversity Protection of Endangered Species

Firstly, there is constant emergence of new genotypes as a result of interactions such as mutation, recombination, and relations; as a result of immigration of the total organisms, gametes, and propagules. Secondly, diversity refers to the population that has been eliminated upon the action of natural selection, and lost via emigration of individuals. The losing of species may be very fast, and variants may thrive for over a long period of time. Thus, diversity emerge due to the speed at variants are eliminated, or new variants are formed (Secretariat of the Convention on Biological Diversity, 2009; Cavender-Bares et al., 2021). Plant biodiversity is extremely important and therefore needs to be protected amidst increasing loss of species due to incensing trend of anthropogenic activities. The 6 Table shows some of the strategies for protecting plant biodiversity (Adom et al., 2019).

Tables 6: Some methods for protecting biodiversity (adapted from Santra, 2017)

In-situ protection		Ex-situ protection	
Specific management system approach			
National parks, natural research sites	Agroecosystems Wildlife refugees	Zoological parks Botanical gardens	Seed and pollen bank Semen, ova, and embryo banks
Conservation objectives			

Marine sanctuaries Resource development	In situ gene banks Games parks and game reserves	To maintain breeding stock	To provide convenient germplasm source for engaging in breeding activities
To establish genetic resources reservoir	To promote generic interaction between domesticated species	To facilitate field research and development of new varieties and breeds	To preserve germplasm of uncertain or threatened species
To protect and preserve evolutionary potential	To maintain viable wild populations for sustainable exploitations	To promote and facilitate off-site cultivation, and propagation	To give convenient germplasm source for conducting breeding activities
For preservation of several ecological processes	To save the viable populations of threatened species	To maintain captive breeding stick of populations threatened in the wild	To maintain reference type collections as standard for research and patenting
To preserve and protect species	To preserve species that provide important indirect benefits (for pollination or as well pest control)	To make wild species readily for education, display, and research	To protect and provide access to germplasm from an array of wide geographical sites
To protect representative species	To make “keystone species” through ecosystem support	To provide wild species readily present for conducting studies, education, research, and display	To protect genetic materials from endangered species

Methods/Steps of Plant Protection

Some methods of plant protection are outlined as follows:

- Naming of plant species-Every plant species should be given a definitive name to ease identification and know if it is there or it is being disturbed, but this is tedious work. In the world flora made, there are names of plants, illustrations, notes and flowering time (Willis & Yang, 2021).
- Researches are important to point out methods and ways of conducting plant -based conservation.
- Sustainable land management involved use of lands for agriculture in a manner that protects the future - Organic production including use of natural products such as manure in farming is utilized. Also there is use of integrated pest management options to effectively protect the environment, soil cover, and minimal disturbance among others (Gour, 2022).
- Biotechnological methods involve diverse developed methods to conserve plant species. The approaches include, invitro propagation, cryopreservation, molecular conservation, etc (Avhad et al., 2023).
- Invitro propagation involved plant tissue culture as a fast and effective strategy to regenerate or multiply plants in large amount. This method can be utilized to preserve shoot top, leaves, nodal segments, seeds, rhizome, roots (Avhad et al., 2023).

- Somatic embryogenesis involves a process of making an embryo like structure from somatic tissues from cell suspension culture or callus. It is a non-sexual development process producing bipolar embryo through somatic culture. The technique examples are shown in Table
- Molecular conservation methods are also used to conserve plants species. Nuclear DNA assay uses genetic information to conserve endangered species, some of the methods applied in conservation were listed (Paul et al., 2020ab).

Advantages of Plant Biodiversity

The earth is full of enormous species of plants and animals that are vast and advantageous and are utilized in various forms of human activities. Even in terrible situations plants try to flourish. In environments such as oceans, plants are readily blossoming. This portray the proliferating nature of plants species and confer various used to humans such as clothing, shelter, medicines, foods, raw materials for industries. However, there are many species that are on the deadline, such as in the India, where Taxus baccata for example is becoming rare in some places. Dioscorea deltoldea is worst affected by the indiscriminate use, that has led to scarcity. The situation leading to plants scarcity is aggravated or supported because of poor monitoring, security on the plant species available I'm our environment (FAO, 2011; Heydari et al., 2020; Schleiffer et al., 2023).

Plant Biodiversity and Agricultural Concern

There are vast number of vascular plants, but about 45 species among them were kept domesticated by humans. However, monoculture, and other inconveniences have spurred many species to be on the verge of becoming scarce or reduced in population. This had present a significant problem affecting agriculture and food production worldwide (FAO, 2011; Turnbull et al., 2016; WHO, 2021).

Plant Diversity Endangering Endanger Food Security

Estimation has revealed that about 25 % of the plants species dwelling on the earth will be lost by the year 2025, if the current environmental inconveniences are unabated or controlled. Preservation of germ pools is important part of food security. If there is lack of preservation of germ pools, species with adapted features such as disease resistance, pest resistance, yield, and other peculiarities may risk extinction. The important food crops such as rice, maize, millet, wheat, sorghum, potato, cassava, legumes (beans, soybeans, peanuts), fruits (like banana, jack fruits, mango), and others (such as sugarcane, coconut) may be affected (Rawat & Agarwal, 2015).

Detail knowledge and application of biodiversity principles have encouraged the farming systems to emerge since the beginning of agriculture and food production. Agriculture significantly relies on plant biodiversity, it's features including genetic resources (plants and animals), edible crops, cultivars, hybrids, other genetic stuffs, soil organisms for soil and ecosystem functioning, natural methods of controlling insects, pests, and weeds, agroecosytem stuffs (such as ploycultura, monocultural, rain-fed irrigated farms, wild resources (species) inhabiting natural habitats acting to provide ecosystem benefits (Thrupp, 2000). For over many decades, farmers have been trying their own ways to preserve plant biodiversity. Most of the staple crops being produced around the world were introduced to non-native regions through the activities of farmers in places like Africa, Latin America, Asia, etc.

Traditional farming interventions aid biodiversity, such as through polycultural systems, crop rotation, home gardens (Tambari, 2025). Likewise, the agroforestry methods, such as coffee plantations in South America are typically supporting the conservation of biodiversity. Therein, farmers combine leguminous trees, fruit trees in coffee farms for various benefits (Thrupp, 2000).

However, about 800 million people are suffering from hunger (or malnutrition) throughout the world. This can be ease if there is protected plant biodiversity that will in turn produce ecosystem goods and services such as wild foods, pollination, climate regulation, water cycling. Wild foods such as fishes, plants, fruits, and insect contribute in generating foods in developing nations. This will help in contributing to control food insecurity and silent hunger. Biodiversity involves pest control, water provision, climate regulation, and pollination in a sustainable way; doing this will also improve food security level across the world.

Plant biodiversity provides functional ecosystems that unveil products, services, while supporting food production, and resilience to shocks (like drought and disasters) (USAID, 2020).

Commercialization and Biopiracy of Plants

Nowadays, biotechnological innovations aid products are successfully thriving and enormously utilized. It is difficult to exactly state the amount of plant -based products been used or sold globally (Rawat & Agarwal, 2015). Biopiracy of plants products is an act of buying plant-based products from one country and consequently patentisation of the product for commercial benefit. This is an act that is considered unethical, which may be seen when the plant raw materials as re secured from poor-setting countries, and are then patentisized by the rich-country (Santra, 2017).

Plants Conservation and Endangered Species

Conservation is a term linked to preservation. Preservation of the environment refers to the activities of keeping natural resources to prevent damaging them, such as from mining activities, hunting, fishing, grazing, and other anthropogenic activities that are unsustainable (Okonkwo, 2015). A species is considered a group of individuals that have collective genetic, behavioral, morphological variation. That variation proved the source of evolutionary change as well as adaptation (WHO, 2021). Preservation is a twin of conservation. Conservation refers to also an endeavor aiming to protect natural resources for the future. About one-third of the entire species living on earth are in the verge of being lost in the upcoming 100 years, currently the rate at which species are becoming extinct is overwhelmingly very fast due to acts such as deforestation, immigration of species that are dominate the new environment, pollution, construction. An endangered species that is prone to extinction, while ab extinction of plant species that is of concern is the one taking place as a result of human hands (Okonkwo, 2015). There are about four steps along the journey of a plant going to be extinct. A vulnerable species is at risk, but not extinct, but had low population or has a reducing population. The low or reducing population, make this species vulnerable (USAID, 2020). Threatened species is a type that id yet to be extinct, also with no immediate risk of extinction, but is facing challenges or problems seriously. Persistence of these problems affecting this species may make it endangered one. An endangered species is facing an immediate danger of falling to be victim of extinction (becoming extinct). An extinct species is no longer available in the habitat (earth) (Okonkwo, 2015).

Table 7: Categories of species that are on the course of extinction

Serial number	Step/ level	Explanation
1	Extinct	A species not located present in the wild in the last 50 years
2	Endangered	A taxon in danger of extinction, and its survival is likely if the polity is continuously disturb unabated
3	Vulnerable	A taxon that may enter into the stage of being endangered in the nearby future if the likely if the polity is continuously disturb unabated
4	Rare	A taxon that has few population that is not endangered at present or alternatively not vulnerable, but is at risk
5	Intermediate	A taxon regarded as endangered, rare or

		vulnerable, but lack of information didn't allowed it categorized into suitable course(step)
6	Insufficiently known	A taxon susceptibly, but not definitely belonging to any category or step. This has been due shortage of information

Strategies for Endangered Plant Species Preservation

There are several utilized strategies intended to preserve and protect plant species from extinction, especially the endangered species (Hashim, 2023). There are rooted survival strategies utilized to preserve endangered species. Habitat restoration and protection constitutes a method whereby native habitat of an endangered plants is preserved or retired by rejuvenating degraded sites, re-bringing in native species, and lowering human disturbance, for example national parks, reserves, are good strategies (Rawat & Agarwal, 2015). Captive breeding and reintroducing is an act of ensuring breeding of endangered plants using controlled environments, with the intention of increasing popular size, aftermath, the population is rebrought into the native habitat. Community awareness and participation is s way of engaging local people, because they may be already aware about species and habitats, and as well could be made aware on how to behave to protect species in their environment. Research and monitoring are vital tools to find out dangers and solutions to problems affecting habitat or plant biodiversity to safeguard endangered species (Hashim, 2023).

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General methods of conserving endangered plant species are diverse. The methods of conserving endangered plant species are principally regarded into categories as Exsitu, In-situ and invitro conservation (Gundu & Adia, 2014). Ex- situ conservation is a renown processes that involves strategies to preserve an endangered species, which are take place outside the natural habitat, by taking the whole plant species or it's part and out of the threatened (disturbed) habitat and introducing it in a wild or controlled place guarded by humans. These methods involve strategies like zoos for keeping wild animals, and botanical gardens. Botanical gardens are preserved areas set aside for plants species to facilitate continuous existence. Aquarium is man-made facilities for storing preserves fish or aquatic animals. Sees banks is a cryogenic laboratory space meant for preserving seeds of plants over a longer period of time (Gundu & Adia, 2014; Adom et al., 2019; Goleniowaski & Cusido, 2017).

Invitro storage is a method involving preserving plant species with the aid of glass tube or vessel containing nitrogen liquid medium, about 150 degrees Celsius. This set-up is utilized to store reproductive plant parts, or steak or cuttings in order to be viable for a certain time (such as years). Gene bank is a form of cryogenic setup facility used in storing sperm, embryo, egg for future use (reproduction) (Gundu & Adia, 2014; Rawat & Agarwal, 2015).

In -situ conservation involves methods of conservation and as well preservation of plant species in their natural habitat. This method requires entire preservation of the ecosystem, using specific terms like, strict nature reserves, game reserve, national parks, etc (Gundu & Adia, 2014; Cavender-Barres et al., 2021).

Causes of Extinction Risk to Plant Biodiversity

Many plants in the bushes are facing the risk of becoming endangered or extinct, primarily due to reasons elicited by human actions. Habitat destruction is a major reason that cause plant extinction. Due to urbanization, development, large-scale farming or agricultural activities, tree cutting, plants habitats are destroyed indiscriminately (Nguru & Sabo, 2022). This pattern has continued as an open disturbance that spurred about majority of the plant diversity loss. Habitat destruction or loss was spurred by engineering works aimed at producing infrastructures for human projects. For example, humans have led the destruction of land habitats (plant cover, and plant species) in order to build industries, estates, farms, sporting centers, schools or universities. Humans have destroyed aquatic habitats by engineering disturbances such as deposition of waste, shipping transportation, recreational activities in waters, production hydroelectric power, irrigation activities, among others. Climate Change is another reason endangering plants species. This event has been causing changes in how plant species exists. This event has been disturbing plants distribution around the world (Saigal et al., 2022).

Overexploitation of plant species or related resource led to plant biodiversity loss. After excessive injection of harmful chemicals (waste materials) into soils, and water, there is considerably diverse effects such as death, injury, deteriorating health on the aquatic species and in turn spur biodiversity loss, humans engage in unsustainable expunging of plant resources leading to biological perturbations and biodiversity loss (Saigal et al., 2023).

Invasion of alien species is another threat to plant biodiversity. An alien species is a category that is shuttled by humans or other forces (such as animals) or other distinguishing natural events (such as weed, pollinators) into another region that is not the native areas of the immigrant species. Invasive species are the types that behave by spreading at fast, and becoming common in the newly found habitat thereby threatening the native species in a great way (Hobbie et al., 2021).

Pollution is a big threat that involved an introduction of harmful substances or energy Inyo the environment by humans in an environment. Pollution contaminated air, water, and land components of the environment. Pollution had string effects on plants, for example indiscriminate pesticides and biocides application kill plants directly or indirectly. Plastic pollution is an emerging trend, about 8,400 million tons of plastics were synthesized and discarded just from 1950s to date. This has been contaminating the environment (land, water, and Sir) making it unfavorable for plants and other biota species. Plastic intake by biota cause many forms of injuries such as oxidative stress, poor nutrition, poor growth, and poor development, and death (Saigal et al., 2024). Noise and light forms of pollution are emerging important processes that affect all the biological systems. Industries, roads, homes, aircrafts, cars, motorcycles, machines, appliances, etc produce light and noise energies that cause injury and death among many plant species (Werden et al., 2020; Diaz & Malhi, 2022).

Conclusion

Plant conservation is essential for maintaining biodiversity, ecosystem services, and human well-being. Conservation efforts, including in-situ and ex-situ conservation, captive breeding, and community awareness, are necessary to protect endangered plant species. Addressing the causes of extinction risk, such as habitat destruction and climate change, is also crucial for plant conservation.

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