UNIT 4 : BIODIVERSITY AND ITS CONSERVATION

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4.1 LEARNING OBJECTIVES

After going through this unit, you will be able to -

- learn about the concept of biodiversity
- acquqint yourself with the ecological and economical values of biodiversity
- know about the hotspots of biodiversity with reference to Indian subcontinent
- learn about the threats to biodiversity
- know about the common endangered and endemic species of the Indian subcontinent
- know about the biodiversity conservation strategies.

4.2 INTRODUCTION

This unit provides an outlook on the concept and conservation of biodiversity. The learner will learn here the pros and cons of biodiversity at

global, national and local levels and their inherent values. The discussion begins with the definition of biodiversity. Threats to biodiversity at the local and global levels are also an important point of discussion in the unit. The concept of hotpost biodiversity as popurarised by the British naturalist Norman Myes is sought to be explained in order to make the learners acquainted with this new idea. Besides, threat to endangered and endemic species due to human intervation of their habitats calls for a detailed discussion as a part of this unit on biodiversity. Finally, conservation measures of biodiversity at all levels demand a special mention for our understanding of biodiversity.

4.3 DEFINITION OF BIODIVERSITY

Earth, the lone living planet of the universe harbours a great variety of life. These diverse living entities ,which include plants, animals and microorganisms, occurring in varied environment, have been supporting the growth and development of human civilization since its inception. Out of 7000 different kinds of domesticated plants that have been used by the human as food, only about 20 species supply 90 percent of the world's total food requirement. Domestication is an age-old practice of human civilization. Wild species with different genetic make-up still have the potential to play a prominent role in world food security and make substantial contribution to the development of medicine and industry. This information depicts the importance of biological diversity for better health care and industrial growth. This knowledge has been helping in planning sustainable livelihood and conserving natural resources in the growing world.

Biological diversity does not mean the assemblage of plant and animal species in any man made biological parks or agricultural field. Biodiversity is the total variability within all the living organisms and ecological complexes where it exists. In other words, biodiversity may be defined as an inherent quality of all living organisms occurring in any area or ecosystem. Biodiversity too is absolutely essential for stability of the concerned ecosystem and proper maintaining of the food chain or food web therein. UNESCO (1994) defined

biodiversity as "an umbrella term for variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part".

Biodiversity is conceived at various levels, but the commonest are at genetic, species and ecosystem levels.

- **Genetic Diversity:** Genetic diversity refers to the variation of genes within a species of any plants, animals and microorganisms. Each variety within a species is the repository of unique genetic information, and the diversity of genes within the species increases its ability to adapt pollution, diseases and other changes in the environment. With the loss of any varieties and populations of a species, genetic diversity within the species is diminished resulting in the loss of 'gene pool' that exists within that species. With the help of modern biotechnological tools, the genetic information present in some wild animals could be made use of for the improvement of the charactristis traits of the species. Such genetic information is used for the nececery medical knowledge required for preparing medicines and also for the production of industrial goods.
- **Species Diversity:** Species diversity refers to the variety of species within a region that could be measured on the basis of the number of species occurring in the region. It is considered one of the basic taxonomic units of the biological world. The diversity is seen both in natural and man- made (agricultural) ecosystems. Natural vegetation patches have much greater species richness than that of agricultural or silvicultural patches. Species richness is also high in tropics than in temperate biomes.
- **Ecosystem Diversity:** The Earth itself is a great ecosystem within which there exists different landforms or landscapes. Each landform constitutes one unique ecosystem that supports varied and specific type of vegetation, resulting to in large variety of ecosystems on our planet. All these varied ecosystems are the important sources of biodiversity of the region. Ecosystem diversity thus could be best understood as a specific geographical region having distinctive

vegetation formation and land mass formation including aquatic bodies.

4.4 VALUES OF BIODIVERSITY

We are aware of the immense potentials of the biodiversity existing on the Earth. The biological resources not only provide us nourishment, clothing, housing, fuel and medicine but also meet our several other requirements. Biodiversity is also essential for maintaining ecological processes starting from food preparation to soil formation and from watershed management to climate change. It is considered a socio-economic and monetary asset of a nation. The knowledge of biodiversity is, thus, of immense value in planning sustainable livelihood and conserving nature and natural resources. Values related to biodiversity can be grouped into *direct values* and *indirect values*. Direct values are assigned to the products harvested by the beneficiary people, and the indirect values are assigned to the benefits obtaining from biodiversity without harvesting and destroying the resources.

- **Consumptive Use Value:** Direct utilization of biological diversity or wealth as food, fodder, fuel wood, timber, medicine and game by the local beneficiary peoples come under this category. Consumptive value is related to natural biological products that are collected and consumed directly by the local communities and they do not figure in trade and market. Forest dwellers and fisher folks are completely dependent on biological resources for their sustenance.
- **Productive Use Value:** This is assigned to the products that are harvested or collected from the wild to be sold in markets at local, national and international levels. This value of biological wealth is linked with national income. Biodiversity provides us commercial products like fuel, fish, food supplements, fruits, fodder, skin, fur, wool, fiber, cereals, medicinal plants and many more. Conservation of biodiversity is, therefore, necessitated for further growth of industry and commerce.
- **Social Value:** Traditional societies are always closly associated with and depended on biodiversity. Cultural diversity is linked up with

biodiversity and cultural values of biodiversity have been recognized in religion, art and literature from the earliest days of the recorded history. One cannot ignore the social value of betel-nut (tamul) among the traditional societies of Assam.

- **Ethical Value:** Sacred groves are the ramnant patches of the old groves of forests preserved by the indigenous tribes as a part of their age-old culture and religious beliefs. These are almost intact forest communities. They provide the refuge for a large number of endemic and rare plants and animals of the region. Thus, locally protected forest patches harbour a good number of medicinal and other plants of economic importance. In other words, one can say that the sacred groves of the temple forests have been acting as gene banks for wild plants in natural environment.
- **Aesthetic Value:** Biodiversity is one of the beautiful and wonderful aspects of nature. From imagination to creativity, and from aesthetic to ethics, biodiversity attracts people for its inherent value and beauty. Aesthetic values such as the taste of wild fruits and sweet fragrance of wild flowers compel people to think about them. Recreation and eco-tourism is now an emerging trend due to this value of landscape biodiversity.

  All the native species constitute the genetic reservoir. This has the potential to provide an economic benefit to mankind at some point in the near or remote future. Studies are going on to assess the bioprospecting potential of different plants and microbes to tackle pollution and to fight with cancer, AIDS etc. with the use of the inherent genetic characteristics therein.
- **Existence Value:** This value is assigned to protect the biodiversity of an area. People offer moneytary contribution for conservation such rare animals as rhino, golden langur and migratory birds. Becouse these are also a source of income for the recreation and tourism industry of the nation. Government too spend money on the conservation the total biodiversity along with landscapes and the wild animals.

4.5 BIODIVERSITY AT A GLOBAL, NATIONAL AND LOCAL LEVELS

It has been estimated that more than 50 million species of plants, animals and microorganisms exist in the world. Out of these, the scientists have so far documented about 1.8 million organisms. Data so far available indicate that only a small fraction of the organisms is known as yet. Scientists are also aware of the immense potential of biological wealth of the Earth and they consider it a 'global resource'. The social, ethical, economic and cultural values of this biological wealth have also been recognized by the modern civilization. Different species along with their unique genetic make-up have made substantial contribution to the development of agriculture, medicine, industry, as well as to the stabilization of climate, protection of watershed, protection of soil and the protection of breeding and roaming grounds at the global level.

Each geographical region is characterized by its own biodiversity depending mainly on its climate. The species occurring in the tropical forests potentially contain cures to many diseases that afflict the modern world. India, with a very wide range of climate and habitat types have harboured about 48,000 species of plants which represent almost 11 percent of the total world flora and 81,000 animal species representing 6.4 percent of the world's fauna. One estimate says that the Indian subcontinent ,which is also know as 'Hindustan Centre' of origin and diversity of crop plants, is the centre of the origin of atleast 167 species of agri-horticultural crops. The Indian subcontinent is rich in germplasm reserve too having around 34,000 cultivars of cereals, 27 breeds of cattle and eight indigenous breeds of buffalos. Like India, Brazil, Malaysia and Indonesia are also rich in biodiversity. These biologically rich areas of the contemporary world have been attracting appreciation for the unimaginable value that exists with their biodiversity.

Assam is one of the largest states of the North east India and is characterized by distinct habitats, landscapes, broad valleys and hills. The forest types are mostly tropical and sub-tropical, which harbour one of the richest biodiversity. An estimate says that the state flora alone comprise

3017 species. Assam is also the abode of some rare species of wild animals and birds like one horned rhinoceros, pygmy hog, golden langur, hollock gibbon, white winged wood duck, adjutant stroke and many more. With its rare variety of biological wealth along with distinctive habitat types, Assam contributes a lot to the global status of biodiversity.

4.6 HOTSPOTS OF BIODIVERSITY

Life on our planet Earth is now faceing an acute crisis. Limitless consumption of the natural recources in the modern world and increasing poverty have contributed to the destruction of these resources. As a result, biodiversity has been exposed to a severe threat. Extinction is the gravest aspect of the biodiversity crisis. Though extinction is a natural process, human action have accelerated the rate of extinction many times over the natural rate. In the world today efforts are on to preseve the valuable specis , but the budgets required for this are insufficient in relation to the number of species threatened with extinction. So, identification of the conservation priorities has become very crucial. In this regard one question may come to our mind as to the biodiversity of which area of the world call for conservation.

To address the this crisis, one British ecologist Norman Myers introduced the 'Biodiversity Hotspots' concept in the year 1988. Biodiversity hotspots hold especially high number of endemic species, yet their combined area of the remaining habitat covers only about 2.3 percent of the Earth's surface. In 1988, Norman Myers for the first time identified ten tropical forest "hotspots" characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. To qualify as a hotspot, a region must meet two strict criteria: it must contain atleast 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics, and it has to have lost atleast 70 percent of its original habitat.

Hotspot analysis is in constant evolution i.e. hotspots may change over time. Recently Myers identified altogether 34 biodiversity hotspots covering the entire globe. Over 50 percent of the world's plant species and 42 percent of all terrestrial species are endemic to these 34- biodiversity hotspots.

India with rich biodiversity has now become a part of *three* biodiversity hotspots: the *Himalaya*, the *Indo-Burma* and the *Western Ghats and Sri Lanka*.

- **The Himalaya Hotspot:** The Himalaya Hotspot is the home to the world's highest mountain range having a diversity of ecosystem ranging from grasslands, subtropical broad leaf forest to alpine meadows. This hotspot is the home to 3160 endemic plant species, 8 endemic threatened birds and 4 endemic threatened mammals.
- **Indo Burma:** Indo-Burma with its immense biological treasure has covered more than 12 million km^2 of tropical Asia. A wide variety of distinctive, localized vegetation formation including low land floodplain, swamps, mangroves and seasonally inundated grasslands is represented in this hotspot. Indo-Burma hotspot holds remarkable endemism in plants with 7000 species, threatened mammals with 25 species and threatened birds with 18 species. This hotspot is the home to a good number of freshwater turtle species.
  - *Western Ghats and Sri Lanka:* The remaining forests of the Western Ghats of southwestern India and the highland of southwestern Sri Lanka, which are similar in their geology, climate and evolutionary history, have been heavily fragmented due to tremendous population pressure. This hotspot region houses 3049 species of endemic plant, 10 species of threatened birds and 14 species of threatened mammals. Freshwater fish endemism is extremely high as well, with over 140 native species in this hotspot area.
- **North Eastern Region of India : A Bio-rich Area:** The North Eastern Region of India is rich in biodiversity. The rich biosphere in this region has been immeensily contributing to the agriculture, animal husbandry, fisheries, forestry and pharmaceutical industry. Geographically the region is situated at the confluence of two biodiversity hotspots- the Himalaya and the Indo-Burma. Stretching in an arc over 3,000 kilometers from northern Pakistan, the Himalaya hotspot extends upto northern Myanmar. It covers hills and mountains of Sikkim, Assam and Arunachal Pradesh. The Indo-Burma hotspot again begins in eastern Bangladesh and then

extends across North East India and south of the Brahmaputra river up to Vietnam and Malaysia. The Hot spot confluence is the home to the important populations of numerous birds and mammals, including vultures, tigers, elephants, rhinos and wild water buffalos. This region has been identified by ICAR as a centre of rice germplasm, while NBPGR (India) has highlighted the region as being rich in wild crops.



CHECK YOUR PROGRESS

Q1. (i) Biodiversity is an abbreviation of

a. Abiotic factors b. Biotic factors

c. Biological diversity d. Biological rhythm

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(ii) Genetic diversity refers to

a. Variation of genes within a species

b. Variation of genes within a genus

c. Variation of genes within a habitat

d. Variation of genes within a fruit

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(iii) Species diversity is high at

a. Temperate forest b. Tropical forest

c. Mountain peaks d. Highway sides

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(iv) 'Biodiversity Hotspot' concept is put forward by

a. Darwin b. Fleming c. Myers d. De Vries

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(v) North eastern Region is situated at the confluence of two biodiversity hotspots

a. Himalaya and Andaman b. Himalaya and Indo-Burma

c. Himalaya and Bangladesh d. Himalaya and Bay of Bengal

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Speciation : Formation of new and distinct species in the course of evolution.

4.7 ENDANGERED AND ENDEMIC SPECIES

- **Endangered Species:** ***Speciation*** and extinction are two inevitable

natural processes. Though extinction is the ultimate fate of a species in the struggle for survival, habitat loss mainly due to human intervention does expedite the process of extinction. Since 1600, the world has lost about 62 mammals, 117 birds and 596 plant species due to human interference. Considering the relative importance of threat to species extinction, IUCN has categorized *six* major groups of threatened species in the *Red Data Book*: *extinct, endangered, vulnerable, rare, indeterminate and less know.*

The *endangered* species are those that are in danger of extinction if the current causal factors continue to operate. The population size of these species has been reduced to almost 50 % over the last 10 years. The prime factors for the rapid decline in number of the species are loss of habitats and breeding grounds, harvesting and hunting, predation, disease, climate change etc.

According to the Indian Red Data Book published by Botanical Survey of India, ten per cent of the total flowering plants in the country are endangered. Out of 1500 endangered flowering plants, 800 are reported from North East India. As per IUCN Red Data Book about 12 out of 19 primates and about 28 out of 36 carnivores of India are endangered.

Some endangered species of North Eastern Region are given below:

Plants	**Animals**
Arundia graminifolia	*Rhinoceros unicornis*
Dipteris wallichii	*Hylobates hoolock*
Dendrobium aurantiacum	*Presbytis geei*
Dendrobium hispida	*Cervus unicolor*
Brainae insignis	*Panthera tigris*
Livistonia Jenkinsiana	*Elephus maximus*
Clematis apiculata	*Cairina scutulata*
Ophiorrhiza hispida	*Eupodotis bengalensis*

- **Endemic Species:** Endemism means the confinement of a particular species to a particular geographical location. It means that it is found only in that part of the world and nowhere else, and such species are

known as 'endemic species'. Endemic species can easily become endangered or extinct because of their restricted habitat and the actions of men. The factors responsible for endemism are: geographical barriers and poor adaptability of the species to a wide range of environment. The NER alone have 1,500 endemic plant species.

Given below is a list of some endemic plants of Assam:

Mesua assamica	*Camellia sinensis*
Aquilaria agalocha	*Dipterocarpous manii*
Impatiens manii	*Ixora goalparensis*
Maba cacharensis	*Derris cuneifolia*

4.8 THREATS TO BIODIVERSITY

Human activities are the major threat to biodiversity. Man is responsible for the deforesting of natural patches and the grasslands resulting in the loss of thousands of valued species along with their habitats. With the explosive growth of human population, the requirement for food, fodder, fuel and fibre has increased manifolds which has put great stress on the natural wealth. Overexploitation of natural resources, habitat loss and pollution are contributing to a greater extent towards the rapid degradation of environment quality along with irreversible loss of biodiversity.

- **Habitat Loss:** The primary cause of loss of biodiversity is the habitat destruction. No habitat-no life. Explosion of human population and expansion of human activities are responsible for the habitat destruction. As a consequence of this, the native species must either adopt to changes or move elsewhere or succumb to ***predation***, starvation and disease and eventually die. Habitat fragmentation may limit the potential of the species for dispersal and colonization. Fragmented forest patches have now become hurdles threatering the survivality of the Hollock Gibbon community in upper Assam. Bengal Florican and Pygmy Hog are again on the verge of extinction due to habitat destruction in Assam. Construction and expansion of roads, extenssion of agriculture and industrial firms have drastically affected the density and abundance of Pitcher plant (*Nephenthes khasiana*) in Meghalaya.



Predation : The preying of one animal on an other.

- **Poaching of Wildlife:** The wild animals are being killed for their products like hides and skins, tusks, fur, meat, medicine and perfumes etc. Assam rhino is now on the verge of extinction due to poaching for its horn. In Africa and Canada, excessive killings of rhinos and elephants in the last century have resulted in the extinction of these species in their native ranges. In Assam too, the elephant is hunted for its ivory and meat; cats are killed for their skins and bones, dolphins for meat and fat, migratory and some resident birds for feathers and meat, and snakes and lizards for their skin. Several species of the wild ***ungulates*** thus have been endangered by their demand in national and international trade. Being the signatory of CITES (Convention on International Trade in Endangered Species), India is now working for the protection of species at national, as well as international level. CITES regulations have reduced illegal international trading to a great extent. But, poaching is still continuing in the bio- rich zones at local level.



Ungulate: a mammal that has hoofs.

- **Biopiracy:** Biopiracy is a kind of procurement of biological resources from a country or place and the subsequent patentisation of their products. Indigenous societies of the developing and underdeveloped countries are the repository of traditional knowledge and beliefs. Scientists and some times the industry people of some developed regions of the world unethically collect living life materials and information on them from the local people of the countries rich in biodiversities and subsequently proceed for patent documentation claiming that the products are the information on their own. Thus through false advertisement they acquire the rights of marketing these products. 'Turmeric' and 'Basmati rice' which have been used by Indian societies over centuries have been accorded the US patent. These are some clear cases of 'biopiracy'. The Government of India should challenge against these countries for such unethical patent right indulged in by them.
- **Man-Animal Conflict:** Man-animal interactions have always had profound consequences on their very existence. With the shrinkage and destruction of the natural habitat, this interaction has taken an ugly turn. This leads to conflict between the lwo resulting in loss to human and wildlife. Man-

animal conflict has now become a sensitive issue overwhelming in its magnitude and complexity. Population explosion, expansion of human habitation, expansion of agriculture and industries, extraction of timber and non timber forest resources are the root causes behind the increasing cases of conflict between wild animals and human beings.

For example, the infiltration of leopards the Guwahati city has also been rising with the expansion of the city since 1990. The incidence of human-elephant conflict again has been on the rise in Assam. More than 40 people on an average have lost their lives to elephants every year in Assam. It has been reported that more than a hundred people and over 90 elephants have lost their lives in the last decade in the Sonitpur District of Assam alone.

4.9 CONSERVATION OF BIODIVERSITY

Conservation of biodiversity is the rational management of the biological wealth along with its interacting ecological systems for the benefit of all lives including humankind, in the entire biosphere. It has to be so managed that it may yield sustainable benefit not only to the present generation, but may also meet the needs and aspirations of the future generations. A few ethical arguments behind the conservation concept are: each species has a right to exist; it renders specific ecological service to mankind irrespective of its size; the loss of the species may have far reaching consequences for nature.

Conservation of biodiversity is of two types:

- In-situ conservation
- Ex-situ conservation

- **In-situ Conservation:** The conservation of biological diversity along with its habitat and ecosystem where they naturally occur is called *in-situ* conservation, i.e. on site preservation. It is one of the advantageous and feasible methods to conserve natural biodiversity of a geographical area. 'The Protected Area' concept has been suggested for *in-situ* conservation of the threatened plant and animal species. The IUCN

(1985) has categorized eight different types of protected areas with distinct management objectives. These are : the scientific reserves/ strict nature reserves, national parks, national monuments/landmark, managed nature reserve/wildlife sanctuary, protected landscapes, resource reserve, natural biotic area/anthropological reserve and multiple- use management areas.

At the initiative of Government and some non Governmental Organizations, Assam now has 5 National Parks, and 22 Wildlife Sanctuaries. The Kaziranga National Park and the Pobitora Wildlife Sanctuary are protecting the remaining population of the Asiatic Rhino. The wet alluvial savannah grassland habitat of Kaziranga is also the home of large herds of swamp deer, hog deer, elephants and birds like- Bengal Florican. The Pobitora Wildlife Sanctuary offers a wonderful opportunity to observe rhinos from elephant back. The Manas National Park, which is also declared as 'Biosphere Reserve', is the home for rare Golden Langur and Pygmy Hog.

- **Ex-situ Conservation:** Ex-suit conservation is the conservation of vulnerable species outside its natural habitat in a carefully managed and controlled situation such as botanical garden for plants and zoo or zoological park for the animals. These gardens and parks are artificially managed to allow the species to multiply. Preservation of germplasm of any species in a gene bank is also an experimental situation in monitored conditioned. Though expensive, gene banks provide an excellent opportunity to preserve genetic diversity, so that it can be used, if needed, in future breeding programmes. In Assam, successful ex-situ conservation programmes have been undertaken for Pygmy Hog, the smallest wild bore of the world at Basistha, Guwahati.



CHECK YOUR PROGRESS

Q 2. State whether the following statements are true (T) or false (F) -

(i) Rhino is found in Nagaland.

.....

(ii) White winged wood duck is the state bird of Assam.

.....

(iii) *Aquilaria agalocha* is endemic to Assam.

.....

(iv) Pygmy hog is a migratory animal.

.....

(v) Zoo is the example of *ex-situ* facilities.

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(vi) Gene banks provide an opportunity to preserve genetic diversity.

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4.10 LET US SUM UP

- Biodiversity refers to the variability among the living organisms.
- Biodiversity concept can be subdivided into three levels- genetic diversity, species diversity, and ecosystem diversity.
- The knowledge of biodiversity is of immense utility in planning sustainable livelihood and conserving natural resources as a whole.
- Each species has value of its own in nature.
- The loss of biodiversity may have far reaching consequences for nature.
- Biodiversity is a valuable resource that should not be wasted.
- Loss of biodiversity means the extinction of species and erosion in gene pool.
- Human activity is the major threat to biodiversity.
- People should take responsibility for conserving biodiversity.
- Attempts have already been made to identify the areas of the world that have rich biodiversity and high level of endemism and are facing immediate threat of species extinction and habitat destruction.
- Biodiversity with intact ecosystem can be preserved *in-situ* by taking adequate measures to cover the under protected area network.

- Protected areas like Natural parks and Sanctuaries have been created to protect the highly endangered species of wild plants and animals in their homeland itself.
- Botanical gardens, Zoological parks and Gene banks are a few measures of *ex-situ* conservation.



4.11 FURTHER READING

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4.12 ANSWER TO CHECK YOUR PROGRESS

Ans to Q No 1: (i) c (ii) a (iii) b (iv) c (v) b

Ans to Q No 2: ((i) False (ii) True (iii) True (iv) False (v) True (vi) True



4.13 POSSIBLE QUESTIONS

VERY SHORT ANSWER QUESTIONS

Q 1. What is biodiversity?

Q 2. What are the causes of the extinction of biodiversity?

SHORT ANSWER QUESTIONS

Q 1. What are the consumptive and non-consumptive values of biodiversity?

Q 2. Write short notes on

a. National Parks of Assam

b. Endemic Species

c. Biodiversity Hotspots and North Eastern Region of India

LONG ANSWER QUESTIONS

Q 1. Explain the various threats to biodiversity and the mode as for its conservation.

Q 2. Why should we conserve biodiversity?

Q 3. Write a note on man-animal conflicts of Assam.

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