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THREATS TO BIODIVERSITY: HABITAT LOSS, POACHING OF WILDLIFE, MAN-WILDLIF CONFLICTS

Man has begun to overuse or misuse most of these natural ecosystems. Due to this 'unsustainable' resource-use, once productive forests and grasslands have been turned into deserts and wasteland have increased all over the world. Mangroves have been cleared for fuelwood and prawn farming, which has led to a decrease in the habitat essential for breeding of marine fish. Wetlands have been drained to increase agricultural land. These changes have grave economic implications in the longer term. The current destruction of the remaining large areas of wilderness habitats, especially in the super diverse tropical forests and coral reefs, is the most important threat worldwide to biodiversity. Scientists have estimated that human activities are likely to eliminate approximately 10 million species by the year 2050.

CASE STUDY

Kailadevi Wildlife Sanctuary – Sawai Madhopur, Rajashtan

While conservation efforts are associated with conflicts between villagers and Forest Officials in most Protected Areas across the country, the Kailadevi Wildlife Sanctuary in Rajasthan has involved local community initiatives for conservation and regeneration. The Sanctuary was initiated in 1983, over 674 sq km forming a part of the 1334 sq km Ranthambore Tiger Reserve. It is located within the Karauli and Sapotra blocks of Sawai Madhopur district.

The primary occupation of the predominant Meena and Gujjar communities is pastoralism and subsistence agriculture.

Pressures on the sanctuary included migrant grazers known as the Rabaris, who came from the Mewar region of Rajasthan with herds of over 150,000 sheep. Other pressures were from exploitation of timber and fuelwood and mining. The threat poised by the migrant grazers spurred the formation
of the "Baragaon ki Panchayat" in 1990, which in turn initiated a 'Bhed Bhagao Andolan'.

The Forest Department supported the villagers in the formation of Forest Protection Committees and Van Suraksha Samitis. The benefits of involving local people in protection of their resources were obvious. Illegal felling was checked. The use of forest resources for local use was monitored. The Forest Protection Committees (FPCs) were also successful in stopping the mining in the Sanctuary. Mining is now banned in the Sanctuary. The people not only protect their forests but also use their resources judiciously.

There are about 1.8 million species of plants and animals, both large and microscopic, known to science in the world at present. The number of species however is likely to be greater by a factor of at least 10. Plants and insects as well as other forms of life not known to science are continually being identified in the worlds' 'hotspots' of diversity. Unfortunately at the present rate of extinction about 25% of the worlds' species will undergo extinction fairly

rapidly. This may occur at the rate of 10 to 20 thousand species per year, a thousand to ten thousand times faster than the expected natural rate! Human actions could well exterminate 25% of the world's species within the next twenty or thirty years. Much of this mega extinction spasm is related to human population growth, industrialization and changes in land-use patterns. A major part of these extinctions will occur in 'biorich' areas such as tropical forests, wetlands, and coral reefs. The loss of wild habitats due to rapid human population growth and short term economic development are major contributors to the rapid global destruction of biodiversity.

Island flora and fauna having high endemism in small isolated areas surrounded by sea have so far been most seriously affected by human activity, which has already led to extinction of many island plants and animals (the dodo is a famous example). Habitat loss also results from man's introduction of species from one area into another, disturbing the balance in existing communities. In the process, the purposely or accidentally introduced organisms (Eupatorium, Lantana, Hyacinth, Congress grass or Parthenium) have led to the extinction of many local species. Loss of species occurs due to the destruction of natural ecosystems, either for conversion to agriculture or industry, or by over-extraction of their resources, or through pollution of air, water and soil.

In India, forests and grasslands are continuously being changed to agricultural land. Encroachments have been legalized repeatedly. Similarly natural wetland systems have been drained to establish croplands resulting in loss of aquatic species. Grasslands that were once sustainably used by a relatively smaller number of human beings and their cattle are either changed to other forms of use or degraded by overgrazing.

CASE STUDY:
Kokkare Bellure – Karnataka: Co-existence
(Man and Wildlife)

The pelican, which is an endangered species breeds in large numbers at Kokkare Bellur which is one of the ten known breeding sites min India. Kokkare Bellure is a village in Karnataka in Southern India. In December every year, hundreds of spot billed pelicans, painted storks, ibis and other birds migrate to this area to establish breeding colonies on the tall tamarind trees in the center of the village. The local people have protected the birds, believing that they bring good luck with regard to rain and crops. The villagers collect a rich supply of the natural fertilizer that collects below the nests – the guano. The droppings of fish-eating birds are rich in nitrates. The owners of the trees inhabited by the birds dig deep pits under the trees, into which the guano falls. Silt from nearby lakes and ponds is mixed with the guano which is used in their fields and sold as fertilizer. They have now planted trees around their homes to encourage nesting.

Our natural forests are being deforested for timber and replanted using teak, sal or other single species for their timber value. Such plantations do not support the same biological diversity as a multi-storied natural forest, which has a closed canopy and a rich understorey of vegetation.

When excessive firewood is collected from the forest by lopping the branches of trees, the forest canopy is opened up and this alters local biodiversity. Foraging cattle retard the regeneration of the forest as seedlings are constantly trampled.

Increasing human population on the fringes of our Protected Areas degrade forest ecosystems. This is a major factor to consider in evaluating the quality of the ecosystem.

Repeated fires started by local grazers to increase grass growth ultimately reduces regeneration and lowers the diversity of plant species. Without alternate sources of fodder this pressure cannot be decreased.

Another factor that disrupts forest biodiversity is the introduction of exotic weeds which are not a part of the natural vegetation. Common examples in India are lantana bushes, Eupatorium shrubs and 'congress' grass. These have been imported into the country from abroad and have invaded several large tracts of our natural forests. These weeds spread at the expense of the diverse range of indigenous undergrowth species. The impact on the diversity of insect, bird and other wildlife species, though not adequately studied, is quite obvious.

In our country a variety of traditional farming techniques have evolved over several centuries. Cultivation by slash and burn in the Himalayas, and 'rab' by lopping of tree branches to act as a wood-ash fertilizer in the Western Ghats, are two such systems. When human population in these areas was low, these were sustainable methods of agriculture. Unfortunately these areas now have a large number of people who subsist largely on forest agriculture. These methods are now unsustainable and are leading to a loss of forest biodiversity.

Overharvesting of fish, especially by trawling is leading to serious depletion of fish stocks. Turtles are being massacred off the coast of Orissa. The rare whale shark, a highly endangered species, is being killed off the coast of Gujarat.

Poaching: Specific threats to certain animals are related to large economic benefits. Skin and bones from tigers, ivory from elephants, horns rhinos and the perfume from the must deer are extensively used abroad. Bears are killed for their gall bladders. Corals and shells are also collected for export or sold on the beaches of Chennai and Kanyakumari. A variety of wild plants with real or at times dubious medicinal value are being over harvested. The commonly collected plants include Rauvolfia, Nuxvomica, Datura, etc. Collection of garden plants includes orchids, ferns and moss.

The Rights of Species

We do not see all the varied functions that biodiversity plays in our lives because they are not obvious. We rarely see how they are controlling our environment unless we study nature. Thus we tend to take short-term actions that can have serious impacts on biodiversity leading to even extinction of species by disturbing their habitats. Man has no right to do so. We only share this planet with millions of other species that also have a right to survive on earth. It is morally wrong to allow man's actions to lead to the extinction of species.

India as a Mega Diversity Nation

India is known for its rich heritage of Biological diversity, having already documented over 91,000 species of animals and 45,500 species of plants in its 10 biogeographic regions. Nearly 6,500 native plants are still used prominently in indigenous healthcare systems. Thousands of locally adapted crop varieties grown traditionally since ancient times, and nearly 140 native breeds of farm livestock, continue to thrive in its diversified farming

systems. The country is recognized as one of the eight Vavilovian centres of origin and diversity of crop plants, having more than 300 wild ancestors and close relatives of cultivated plants still growing and evolving under natural conditions.

Biodiversity is not distributed evenly across the globe. Certain countries, lying mostly in the tropics, are characterised by high species richness and more number of endemic species- called Mega diversity nations About 19 countries/Nations belongs to this category as on today.India is one of them. India a mega diversity country with only 2.4% of the land area of the world, but accounts for 7.8% of the recorded species of the world.

The detailed biodiversity system of India is given in Tables 6.10 to 6.13:

Table 6.10: Recorded plant species

Taxonomic group	Number of species		% of the world flora
	World	India	
Angiosperms	250,000	17,500	7.0
Gymnosperms	650	48	7.4
Pteridophytes	10,000	1,200	12.0
Bryophytes	14,500	2,850	19.7
Lichens	13,500	2,075	15.0
Fungi	70,000	14,500	20.7
Algae	40,000	6,500	16.3
Virus/Bacteria	8,050	850	10.6
Total	**406,700**	**45,523**	**11.8**

Source: India's Third National Report to CBD, 2006.

Table 6.11: Recorded animal species

Taxonomic group	Number of species		% in India
	World	India	
PROTISTA (Protozoa)	31,250	2,577	8.24
ANIMALIA			
Mesozoa	71	10	14.08
Porifera	4,562	500	10.70
Cnidaria	9,916	842	8.49
Ctenophora	100	12	12.00
Platyhelminthes	17,500	1,622	9.22
Nemertinea	600		
Rotifera	2,500	330	13.20
Gastrotricha	3,000	100	3.33
Kinorhyncha	100	10	10.00

Nematoda	30,000	2,850	9.50
Nematomorpha	250		
Acanthocephala	800	229	28.62
Sipuncula	145	35	24.14
Mollusca	66,535	5,072	7.62
Echiura	127	43	33.86
Annelida	12,700	840	6.61
Onychophora	100	1	1.00
Arthropoda	**970,670**	**69,903**	**7.20**
Crustacea	35,534	2,934	8.26
Insecra	861,696	61,151	7.10
Arachnida	73,440	5,818	7.96
Pycnogonida	600	16	2.67
Pauropoda	360		
Chilopoda	3,000	100	3.33
Diplopoda	7,500	162	2.16
Symphyla	120	4	3.33
Merostomata	4	2	50.00
Phoronida	11	3	27.27
Bryozoa (Ecroprocta)	4,000	200	5.00
Entoprocta	60	10	16.66
Brachiopoda	300		1.00
Pogonophora	80		
Priapulida	8		
Pentastomida	70		
Chaetognatha	111	30	27.02
Tardigrada	514	30	5.83
Echinodermata	6,223	765	12.29
Hemichordata	120	12	10.00
Chordata	**48,451**	**4,994**	**10.40**
Protochordata	2,106	119	5.65
Pisces	21,723	2,546	11.72
Amphibia	5,150	240	4.66
Reptilia	5,817	460	7.91
Aves	9,026	1,232	13.66
Mammalia	4,629	397	8.58
Total (Animalia)	1,191,208	88,730	7.45
Grand Total (Protista + Animalia)	**1,222,458**	**91,307***	7.46

Table 6.12: Wild relatives of crop plants in India	
Crop	Number of wild relatives
Cereals & Millets	46
Pulses	81
Fruits	91
Spices and Condiments	28
Vegetables	76
Fibre crops	15
Oilseeds	14
Miscellaneous plants	28
Total	**379**

Table 6.13: Indian native breeds of domesticated animals	
Group	Number
Cattle	30
Buffalo	10
Sheep	42
Goat	20
Camel	9
Horse	6
Donkey	2
Poultry	18

ENDANGERED AND ENDEMIC SPECIES OF INDIA

To appreciate the endemic and endangered species of India it is important to understand the wide variety of plant and animal species that are found in the country.

Of the well-known species, there are several which are endangered by human activity. The endangered species in the country are categorised as Vulnerable, Rare, Indeterminate and Threatened. Other species are found only in India and are thus endemic or restricted to our country. Some of these may have very localized distribution and are considered highly endemic.

Several plant and animal species in the country are now found in only one or a few Protected Areas. Among the important endangered animals are charismatic species such as the tiger, the elephant, the rhino, etc. The less well-known major mammals restricted to a single area include the Indian wild ass, the Hangul or Kashmir stag, the Golden langur, the pygmy hog and a host of others. There are also endangered bird species such as the Siberian crane, the Great Indian Bustard, the Florican and several birds of prey. During the recent past, vultures which were common a decade ago, have suddenly disappeared and are now highly threatened. Equally threatened are several species of reptiles and amphibia. Many invertebrates are also threatened, including a large number of species that inhabit our coral reefs.

Many plant species are now increasingly threatened due to changes in their habitats induced by human activity. Apart from major trees, shrubs and climbers that are extremely habitat specific and thus endangered, there are thousands of small herbs which are greatly threatened by habitat loss. Several orchids are yet another group of plants that are under threat. Many plants are threatened due to overharvesting as ingredients in medicinal products.

To protect endangered species India has created the Wildlife Protection Act. This includes lists of plants and animals categorised according to the threat on their survival.

We know so little about the species diversity of our country. There are several groups of which we know very little. Most of us are only aware of the plight of a few glamorous large mammals, but we need to appreciate the threat to the less known species of plants and animals. We need to find ways to support the conservation of our incredible wildlife for future generations.

Common Plant species

Teak: This tree is from the Southwest parts of peninsular India. It is a common tree in deciduous forests. It yields a much sought after timber used for making excellent furniture. During the early British period it was cut down from many forest tracts to build ships. As the stocks were diminishing, the British selected areas which they called Reserved Forests where teak was planted for the Government's use. Teak is grown extensively by the Forest Department and is a highly priced wood.

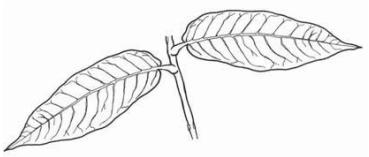
The teak tree is identified by its large leaves, which grow to more than 40 or 50cms long and 20cms wide. It has tiny flowers and fruit. In the winter, the trees shed all their leaves. In the growing season, which begins in April and extends through the monsoon, teak forests are bright green and shady. Most natural teak forests have various other species of plants and

have a large number of wild animals. Some areas of teak forests that have exceptional populations of wildlife have been included in our National Parks and Wildlife Sanctuaries.

Sal: This is a common species of several types of forests of the Northeastern region of India, extending into Madhya Pradesh and Orissa. It has bright green foliage and its canopy remains green nearly throughout the year. Sal wood is hard and durable. Sal gets a large number of seeds which are used in making cosmetics. The sal forests are rich in wild mammals, birds, reptiles and insect life. Several areas are included in our network of National Parks and Sanctuaries.

Mango:

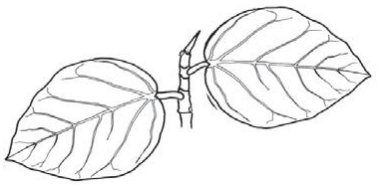
This has become one of our most popular horticultural species with different varieties grown all over the country. The wild mango tree has small tangy fruit and a big seed in comparison to the large pulpy fruit used in horticulture. The mango tree is an evergreen species and gets small flowers that are pollinated by insects. In the forest, fruit dependent animals such as monkeys, squirrels and fruit eating birds relish its ripe fruit.



Mango

Ficus sp.:

Peepal, Banyan and many other ficus species form a part of this group of important trees. They are all ecologically of great importance as many different species of insects, birds and mammals live on ficus berries. The flowers are inside the berries. They are pollinated by a specific wasp which lays its eggs inside theberries on which the larvae feed and grow. The ficus trees bear berries throughout the year, thus supplying nutritious food to several animal species when other trees have no fruit. Ficus species are thus known as 'keystone' species in the ecosystem and support a major part of the food web in several ecosystems. Ficus trees such as Peepal and Banyan are considered sacred and are protected in India.



Ficus

Neem:

This species is known as Azadirachta Indica. It has been traditionally used in indigenous medicine. It has small yellow fruit. The leaves and fruit are bitter to taste. It is used extensively as an environmentally friendly insecticide.It grows extremely well in semi-arid regions and can be planted in afforestation programs where soil is poor and rainfall is low.

Neem

Tamarind:

One of the best known Indian trees, it grows to a large size and is known to live for over 200 years. Its familiar fruit is a curved pod with sour pulp and contains a number of squarish

seeds. The pulp in the fresh fruit is either green or red. As it ripens, it turns sticky and brown and separates from the skin. The tree is commonly cultivated as a shade tree and for its edible sour fruit which contains high concentrations of vitamin C. It is used as an additive in food to give a tangy flavour. It is valued for its timber as well as for fuelwood.

Babul:
This is a thorny species that is characteristic of semi arid areas of Western India and the Deccan plateau. It grows sparsely in tracts of grassland and around farms. It is used for fodder and fuelwood. It remains green throughout the year even under the driest conditions and is browsed by wild animals and cattle. It has small leaves and bright yellow flowers and small seedpods with multiple seeds. Its main characteristic is its long sharp, straight thorns which prevent excessive browsing of its older branches.

Zizyphus:
These are the typical small trees and shrubs that are found in the arid and semi arid areas of India. Z. mauritiana and Z. jujuba are the most frequent species. It is a favourite of frugivorous birds. The tree fruits extensively and is eaten by a variety of birds and mammals. The popular fruit is commonly collected and sold in local markets.

Jamun:
This tree is an evergreen species which has a tasty purple fruit. It is a favourite with not only people but also with many wild birds and mammals. It grows in many parts of India and has several varieties with fruit of different sizes.

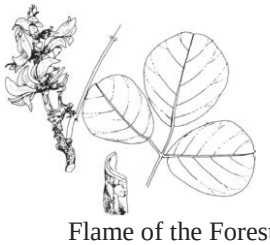

Jamun

Tendu:
Tendu is a mid-sized, deciduous tree, common in dry deciduous forests throughout the Subcontinent. There are around 50 Indian species. Its bark exfoliates in large rectangular scales. It branches profusely forming a dense crown. The leaves are elliptical and leathery and its young leaves are extensively used for making ‘bidis’.The fruit is brownish yellow and astringent. Tendu leaf collection necessitates burning undergrowth and slashing the branches of the trees to get at the leaves. The resulting disturbance to wildlife is a serious issue in Protected Areas.

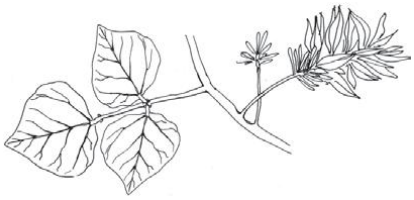
Jackfruit:
A tree that is planted around many villages and has huge fruit growing from its branches. The fruit has a prickly skin. The fruit when unripe is cooked. Once ripe it is eaten raw after it turns into a sweet, sticky, golden-yellow fruit which has a strong smell.

Flame of the Forest (Butea monosperma):

This tree grows in many parts of India. It has bright orange flowers when it is leafless, thus it is called ‘flame of the forest’. The flowers are full of nectar which attracts monkeys and many nectar dependent birds.


Flame of the Forest

Coral Tree (Erythrina):
A common deciduous tree that is leafless in February when it gets bright scarlet flowers that are used for their nectar by many birds such as mynas, crows and sunbirds, that act as its major pollinators. Its long black seed pods contain several shiny brown seeds which germinate well. This tree can also be propagated by cutting and planting its young branches. It is a rapid grower and usually begins to flower in four or five years time.



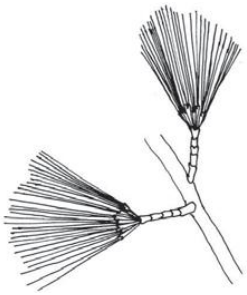
Erythrina

Amla:
This deciduous medium sized tree is known for its sour, green-yellow fruit which is rich in vitamin C. It is used as a medicine, in pickles and for dying and tanning. It is frequently referred to as the Indian 'olive', to which it has no similarity either in appearance or taste.

Dipterocarps:
This group of trees grows in evergreen forests of the southern part of the Western Ghats and in the Northeast of India, in high rainfall areas. It grows to an enormous height with a wide girth. The seed has a pair of wing like structures which aid in wind dispersal.

Quercus (Oak):
Quercus (Oak) is a large tree and is economically an important genus which includes many trees known for their beautiful shape and their changing seasonal colours. There are 30 to 40 Indian species of this genus found in the temperate areas throughout the Himalayas. The fruit is a large, hard, solitary characteristic nut (acorn). Oaks provide the finest hardwoods of great strength and durability and were once used for building ships and bridges. It is a famous wood for high quality furniture. Some of its species are excellent fodder plants.

Pine:
There are 5 species of true pines that are found in India in the Himalayan region. The timber of these trees is frequently used in construction, carpentry and the paper industry. Pine resin is used to make turpentine, rosin, tar and pitch. Pine oils are obtained by distillation of leaves and shoots. Pine leaves are thin and needle-like. The male and female spores are produced in woody cones. Dispersal of pollen is aided by each grain having two wings.

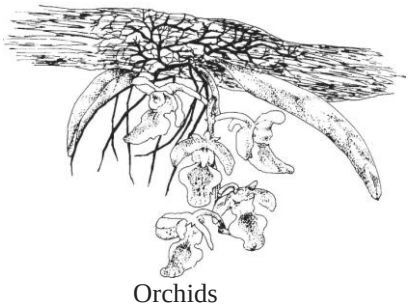


Pine

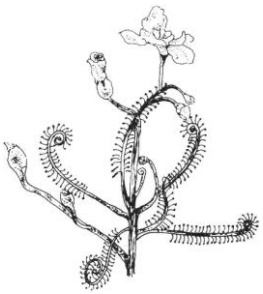
Cycas:
These plants are uncommon in India and have a palm-like appearance. Cycads along with conifers make up the gymnosperms. They are among the most primitive seed plants, and have remained virtually unchanged through the past 200 million years. There are five species found in India, mostly in high rainfall areas.

Coconut:
This tall stately palm has a more or less straight trunk with circular markings. It mostly grows in coastal plains. The base is surrounded by a mass of fine roots. It produces the familiar coconut, filled with liquid and a soft white edible, initially jelly like material that hardens when the fruit ripens. It is a common ingredient of food in India, especially in the Southern States. It is extensively cultivated along the coastal regions and islands of India. Most parts of the tree yield several useful products such as broomsticks from its leaves and fiber from the husk of dried coconuts.

Orchids:
This is the largest group of flowering plants in the world with over 18,000 known species. Of these, 1500 species are found in India, making it one of the largest plant families in the country with a high concentration of a staggering 700 species in the Northeastern States. These plants are terrestrial or epiphytic herbs. Flowers show a range of bright colours and great variations in structure. In some species, one of the petals is distinct from the others and is called a lip or labellum. This colourful petal attracts pollinators. In India a large number of orchid species are found in the Western Ghats, the Northeast, and the Andaman and Nicobar Islands. Orchids are however seen in several ecological conditions except extremes such as very cold or very hot and dry ecosystems.


Orchids

Drosera:
This is a small insectivorous plant, usually 5 or 6cms in height, which has tiny hair which secrete a sticky droplet of fluid on which insects get stuck. The leaf winds around the struggling insect which is then slowly digested. The plant has pretty flowers. It grows in shallow poor quality soil. It is a rare plant and is found in small patches.


Drosera

Lotus:
An aquatic floating plant with a large rhizome, which is rooted in mud. Its leaves are circular flat and covered with a waxy coating which protects it from water. The flower grows on an erect stalk with several petals ranging from pink violet to white. The fruit is a spongy cone with multiple round seeds. It is widely distributed in wetland habitats and shallow parts of lakes and marshy areas. The rhizome, stalks of the leaves and seeds are considered delicacies. The fruit is used for dry decorations. The flower has been a traditional motif in Indian art. The lotus is the National flower of India.

Grasses:
Grasses form the second largest group of flowering plants in the world. They are a very

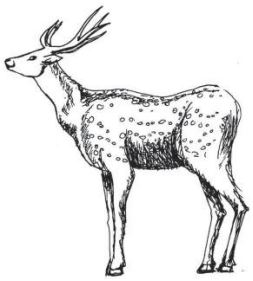
important group of plants as they are used for various purposes such as making fiber, paper, thatching material for roofs, oil, gum, medicines and many other useful products. The economically important grasses include sugarcane, bamboo and cereals like rice, wheat, millets, maize, etc. Grasses are important as they provide fodder for domestic animals.

Bamboo:
This is a group of large grasslike species that grow as a clump to great heights in many forests of India. It is extremely useful and is used for constructing huts and making several useful household articles in rural areas such as baskets, farm implements, fences, household implements, matting, etc. The young shoots are used as food. It is extensively used in the pulp and paper industry as a raw material. Bamboos flower after more than two decades. The plant then dies. The flowering produces thousands of seeds which results in the slow regrowth of the bamboo. Bamboo is a favourite food of elephants and other large herbivores of the forest such as gaur and deer.

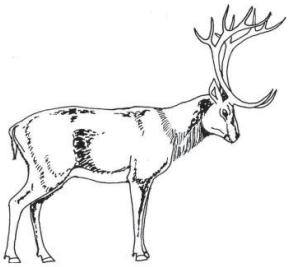
Wild relatives of crop plants: All our present day cultivated varieties of rice, which are grown for food, come from wild varieties of rice, many of which have originated in India, China and Indonesia. Rice forms one of the staple foods of the world. Although wild varieties are not used as food crops, they are important as they contain genes, which can be used to develop disease or pest resistance in crops. Many local varieties of rice have already been lost, as most farmers now grow only high yielding varieties.

Common Animal species

Mammals:
The common deer species found in India include the sambar, chital, barasingha and barking deer. **Sambar** live in small family parties especially in hilly forested areas and feed mainly on shrubs and leaves of low branches. They are dark brown in colour and have large thick antlers, each having 3 branches. **Chital** or spotted deer live in large herds in forest clearings where they graze on the grass. They have a rust brown body with white spots which camouflages them in the forest. Each antler has three branches called tines.


Chital

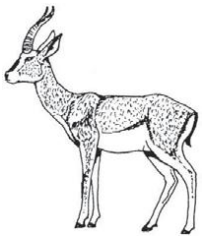
The rare **Hangul** deer is found only in Kashmir. It has a magnificent spread of antlers with 6 branches on each antler. The **Barasingha, or swamp deer**, has wide hoofs that enable this beautiful animal to live in boggy areas of the Terai. Each antler has 6 or more branches. The tiny **barking deer** lives in many forest areas all over India. It has two ridges on its face and a short antler with only 2 branches. Its call sounds like the bark of a dog.


Barasingha

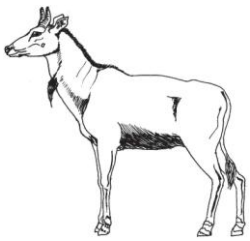
The **blackbuck** is the only true antelope found in India. It lives in large herds. The males are black on top and cream below and have beautiful spiral horns that form a 'V' shape. The **chinkara**, also known as the **Indian gazelle**, is a smaller animal and is pale brown in colour it has beautiful curved horns. The rare **Chausingha**, **or four horned antelope**, is the only

animal in the world that has four horns.
The **nilgai** is the largest of the dryland herbi vores. The males are blue-gray. Nilgai have white markings on the legs and head. They have short strong spike-like horns.

Blackbuck



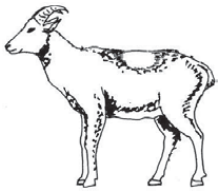
Chinkara



Nilgai

A very special rare species is the **Indian wild ass**, endemic to the Little Rann of Kutch. Himalayan pastures support several species of wild goats and sheep, many of them restricted to the region, like the **goral** and the **Himalayan tahr**. A single species, the **Nilgiri tahr** is found in the Nilgiri and Annamalai hills in south India.

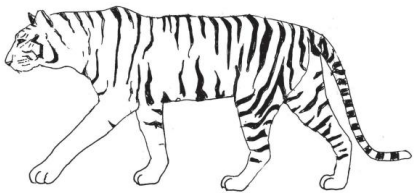
Indian wild ass



Nilgiri tahr

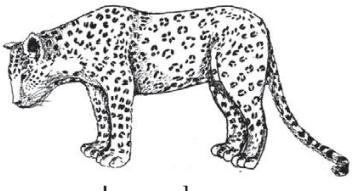
The **rhinocerous** is now restricted to Assam but was once found throughout the Gangetic plains. The **wild buffalo** is now also restricted to the Terai. The **elephant** is distributed in the Northeastern and Southern States. It is threatened by habitat loss and poaching for ivory. **Gaur** is found in patches in several well-wooded parts of India.

The best known predator of our forests is the **tiger**. Its gold and black stripes hide it perfectly in the forest undergrowth. It preys on herbivores such as sambar or chital or less frequently on domestic animals. The tiger kills only three or four times a month. Its numbers have declined due to poaching for its superb skin, and for the supposed magical value of its teeth, claws and whiskers. In the recent past it has been extensively killed for the supposed medicinal properties of its bones that are used in Chinese medicine. The **Asiatic lion** is now found only in the Gir forests of Gujarat.



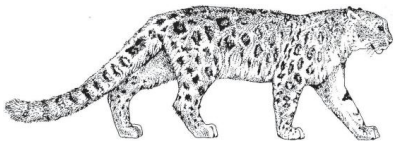
Asiatic lion

The **leopard** is more adaptable than the tiger and lives both in thick forests and degraded forest areas. Its beautiful ring like markings camouflage it so perfectly that its prey cannot see its stealthy approach. The smaller **jungle cat**, which is a light brown animal and



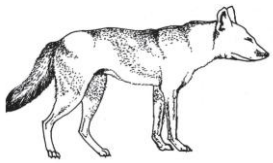
Leopard

the **leopard cat**, which is a little bigger than a domestic cat, are very rare. The most typical predator of the HImalayas is the **snow leopard**, which is very rare and poached for its beautiful skin which is pale grey with dark grey ring-like markings.

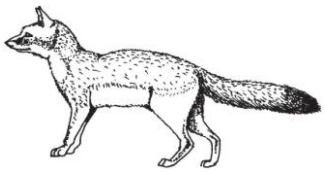


Snow leopard,

The **wolf, jackal, fox** and the **wild dog or 'dhole'** form a group called canids. Another threatened predator is the **Himalayan wolf**. The wolves are now highly threatened as they have become increasingly dependent on shepherd's flocks. Thus shepherds constantly find ways to kill the wolves.



Wolf



Fox

One of the common monkey species of the forest is the **bonnet macaque**, which has a red face, a very long tail and a whorl of hair on the scalp which looks like a cap. Our other common monkey is the **rhesus macaque**, which is smaller and has a shorter tail than the bonnet. A rare macaque is the **lion-tailed macaque** found only in a few forests of the southern Western Ghats and Annamalai ranges. It is black in colour, has long hair, a grey mane and a tassel at the end of its tail that looks like a lion's tail. The **common langur** has a black face and is known as the Hanuman monkey. The rare **golden langur**, is golden yellow in colour and lives along the banks of the Manas River in Assam. The **capped langur** is an uncommon species of Northeast India. The rare black **nilgiri langur** lives in the southern Western Ghats, Nilgiris and Annamalais.

Birds:

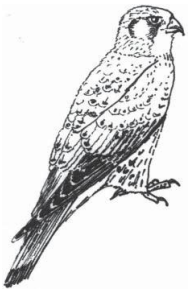
There are over 1200 bird species found in India in different habitats. Most of our forest birds are specially adapted to life in certain forest types. Some Himalayan species however can also be seen in the Western Ghats. There are several species of **Hornbills** that live on fruit. They have heavy curved beaks with a projection on top. Frugivores such as **parakeets, barbets** and **bulbuls** live on fruit and are often seen eating Ficus fruits such as those of banyan and peepal.

Hornbills

Insectivorous birds of many species live on forest insects. They include various species of **flycatchers, bee-eaters**, and others. The male paradise flycatcher is a small beautiful white bird with a black head and two long white trailing tail feathers. The female is brown and does not have the long tail feathers. There are several eagles, falcons and kites many of which are now endangered.

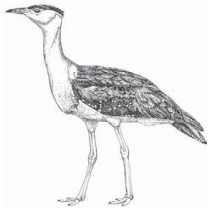
Paradise flycatcher

Bee-eater



Bird of pray

Grasslands support many species of birds. The most threatened species is the **Great Indian bustard**, a large, brown stately bird with long legs which struts about through grasslands look ing for locusts and grasshoppers. Another rare group of threatened birds are the floricans. There are many species of **quails, partridges, larks, munias** and other grain eating birds that are adapted to grasslands.



Great Indian Bustard

Partridge

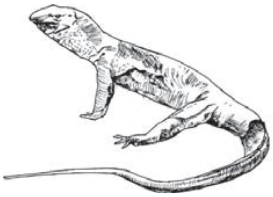
There are several species of aquatic birds such as **waders, gulls and terns,** which live along the seashore and go out fishing many kilometers to the sea. Many of these birds have lost their coastal habitats due to pollution. Aquatic birds in freshwater are those with long legs and are known as waders such as **stilts** and **sandpipers**. The other group form birds that swim on water such as several species of **ducks** and **geese**.

There are many species of spectacular large birds associated with water or marshy areas. These include different species of **storks, cranes, spoonbills, flamingo** and **pelicans**. Many aquatic species are migrants. They breed in Northern Europe or Siberia and come to India in thousands during winter.

Stilt

Flamingo

India has a wide variety of lizards, snakes and turtles, with a high level of endemism. The lizards include the **common garden lizard, Fan throated l i z a r d** , **Chamelion, Skink, Common Monitor** and **Water Monitor**. Some of these are threatened due to trade in reptile skins. Indian snakes include the **Rock Python,**

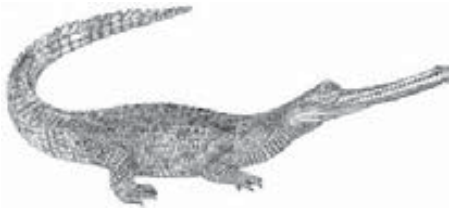


Monitor Lizard

Russell's viper and the **Vine snake**. We rarely appreciate the fact that only a few species of snakes are poisonous and most snakes are harmless. The **Star tortoise** and **Travancore tortoise** are now rare. The **Olive Ridley** and **Flapshell turtle** are the well-known turtles of India. Many turtles are becoming increasingly rare due to poaching of adults and eggs. The **crocodile** is our largest reptile which is poached for its prized skin. The **gharial** is endemic to India and is highly threatened.

Fanthroated Lizard

Star tortoise



Gharial

Amphibia:

Most of the amphibians found in India are frogs and toads. These include several species like the Indian **Bull frog, Tree frog**, etc. These amphibians are mostly found in the hotspots in the Northeast and the Western Ghats. It is now thought that global warming and increasing lev- els of UV radiation may be seriously affecting amphibian populations in some areas.

Invertebrates:

Invertebrates include a variety of taxa that inhabit both terrestrial and aquatic ecosystems. Microscopic animals like protozoa and **zooplankton** form the basis of the food chain in aquatic habitats. **Coral** is formed by colonies of polyp like animals. **Worms, molluscs (snails), spiders, crabs, jellyfish, octopus** are a few of the better known invertebrates found in India.

Snail

Crab

There are more than a million insect species on earth that are known to science. They include **grasshoppers, bugs, beetles, ants, bees, butterflies** and **moth**s. India is rich in its butterfly and moth species.

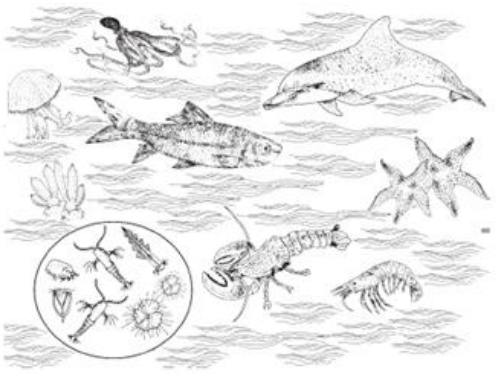
Spider

Beetle

Marine Life:

Marine ecosystems are most frequently associated with fish and crustacea like **crabs and shrimp**, which we use as food. The other species that are endangered include the marine turtles, which are reptiles, and whales that are mammals. There are a

large number of species of freshwater **fish** found in our Indian rivers and lakes that are now threatened by the introduction of fish from abroad as well as due to being introduced from one river into another. Fish are also now seriously affected by pollution. Marine fisheries are being over harvested in our coastal waters and the fish catch has decreased seriously over the last few years. Mechanized boats with giant, small-meshed nets are a major cause of depleting this resource. There are many endangered fish such as the **Mahseer** which once grew to over a meter in length. Many species of marine animals such as the **whales, sharks** and **dolphins** that live in the Indian Ocean are now threatened by extinction due to fishing in the deep sea.



Marine Life

For further details see:

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2) The Book of Indian Animals, SH Prater, BNHS.
3) The Book of Indian Birds, Salim Ali, BNHS.

CONSERVATION OF BIODIVERSITY: INSITU AND EX-SITU

In-situ conservation

Biodiversity at all its levels, genetic species and as intact ecosystems can be best preserved insitu by setting aside an adequate representation of wilderness as 'Protected Areas'. These should consist of a network of National Parks and Wildlife Sanctuaries with each distinctive ecosystem included in the network. Such a network would preserve the total diversity of life of a region.

In the past National Parks and Sanctuaries in India were notified to preserve major wildlife species such as tigers, lions, elephants, and deer. The objective of these areas should be expanded to the preservation of relatively intact natural ecosystems, where biological diversity – from microscopic unicellular plants and animals, to the giant trees and major mammals – can all be preserved.

Project Tiger:

Project Tiger was launched by the Government of India with the support of WWF-International in 1973 and was the first such initiative aimed at protecting this key species and all its habitats. Project Tiger was initiated in nine Tiger Reserves in different ecosystems of the country covering an area of 16339 sq km. By 2001 the of Tiger Reserves increased to 27, covering an area of 37761 sq km. The tiger count climbed from 268 in 1972 in the nine Tiger Reserves, to around 1500 in 1997 in the 23 Tiger Reserves. The Project tiger recognized the fact that tigers cannot be protected in isolation, and that to protect the tiger, its habitat needed to be protected.

Crocodile Conservation:

Crocodiles have been threatened as their skin is used for making leather articles. This led to the near extinction of crocodiles in the wild in the 1960s in India. A Crocodile Breeding and Conservation Program was initiated in 1975 to protect the remaining population of crocodilians in their natural habitat and by creating breeding centers. It is perhaps one of the most successful ex situ conservation breeding projects in the country. Crocodiles have been extensively bred in over 30 captive breeding centers, zoos and other sites where successful breeding takes place. Thousands of crocodiles of all three species have been bred and restocked in 20 natural water bodies.

Project Elephant:
Project Elephant was launched in 1992 to ensure the long-term survival of a viable population of elephants in their natural habitats in north and northeastern India and south India. It is being implemented in 12 States. In spite of this, our elephant herds are at threat as their habitat is shrinking and their migration routes are disrupted by human activities.

However species cannot be protected individually as they are all inter dependent on each other. Thus the whole ecosystem must be protected. The biologist's view point deals with areas that are relatively species rich, or those where rare, threatened or endangered species are found, or those with 'endemic' species which are not found elsewhere. As rare endemic species are found only in a small area these easily become extinct due to human activity. Such areas must be given an added importance as their biodiversity is a special feature of the region.

Animals such as elephants require different types of habitat to feed in during different seasons. They utilize open grasslands after the rains when the young grass shoots are highly nutritious. As the grasses dry, the elephants move into the forest to feed on foliage from the trees. A Protected Area that is meant to protect elephants must therefore be large enough and include diverse habitat types to support a complete complement of inter linked species.

Wildlife Sanctuaries and National Parks of India:

There are 589 Protected Areas in India of which 89 are National Parks and 500 are Wildlife Sanctuaries. They include a variety of ecosystems and habitats. Some have been created in order to protect highly endangered species of wild plants and animals found nowhere else in the world.

The Great Himalayan National Park is the largest sanctuary in this ecosystem and is one of the last homes of the beautiful snow leopard. **Dachigam Sanctuary** is the only place where the rare Hangul or Kashmir stag is found. There are several Sanctuaries in the Terai region, **Kaziranga National Park** is the most famous which has elephant, wild buffalo, gaur, wild boar, swamp deer, and hog deer, in large numbers, as well as tiger and leopard. Its bird life is extremely rich and includes ducks, geese, pelicans and storks. The **Manas Sanctuary**, in addition to the above Terai species, also includes the rare golden langur and the very rare pygmy hog, the smallest wild boar in the world. The florican is found only in a few undisturbed grasslands in the Terai sanctuaries.

In the sal forests of Madhya Pradesh, there are several Protected Areas. **Kanha** offers a wonderful opportunity to observe wild tigers from elephant back. It is the only Protected Area in which a sub species of the Barasingha is found.

Bharatpur is one of the most famous water bird sanctuaries in the world. Thousands of ducks, geese, herons, and other wading birds can be seen here. This is the only home of the very rare Siberian crane which migrates to India every winter. During the last 20 years, the 30 or 40 Siberian cranes have dwindled to only 2 or 3. During 2002-3 no cranes were seen and it is possible that this beautiful bird will never again come to India.

In the Thar desert, the wild life is protected in the **Desert National Park.** Here large numbers of black buck, neelgai and chinkara can be seen. The Great Indian Bustard lives in these arid lands.

Ranthambor was the most well known sanctuary for observing tigers in the wild till about 3 or 4 years ago. Since then many tigers have been killed by poachers.

The **Great and the Little Rann of Kutch** have been made into sanctuaries to protect the very rare wild ass, the flamingo, the star tortoise and the desert fox.

In Gujarat, the **Gir Sanctuary** protects the last population of the majestic Asiatic lion. This thorn and deciduous forest is also the home of large herds of chital, sambhar, and nilgai.

The Sanctuaries of the Western Ghats and associated hill ranges protect some of the most diverse forest types in the country. The few examples of highly threatened species include the Malabar giant squirrel, the flying squirrel and a variety of hill birds, several species of amphibians, reptiles and insects. These regions are also rich in highly endemic plant life. Sanctuaries such as **Bhimashankar, Koyana, Chandoli and Radhanagari** preserve this rich flora in Maharashtra, **Bandipur, Bhadra, Dandeli, Nagarhole,** etc. in Karnataka, and **Eraviculum, Perambiculum, Periyar, Silent Valley**, in Kerala.

In the Nilgiri Hills the rich forest Sanctuaries protect some of the last pockets of the Indian elephant in South India. Examples include **Bandipur, Madhumalai, Wynad** and **Bhadra.** During the last 10 years, a large number of the great tusker elephants of this region have been ruthlessly killed for their ivory. Now very few of these magnificent animals are left in these jungles.

Two important sanctuaries meant for preservation of coastal ecosystems are the **Chilka Lake** and **Point Calimere.** The **Sunderbans** protect the largest mangrove delta in India. The **Marine National Park** in Gujarat protects shallow areas in the sea, islands, coral reefs and extensive mudflats.

Over a hundred Protected Areas have been created in the Andaman and Nicobar Islands to preserve their very special island ecosystems.

CASE STUDY

Orissa – Olive Ridley Turtles Every year at Gahirmatha and two other sites on the Orissa coast, hundreds of thousands of Olive Ridley turtles congregate on the beach, between December and April, for mass nesting. This was the largest nesting site for the Olive Ridleys

in the world. In 1999 by the end of March it was estimated that around 200,000 turtles had nested at the Gahirmatha beach. Marine biologists believe that only one out of every 1000 eggs actually matures into an adult.
There are severe threats to these nesting sites. Shrinking nesting sites, construction of roads and buildings close to these rookeries, and other infrastructure development projects hamper nesting. Trawler fishing is another large threat to the turtles.

After its 'discovery' in 1974, the beach was notified as a Sanctuary (the Bhitarkanaika Sanctuary) and was closed for hunting. Recognising the threats to turtles from fishing by large trawlers, the Orissa Marine Fisheries Regulation Act was passed in 1982. This Act prohibits trawling within 10 km of the coastline throughout the state and makes it mandatory for all trawlers to use Turtle Excluder Devices (TEDs). In 2001, the State Government of Orissa declared that a five month period between January to May should constitute a no-fishing season for a distance of 20 km from the coastline.

Apart form these initiatives, Operation Kachhapa is being coordinated by the Wildlife Protection Society of India, Delhi and Wildlife Society of Orissa with many local NGOs as partners. The Orissa Forest Department, WII, Dehra Dun and the Coast Guard are also involved in the Project.

The need for an Integrated Protected Area System (IPAS): Protected Areas, to be effective, must be established in every biogeographic region. A relatively larger representation must be included of highly fragile ecosystems, areas of high species diversity or high endemism. Protected Areas must also be integrated with each other by establishing corridors between adjacent areas wherever possible so that wildlife can move between them.

In our country, which has a rapidly growing human population, it is not easily feasible to set aside more and more land to create Protected Areas. The need to provide a greater amount of land for agricultural and other needs has become an increasing cause of concern in land and resource management. This forms a major impediment for creating new Protected Areas. Having said this, there is an urgent need to add to our Protected Areas to preserve our very rich biological diversity. Much of the natural wilderness has already undergone extensive changes. The residual areas that have high levels of species richness, endemism or endangered plants and animals must be notified as National Parks and Wildlife Sanctuaries. Other areas can be made into Community Conserved Areas which are managed by local people.

The International Union for Conservation of Nature and Natural Resources states that it is essential to include at least 10% of all ecosystems as Protected Areas if biodiversity is to be conserved in the long-term. India has only 5% of land in its 589 Protected Areas in 2004. However much of this includes plantations of sal or teak, which were developed for timber in the past and are thus relatively poor in diversity and have a low level of 'naturalness'. There are only a few good grasslands left in our country that are notified as Protected Areas. Some are overgrazed wastelands in areas that were once flourishing grasslands. Most of these areas have a low biological value and need careful management to allow them to revert to a more 'natural' state, with their full complement of plants and animals. Only a few wetlands have been made into Sanctuaries. These require better management.

A major strategy to reduce impacts on the biodiversity of the PAs should be to provide a sustainable source of resources for local people living around them. A Protected Area curtails their traditional grazing practices and access fuelwood sources. These resources must be provided by developing them in buffer areas. Plantations of fuel wood and good grassland management in areas outside Protected Areas can help reduce the pressure on the habitat of wildlife in the Protected Area. Management must ensure that local people derive a direct economic benefit from the presence of the PA. Involving local people in Protected Area management and developing tourist facilities that support the income generation for local people helps in involving their support for the Protected Area.

A carefully designed management plan which incorporates an **'ecodevelopment'** component aimed at providing a source of fuel wood, fodder and alternate income generation for local people, is an important aspect of PA management.

There are several species of plants and animals that survive without protection outside our current network of PAs. As it is not practical to notify more PAs without affecting the lives of people, alternate strategies such as Community Reserves or Community Conserved Areas need to be created. These should be managed by local people to bring about the conservation of biodiversity while using the area's resources in an equitable and sustainable way. A Community Conserved Area must have specific conservation goals that can be achieved without compromising the area's utilitarian potential.

A major drive for conservation of biological diversity can only come from a mass environmental education program on the value of protecting our dwindling biological resources.

Ex-situ conservation

Conservation of a species is best done by protecting its habitat along with all the other species that live in it in nature. This is known as in-situ conservation, which is conserving a species in its own environment by creating National Parks and Wildlife Sanctuaries. However, there are situations in which an endangered species is so close to extinction that unless alternate methods are instituted, the species may be rapidly driven to extinction. This strategy is known as ex-situ conservation, i.e. outside its natural habitat in a carefully controlled situation such as a botanical garden for plants or a zoological park for animals, where there is expertise to multiply the species under artificially managed conditions. These breeding programs for rare plants and animals are however more expensive than managing a Protected Area.

There is also another form of preserving a plant by preserving its germ plasm in a gene bank so that it can be used if needed in future. This is even more expensive.

When an animal is on the brink of extinction, it must be carefully bred so that inbreeding does not lead to the genetic makeup becoming weak. Breeding from the same stock can lead to poorly adapted progeny or even inability to get enough offspring.

Modern breeding programs are done in zoos that provide for all the animal's needs, including enclosures that simulate their wild habitats. There may also be a need to assist breeding artificially. Thus while most zoos are meant to provide visitors with a visual experience of seeing a wild animal close up, and provide the visitors with information about the species, a

modern zoo has to go beyond these functions that include breeding of endangered species as a conservation measure.

In India, successful ex situ conservation programs have been done for all our three species of crocodiles. This has been highly successful. Another recent success has been the breeding of the very rare pygmy hog in Gauhati zoo. Delhi zoo has successfully bred the rare Manipur brow antlered deer. However the most important step of a successful breeding program is the reintroduction of a species into its original wild habitat. This requires rehabilitation of the degraded habitat and removal of the other causes such as poaching, disturbance, or other manmade influences that have been the primary cause of reducing the population of the species.

Conservation of cultivars and livestock breeds: There were an estimated thirty thousand varieties of rice grown in India till about 50 years ago. Now only a few of these are still grown. The new varieties which are now being cultivated everywhere have been developed using germ plasm of these original types of rice. If all the traditional varieties vanish completely it will be difficult to develop new disease resistant varieties of rice in the future. Several varieties have been preserved in gene banks. However, this is both very expensive and risky. Encouraging farmers to continue to grow several traditional varieties is thus an important concern for the future of mankind. At present gene bank collections have over 34 thousand cereals and 22 thousand pulses.

CASE STUDY

Beej Bachao Andolan (Save the Seeds Movement) This movement began in the Himalayan foothills. The members have collected seeds of diverse crops in Garhwal. The movement has successfully conserved hundreds of local rice varieties, rajma, pulses, millets, vegetables, spices and herbs. Many different varieties are being grown as an outcome of this program in local farmer's fields. This has also been supported by local women's groups who felt these varieties were better than those provided by the green revolution. In contrast, men who were interested in cash returns in a short time found it difficult to appreciate the benefits of growing indigenous varieties

In the past, domestic animals were selected and bred for their ability to adapt to local conditions. Traditional agropastoralists in India have selectively bred livestock for 2 to 3 thousand years. India has 27 breeds of cattle, 40 breeds of sheep, 22 breeds of goats, and 8 breeds of buffaloes. These traditional breeds must be maintained for their genetic variability.

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