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Editor

Prakash Gole

Foreword

Associations in Nature and Our Future

This issue of our Journal presents some interesting information on associations in nature among different organisms. Indeed nature is a system of associations. These involve intricate interactions between food chains and predator – prey relationships. The two basic ecosystems of the world – land and the sea – are intimately associated, the former sending nutrient flows to the sea and the latter returning the debt in terms of moisture and clouds, the sources of fresh water for life on land. I was forcibly reminded of this fact when I was studying the West coast of India. The bastion of Western Ghats which shields the coast from the east, is the source of nutrients which flow down to the sea through innumerable streams and rivers. When streams were blocked by dams and barrages, these flows are interrupted and the breeding and nursing of marine organisms suffer. We hardly appreciate the fact that the ultimate source of moisture is the sea; and this moisture is forcibly brought down to the earth by hills and mountains. If everyone realizes the role of the sea and the mountains in providing fresh water to all, they will appear in a different light and will not be wantonly disturbed.

Mountains can do this trick only if they are covered with adequate vegetation. The association between the vegetation and mountains is vital for precipitation of rain. Vegetation affects rainfall and rainfall determines the character of vegetation. The extent and distribution of rainfall together with vegetation affect the soil character. Different soils are associated with different patterns of rainfall and vegetation. Topography and soil, together with vegetation and rainfall, influence the variety and quality of habitats supporting innumerable organisms. The living organisms have varied associations and interactions with their habitats and have also evolved associations between themselves. In short, life on earth survives through innumerable associations which can only be broken at life's peril.

Human civilization parallels nature's system in intricacies of associations. As civilizations develop, associations and inter-relationships become more complex and intricate. But civilizations depend on surplus food supply – a result of simplication of food chains and break up of associations in nature, as in agriculture. Agriculture simplifies energy and nutrient flows and directs them so as to be useful only for human consumption. The surplus food which agriculture pro-

duces forms the basis of associations in human society, and indeed the basis of the superstructure of civilizations. Till the 21st century human progress seemed to depend on simplification of nature, i.e. break up of naturally evolved associations.

Now since the last decades of the 20th century and may be increasingly in the 21st century, technology will attempt to create new associations unknown to evolution. The aim will be to create a continuously increasing food surplus for an increasing human population, in effect an increasingly man-made environment favouring human beings and a few other life forms useful to humans.

What will be the impact of technology's attempts to forge new molecular associations? How will nature react to products released by technology? Will new bacterial forms emerge to decompose waste generated by technology? In the short run certain natural associations will be totally wiped out in man's attempts at simplification. Cetain organisms will modify and make adaptations in their associations as a reaction to associations brought by technology.

But the relentless march of technology appears to have one ultimate goal. It is to replace associations evolved in nature by associations consciously favouring human beings. Instead of the multiplicity of plants there will only be few genetically modified plants producing enough surplus to feed human population. There will be only few animal consumers who will share this surplus with people and new modified families of decomposers to break down the waste so created. These associations expectedly will produce enough oxygen to keep intact the balance of atmosphere. Or will the balance change to probably bring about structural changes in human beings? Human beings adapting to anaerobic conditions? Again, what will be the cost of such a technology? Who will afford it? Probably only a few! Will they be fortunate few or unfortunate?

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The Flowering Mantis

*Shrikant Ingalhalikar**

Jungle-lore tells us about some animals trying to disguise themselves. A fox after having fallen into weaver's dye wore a blue coat and dreamt of being the king. A donkey made the same effort by wearing a lion's hide. A jackal who entered the herd of sheep wearing a sheep's hide himself fell prey to the hungry wolf. Nature however, has several mimicries serving their pruposes successfully. Some use the minicry for protecting, while some use it for attacking.

I knew of the *Cottonia* orchid flower mimicking an insect for pollination and this winter I watched just the opposite. An insect mimicking a flower. Nature too seems to have cheats!

On a sultry morning of October I was searching for my favourite herb *Aeginetia* among the undergrowth at Sinhagad near Pune. I was also expecting the purple flowers of *Mucuna* that bloom for a short time. The foliage was dense and the birds could only be heard. I was hence scanning the ground for the flowering herbs. The *Helicteres* shrubs were full of red flowers. *Vigna* and *Clerodendron* flowers were in plenty. The *Strobilanthes* shrubs had bloomed after a gap of seven years. Clouds of insects and butterflies stormed around the *Karvi* flowers for nectar. Drongos, Shrikes and Bee-eaters had hoards of insects to stoop on. While passing past a lantana I saw a blue flower in the shrubs which looked like the *Blepharis*. I wondered why a solitary *Blepharis* flowered two months ahead. I was also surprised to see the flower up in the shrub since the Blepharis is usually seen low on the ground.

I took out my botany lens but could not stabilise my sight on the flower because it moved strangely. I suddenly screamed back in a shock because the flower was not a real one. It was painted on the chest of a deadly looking creature which was hanging down from the branch of *Lantana*. Its 12 cm long body was yellowish brown and it resembled the dry branch. The blue flower appeared to have emerged at the node formed by the neck, thorax and the forelegs. The transparent wings had brown-coloured reticulate venation, which resembled the dry leaves. The conical face, large protruding eyes and a pair of feather like long antennae on the forehead gave it the appearance of an extra-terrestrial creature. I got scared because I had gone very close to the awesome creature.

The insect held the pair of forelegs together as if it was praying. It was a Praying Mantis, one among the group of about ten mantids found in the Sahyadris. Some of them are also known as the stick-insects due to their bodies mimicking the dry twings. These are predatory insects preying on butterflies and moths. They camouflage their bodies to hide on the flowering shrubs, which are visited by the butterflies and moths. The forelegs of mantids have a row of spines on the inner edges that close like scissors.

I was watching the present praying mantis *Gongylus gongylodes* for the first time. While hanging down on four legs the pair of forelegs remained free for capturing the prey. Another intention of hanging inverted was to show the flower in the sunlight. It's fully camouflaged body not only fooled the butterflies but protected it from enemies such as birds, lizards and snakes.

I was thrilled to have close-up photographs showing 'the flower'. Apparently a 'Sailer' butterfly also got interested in the solitary blue flower shining in the

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bright daylight. Unfortunately its sailing flight towards 'the flower' turned out its last as it was trapped by the scissor hands praying for the prey. The butterfly had not even settled on to the flower to realise that it was fake. The mantis took a fatal bite on the neck of the 'Sailor'.

I was stunned by the surprise hunt and did not realise that I had the camera. I put my eye on the viewfinder only to find it vacant. The disguised hunter had already flown away in a clumsy flight with its prey. I did not catch the moments of hunt on the film but returned with loads of rare observations to cherish with.

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The Herbal Hunters

*Shrikant Ingalhalikar**

Man relishes a conceited notion that even wild flowers in nature bloom to please him. He wonders why flowers waste their fragrance in the remote high mountains where man steps only for adventure. If flowers were to show reverence, they would regard the bees and the butterflies as their Lord and not the man.

I found symbiosis between plants and insects interesting and intriguing too. I watched pollinating insects carrying a reward of a pack of tasty pollen or a cup of sweet juice. I was amazed to know about the herbal hunters, which trapped and digested the insects. The survival instinct of such plants does not know of any morality and even insects helping the pollination of the insectivorous plants are trapped. Hunting is seen in nature down the food chain from tigers and eagles to even small insects and organisms. I had read about the famous 'Pitcher Plant' of eastern India and wondered if I would ever see one. The herbal hunters of Sahyadri also evaded their identity in my flower watching jaunts. This year I drew a challenge to locate the insect hunting plants of Sahyadri. The list ended meagre with only *Drosera indica* and *Drosera Burmannii* in it. Hunting for the Droseras appeared simple as both grew in south Konkan between September and December.

My first ramble with the herbal hunters was at *Mahabaleshwar* in the month of October. I kneeled on the lush green lateritic plataeu of Kates Point to look for *Drosera Indica*, a tiny herb with small pink flowers. My botany master had hinted about its co-existance with another herb, *Burmannia coelestis* which had tiny bright blue flowers. I combed for an hour through the dwarf grass and failed to locate both. I realized that I should have been looking for a moist habitat depleted with soil cover which would be deficient in nitrogen and proteins. I checked on a patch of sandy soil at the base of a slope and there was my first 'Sundew' plant glittering with diamond-studded leaves that eclipsed the dainty pink flowers.

The astonishing little herb straggled to stand up for a few centimetres among the grasses. The leaves had just vein like tentacles with no chlorophyll between them. The herbal hunters produce food by photosynthesis. They procure their needs of nitrogen and proteins from their victims. The fleshy tentacles were tipped with small dots of sparkling, clear, sticky liquid. The shining dots were certain to lure insects onto them, as they looked very tempting.

A tiny flying insect landed on the Drosera flower. Drosera flowers obviously had no fragrance. It was the bright pink colour that attracted the attention of the insect. It crawled upon the parts of the flower and did not find any juice. It looked down at the mouth watering dots of juice and swiftly landed on them. It got stuck to a few dots, and struggled to get free. The movement stimulated the sensitive leaf to coil up and to trap the insect. The liquid from several tentacles merged together to flood around the insect.

The leaf remained coiled for a few minutes and opened slowly as before. The soft organs of insect got dissolved in the liquid for the herbal hunter to absorb the nutritive stock. The dry shell of the insect body lay rejected on the leaf. I found the slow and silent kill as thrilling as an eagle's kill, as I watched it through the lens instead of binoculars.

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I placed some dry flakes on the leaf, but the tentacles did not respond to the lifeless material. The intelligent plant sensed that the stimulus was not from an insect. It was this animal like sensitiveness of herbal hunters which made the scientists wonder if such plants needed to be classified under the animal kingdom. Darwin in his famous experiments found that Droseras had sensitiveness greater than in any nerve of human body.

The other herbal hunter, *Drosera Burmannii* was to be hunted at Amboli in the month of December. I spotted a drying pond with a cover of low herbs on the sandy bed. While scanning the ground for the herbal hunter my attention was drawn by a flower-like plant lying flat on the moist bottom of the drying pond. The familiar tentacles and the sparkling dots immediately led to the name 'Sundew Plant'. The spread of leaves was in a neat circle of 3 to 5 centimetres. The bright red leaves were in the shape of a spoon.

Fleshy tentacles covered the upper surface of leaves. The tentacles on the margin of leaf were longer. It was interesting that the sticky dew drops did not gather the unwanted dust or foreign particles. They were not found getting washed off with the actual dew or rain drops. A strange repelling force kept them apart even in close proximity. The tentacles of this Drosera closed on the insect like a palm grip as if to squeeze out the soft contents. I could not watch how the intelligent plant disposed dry shells of insect body, which were left at the bottom of spoon shaped leaves. A slender stalk bearing small white flowers rose from the rosette of leaves. *Drosera Burmannii* grows in the drying rice fields of south Konkan in Sahyadri.

A few species of genus *Utricularia*, another group of aquatic insectivorus herbs, also grow in the Sahyadri. They have small 'bladders', which trap and digest insects with the help of digestive juice. The 'bladders' have a narrow mouth through which the insects enter the bladders. Their return is prevented by downward pointing stiff hair. *Utricularias* have brightly coloured attractive flowers. These plants are known as 'Bladderworts' and are called insect 'eating' plants. The Droseras which display hunting instincts with their active external 'stomachs' are known to be the true 'herbal hunters'.

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Insects Living With Ants! (Myrmeciphilous Insects)

*Dr. Makarand Dabak**

Ants

Ants are ubiquitous insects found in a wide variety of habitat. Over 20,000 species of ants have been recorded so far. Though quite a few are solitary, a large majority of ants are social insects that live in colonies or groups. Some colonies consist of millions of ants. They use a wide variety of material for constructing their nests such as : clay, pulp of bark, leaves, sticks, etc. Earthen nests of some species are veritable fortresses with intricate network of tunnels, chambers, balconies and terraces.

Ants undergo complete metamorphosis during their life cycle which consists of 4 distinct stages viz. egg, larva, pupa and adult. Each stage is completely different from the other three. Social ants have three major castes viz. queens, males and workers. A colony may have only one queen or there may be many queens depending upon the species. The queen is an 'egg-laying machine' and spends nearly her entire life laying eggs. The male ants are relatively short lived and serve only one purpose, to fertilize the future queens. The workers are sterile females. They are responsible for most of the activities of the nest including construction and maintenance of nest, foraging for food, nursing of larvae and pupae. They also defend nests from enemies.

Ants are armed with powerful jaws which they use with telling effect in offence and defence. An army of ants comprising individuals that are ready to strike when provoked can deter many a potential predator! Ants recognise each other by means of a special chemical signal called pheromones. Any intruder is attacked if its chemical signal does not match the one that is characteristic of the colony.

Myrmecophilous Insects

Many insect species have managed to forge varying degrees of associations with ants thereby gaining protection. Such insects are known as myrmecophilous insects and include Lycaenid butterflies, aphids, termites, beetles and a number of other insects. Some docile species of ants are also known to be associated with more pugnaceous ones. It goes without saying that a myrmecophilous insect must necessarily be able to overcome the predatory instinct of the host ants. A very large number of insects have managed to do so.

Adaptations of Myrmecophilous insects

Myrmecophilous insects have evolved one or more of the following mechanisms to avoid predation by their hosts.

1. Myrmecophilous aphids and Lycaenid larvae have secretory organs that secrete 'honeydew'. It is a liquid rich in sugars and amino acids and is relished by ants.
2. Some Lycaenid larvae possess perforated cupola organs like minute pits scattered over the epidermis that are supposed to secrete appeasement substances.
3. Many myrmecophilous insects produce chemical signals that modify behaviour of ants.

In addition to above measures a large number of adaptations are found in different species. In a certain group of Lycaenid species the larvae have vibratory papillae that produce sounds that appear to attract

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ants. Some butterfly larvae have evolved very thick skins which ensure protections from ants. The best Indian example of this type is the Moth Butterfly (Lyphira brassolis) from Sikkim whose carnivorous larva is a most unwelcome guest in the nests of the fierce Red Tree Ants. Its skin is very tough and also conceals head and legs. It retains this tough skin even after pupation unlike other butterflies and moths. The imago that emerges from the pupa is covered with easily detachable but adhesive scales. They keep the ants occupied while the butterfly escapes from the nest.

Obligative and faculative Myrmecophiles

Schonrogge and Thomas estimate that more than 10,000 species of insects worldwide are obligative social parasites of ants and a further 80,000 to 90,000 species form closely coupled mutualistic reactions with ants. Obligative myrmecophiles require presence of ants to complete their life cycle whereas facultative myrmecophiles can complete their life cycle without ants. In general facultative myrmecophiles tend to associate with a broad range of ant species while obligative myrmecophiles exhibit a high degree of specificity for ant species.

Relationship between myrmecophilous insects and their hosts

'Honey-dew' secreting Lycaenid larvae and aphids share a mutualistic relationship with ants. Ants are seen to actively solicit honeydew secretion by caressing the bodies of these insects by their antennae. This behaviour is aptly called as 'milking'. In return ants protect these insects from enemies.

Myrmecophilous Lycaenids

Butterflies belonging to family Lycaenidae are small to medium in size. They are popularly known as Blues and Coppers, these being their predominant colours. Like all butterflies they have 4 stages in their life cycle viz. egg, larva or caterpillar, pupa or chrysalis and adult. The eggs hatch into larvae which feed and grow. They moult five times before pupation. The stage between two successive moults is known as an instar.

Members of several genera in this family have evolved associations with ants. Myrmecophilous Lycaenid larvae have a pair of mouthlike openings on the 11th segment of body for secreting honey-dew. Depending upon the species they enjoy varying degrees of protection from ants. Some caterpillars are only intermittently attended by ants, whereas obligative myrmecophiles receive their constant attendence. In fact adult females of obligative myrmecophilous Lycaenids lay their eggs only in the vicinity of ants. Ants may carry Lycaenid eggs or larvae to their nests where they complete their life cycle. Ants are also known to construct shelters for their wards. Once inside the ants' nest the Lycaenid caterpillars receive regurgitated foof from ants and/or feed upon the brood of their hosts. Thus myrmecophilous Lycaenid larvae can be divided into following groups :

1. **Phytophagous :** They feed exclusively on their respective food plants. Ants protect them but do not have any major role in their feeding.
2. **Phytopredaceous :** The first two instars feed on plants after which they are transported by ants to their nests. The larval epidermal glands produce a chemical which mimics the pheromone of the ants' brood. Hence ants treat these larvae as their own brood. In the safety of the nest, the caterpillars become predaceous and feed on the brood of host ants.
3. **Predaceous :** These species feed on Homoptera and/or ant brood. The best known example of such species in India are Brownie (Gerydus sp.), Apefly (Spalgis epeus) and Moth Butterfly. Their caterpillars feed on aphids, scale insects and ants' brood respectively.
4. **Secretion Feeders :** They feed on secretions of Homoptera and/or regurgitated food of host ants.

Several myrmecophilous Lycaenids are found in India. Some of the common ones are as follows :

A) Intermittently attended by ants : Common pierrot (Castalius rosimon), Angled Pierrot (Caleta caleta), Zebra Blue (Syntarucus plinius), Pale Grass Blue (Zizeeria maha), Lime Blue (Chilades laius), Grass Jewel (Freyeria trochilus), Gram Blue (Euchrysops cnejus), Peablue (Lampide boeticus), Common Cerulean (Jamides celeno).

B) Constantly attended by ants : Large Oakblue (Arhopala amantes), Common Acacia Blue (Surendra quercetorum), Common Silverline (Spindasis vulcanus), Yamfly (Loxura atymnus), Indian Red Flash (Rapala iarbus).

Myrmecophilous Aphids

Aphids are fairly common insects and at least a few species of them can be found in most localities. They have sucking mouth parts and feed on sap of plants. Many of them are pests of agriculture. Out of the 4,500 odd species of aphids nearly half are protected by ants in return for their honeydew. Lady Bird Beetles and wasps are among the chief enemies of aphids. Ants are

known to fight off predators just as farmers protect their cattle. They also 'herd' the aphids to different regions of the plant that will provide more sap. Some species of ants even build shelters for aphids. However, if ants find that some aphids are not producing adequate quantities of honeydew they may be carried to the colony as food.

Myrmecophious Termite

Though termites and ants belong to two different orders, they are similar in certain respects. Like ants termites are social insects living in colonies, each colony has a chemical 'signature' and they have three castes viz. queens, males and workers.

Associations between termites and ants are well documented. They are mainly in the form of few ants living in a termite colony or few termites living in an ants' nest. The former type is more common. It is likely that a few stray individuals enter the host colony and if they manage to stay long enough to achieve chemical harmonization they can continue to live there. However, it must be remembered that what is true of one colony is not necessarily reproducible in another colony of the same species.

In many cases the relationship is mutualistic and both species participate in day-to-day activities of the colony. However parasitic relationships are also found where the intruders only share the resources of the colony but contribute nothing.

Myrmecophilous Beetles

Several species of beetles have evolved myrmecophilous habits. They imitate the chemical profile of their host ants allowing integration into the host nest. Ants treat them as one of their own brood and feed them regurgitated food after tactile communication.

Ant-Ant Associations

When two species of ants have their nests close to each other and share the same foraging trails, they may form a close association where individuals of one species live in the colony of the other one. In such cases both species work together. Some species of ants are known as 'slave-maker ants'. They steal brood from other colonies and house it in their own colony where it develops and serves as slave labour. In some ant-ant associations individuals of one species are completely dependent on the other. They contribute nothing to the hosts who tolerate and feed them.

The Case of Maculinea arion

Maculinea arion is an obligative myrmecophilous Lycaenid found in Britain and other parts of Europe. Researchers had noticed that its population in Britain was steadily declining for more than 150 years before it finally became extinct from Britain in 1979. Habitat destruction resulting in shortage of food plants was thought to be the main cause. However, researchers later discovered that what really sealed its fate in Britain was the fact that changes in agricultural practice had rendered the ranges of its foodplant Thyme and its ant host Myrmica sabuleti disjunct. This knowledge was eventually used for the planned reintroduction of Maculinea arion in Britain.

Apart from ants several other insects, especially termites, form associations with other insects. The study of such associations is a fascinating and useful branch of Entomology.

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Threats to the Lepidoptera and Self-defence Against it

*Shauri Sulakhe**

'Butterflies', the most beautiful, elusive and fascinating, scaly-winged creatures, usually named as flying flowers or flying jewels share a very special place in the insect world. Classified under the order Lepidoptera, butterflies and moths number 1,40,000 species in the insect world. Butterflies are supposed to be the model of innocence. With magnificent colours, cheerful flights, not being able to bite or sting, and hypognathous head these holometabolous creatures (with complete metamorphosis) form a very important part of the food chain. The diversity of Indian butterflies accounts about 1,500 species. These terrestrial animals have evolved and occupied almost all habitats from dense forests to scanty vegetation. A good number of butterflies and moths are also seen easily in the cities. This abundance and omnipresence makes Lepidoptera a very attractive prey base.

Various insectivores readily consume Lepidoptera in practically all stages of their life cycle. Especially for some vertebrates butterflies, moths and their caterpillars are an extremely nutritious diet. The organisms that destroy butterflies could be categorized as parasitoids, parasites and predators.

Parasitoids are very small organisms that live at the expense of another animal (a host) that eventually dies as a result. The female parasitoids using their special ovipositors (egg-depositors) lay eggs inside the eggs or larval stages of lepidoptera. Then the larvae of parasitoids emerge and feed on the tissues of the host. Finally when the host is ready for pupation the parasitoids also pupate and the adult parasitoid emerges from the pupae. This can be easily experienced by rearing the butterflies in a neglected condition. The butterflies like Tigers, Crows, Lime butterflies, Tawny costers, and Mormons are commonly affected by parasitoids. There is a mind-boggling diversity of parasitoid species. There are more than one species of parasitoids per species of lepidoptera. Lepidoptera have almost no protection against parasitoids as they use several chemical clues to detect the hosts. Many times the egg laying female of lepidoptera are followed by the parasitoids and then eggs are laid inside the eggs of lepidoptera. Antenna and special ovipositors help them for accurate ovipositioning and easy host acceptance.

The second category is the parasites. These organisms live at the expense of the other animals but may or may not kill them. Various mites, viruses and bacterias parasite the lepidoptera. Mites usually parasite the adult stages. Many viruses are passed on in the host along with the endo-parasitoid wasps in the families of *ichneumonidae* and *braconidae*. Thus the parasitoids and parasites are also associated in parasitism of lepidoptera. Larvae of many butterflies like Tawny costers, Pioneers, Tigers, Crows and many butterflies from Lycaenidae family are seen in groups and are thus infected by viruses gregariously. A large number of butterflies die in the larval stage itself due to bacterial and viral infections.

The third and the last category of organisms that destroy lepidoptera are the predators. They are the organisms that kill and consume a lot of prey animals during their life. Predators like Insects, Reptiles, Mammals and Birds are a real threat to lepidoptera as they consume all stages of butterflies and moths to a great extent. There are a lot of insects that feed on butterflies

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and moths like the Mantids, Dragonflies, Wasps and Robersflies, etc. Around 25% of the insect species are predatory or parasitic in nature. Dragonflies and Robersflies are expert Arial hunters. They are most of the times seen catching the prey in air. Many insects also use sit and wait strategy to hunt. Considering the habitats, prey catching techniques and locations of hunting Dragonflies and Robersflies become the predominant lepidoptera hunters thus proving prey selection and specificity. Lepidoptera eggs are often consumed by cockroaches, ants and lacewings. Lacewing larvae are also a great threat to lepidoptera larvae, especially to Tigers, Crows and Gulls etc.

Praying mantids also have their share of the lepidoptera larvae and adults by camouflaging and attacking suddenly. Mantids are often seen at prominent locations like flowers where butterflies visit for nectar.

Spiders also consume lepidoptera to a large extent. Time and again the butterflies are seen entangled in the spiders webs. Even India's largest butterfly Southern Birdwing was once seen caught in a large web of the Giant Wood spider.

Like insects and spiders some reptiles also feed on lepidoptera. Especially the Skinks, Lizards and some tree snakes are prominent predators of butterflies. The butterflies, which do intensive basking, are often consumed in a great quantity. Some nocturnal insectivorous mammals like Bats and Loris feed extensively on moths. Bats use special techniques of echolocations to catch moths at night.

The most voracious predators of caterpillars and adults of lepidoptera are the birds. Insectivorous birds like the Bee-eater, Orioles, Shrikes, Flycatchers, Bulbuls and Warblers are often seen catching the butterflies. This is the reason birds are crucial agents in the evolution of insect defenses. In some countries lepidoptera caterpillars are also consumed as human food. Caterpillars are considered as a delicacy in Australia.

Being so abundant and vulnerable these creatures have their own lines of defense to escape the threats. To compensate the high rate of mortality butterflies and moths always lay eggs in large quantities. One of the very important techniques that these creatures use for defense is camouflage. The eggs are protectively coloured and match the colour pattern of the food plant. Eggs are also usually laid on the underside of the leaf for protection. Larval stages of lepidoptera are also quite camouflaging. The larvae of Common Mormons are fresh green with markings, which match the colour of the citrus plant. Many caterpillars have colour of patterns like bird droppings, which helps them to confuse the predators. The pupa of Comman Mime butterfly resembles a broken stick and becomes difficult to locate in dry vegetation.

The adult of Blue Oakleaf butterfly resembles a dry leaf and becomes very difficult to locate when it settles in foliage. Similarly many species of butterflies have different colour patterns in the wet and dry seasons to match the surrounding e.g. (Common Evening Brown). Owl moths have very big eye like spots on its wings to scare away the predators. Many blues have thread-like tails on its hind wings in conjunction with a lobe that bears a prominent dark coloured spot on its underside. When the butterfly is sitting idle this combination somewhat appears like a head and antenna, which confuses the predators. Further these creatures move their hind wings against each other vertically to gain attention of the predators towards the tail. I have observed a white spotted fantail flycatcher chasing the Pea Blue and attacking it on its tail mistaking it for the head. The butterfly thus escaped with broken wing.

Many butterflies also get protection due to their habits. The Evening Browns are specifically active at the dusk time and thus are naturally protected from avian predation (Birds). However, the insectivorous bats many times consume them.

Apart from this there is a very specialized technique used by these creatures, which is called unpalatability. There are certain class-I compounds in some species of lepidoptera, which are very specific and effective against vertebrate predators. The most prominent predators of adult and larval lepidoptera are the birds, which are very sensitive to toxins such as cyanides, cardinolides and alkaloids. Lepidopterans derive these compounds from certain classesof foodstuff thus showing association of restricted host plants used and the possession of a chemical defense.

Some Tiger butterflies derive these compounds from (Calotropis gigantea) their food plant. In relation to this they have warning colours, some bright combinations, so that they many be easily recognized. They also fly quite slow thus allotting time for the predators to recognize them. Still the inexperienced birds do try eating these unpalatable butterflies, but its unpleasant taste and smell makes them reluctant to do so the next time.

Some of the commonly seen unpalatable species in India are the Crows, Tigers, Costers, Tree nymphs, Roses and Birdwings. I have once observed a Redwhiskered bulbul feeding on a Common crow but eventually the bird vomitted the butterfly.

Mimicry is one more brilliant technique of protec-

tion in lepidoptera. In this a certain group of insects escape the predatory attacks by imitating the other species in appearance, habits and methods of flying. There are two categories of mimicry. Where the palatable species of insects mimic the unpalatable ones these are termed as Batesian mimics. The common examples of Batesian mimics are the Danaid Eggfly (female) mimicking the Plain Tiger and the common Mourmon (female) having three forms, namely the cyrus similar to the male, *stichius* mimicking the Common Rose and *romulus* mimicking the Crimson Rose. The unpalatable species are required to look similar as the predators should remember the colour pattern and behaviour of the models before consumption. For the above reason the unpalatable species look smimilar and mimic each other. This mimicry is called the Mullerian mimicry. The common examples of the Mullerian mimics are the Tigers i.e. the Blue Tiger, Dark Blue Tiger and glassy Tiger look somewhat similar to each other. Usually in most of the cases the theory of mimicry appears in the more important sex i.e. female. Conversely in India there are approximately a couple of examples of male mimicry.

However, this advantage of mimicry is enjoyed only by the adults. Some caterpillars apart from being unpalatable also have other chemical defenses. Caterpillars from *Papilionidae* family have certain organs, which emit chemicals with pungent odour, which helps them repel the predators. The larvae of Common Mourmon when disturbed suddenly exerts a glistening bifid organ which is situated behind its head called the osmeterium used to scare away the predators with its appearance and aromatic odour.

Lepidoptera also prove to be symbiotic with certain other species of insects. The larval stages of certain butterflies from the Blues have associated themselves with the ants symbiotically. Ants usually consume the caterpillars of Lepidotera except for Blues as they get sugary solutions from the larvae, which they produce, with the help of glands, which they have on their 11th segment. On the other hand the caterpillars are given protection by the ants from the parasitoids and other insects. To enjoy this protection the caterpillars have to keep on secreting the sugar solution all its life.

Grass blues (except Tiny grass blue), Cupids and Pierrots are usually attended by ants. I have observed while trying to disturb the caterpillar the ants are even ready to attack and bite the humans. This association between ants and lepidoptera larvae is the nature's most stunning and highly coevolved technique of protection.

To conclude there are a lot of interesting techniques that lepidotera use to escape threats. Still it is unlikely that any insect has completely escaped the attention of predators and certain birds have been recorded to overcome even the most severe insect defences (unpalatablity). I have once seen Golden Oriole and Common Wood Shrike having a frenzy feeding on the unpalatable Tiger butterflies as if completely insensitive to toxins.

No matter how good the protection there is no such thing as total defense in the co-evolutionary arms race between the prey and predators.

References

Butterflies of the Indian Region, M. A. Wynter-Blyth
The Insects, P. J. Gullan and P. S. Granston

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Plant-Bird Association

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Plants and Birds are common throughout the world. From deserts to equatorial forests and from sea-shores to high peaks, they are to be seen everywhere, in all eco-systems. In any eco-system plants are the producers of food and animals are consumers. In this sense birds are dependent on plants as they belong to the animal kingdom. Like plants they cannot be autotrophs. The association between birds and plants is well known. To observe birds bird-watchers are therefore, attracted to forests and places where a variety of plants can be available.

The close association between plants and birds goes back to very ancient times, over aeons. Spermatophyta, the most evolved group of the plant kingdom and Class Aves, one of the most evolved group of the animal kingdom have progressed in tandem in the march of evolution. The oldest angiosperm fossils are dated about 150 million years ago in the Jurassic age of the Mesozoic era. In the same period birds evolved from reptilian ancestors. Archaeopteryx, the reptilian fossil having wings and feathers is supposed to be the link between reptiles and birds. This fossil dates back to more than 130 million years. Archaeopteryx was supposed to hop from one tree to another by making use of its wings – an association between birds and trees going back to those ancient times!

The association between birds and plants can be considered on following counts :

1. Plants provide habitats to birds
2. They provide birds with food
3. Birds are also useful to plants as pollinators and
4. Birds also prove one of their biological controls.

1. Plants as bird habitat

Many birds are seen habitually to take to trees. Trees provide them shade and shelter from the sun as well as rain. There was a Papaya tree in our backyard at Kolhapur. The adjoining open plot had a lot of castor bushes. When it rained, sparrows could be seen to take shelter on the twigs of papaya and castor using leaves of either plant like an umbrella! Birds can very well make themselves invisible if the foliage of a tree is dense. The foliage protects them from their enemies. Tall trees provide them protection against a predator like a cat. I once accompanied Prakash Gole, the ornithologist, in an expedition to locate and study the Sarus Crane. In Uttar Pradesh Sarus could be seen commonly in agriculture and wet meadows. If we tried to approach them too close, they would fly behind a large mango or mahuwa or palash tree and began foraging. The notional 'hide' provided by these big trees was sufficient for them. If you cannot see the enenmy, you can safely assume that the enemy does not see you either!

Many birds migrate either locally or over long distances. During the night they may roost in trees, bushes or even standing crops. Even otherwise, during noon or at night birds take shelter in thorny trees such as acacia, zizyphus, Aegle marmelos and . They feel more secure in such trees.

During the breeding season birds build nests. Eggs are incubated. The young ones remain in the nests till they grow up and are able to move and fly. There are many types of nests, such as a) nests made of twigs : Crows, Kites, Vultures, some of the eagles and doves

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build crude nests made from twigs. Crows and Kites build their nests in the forks of branches of tall trees. They look like shallow, thinly woven baskets. They are lined from inside by grass or other soft material.

The bird expert from Konkan, Shri Bhau Katdare has studied nesting of a number of pairs of white-bellied sea eagle. At Guhagar, near the nest of this eagle, built on a mango tree, he had put up a TV camera. The movements and happenings in the nest could be seen on a closed circuit TV. The nest was a large, shallow platform made up of twigs. According to Shri Katdare many generations of the eagle used that nest, each time after due repairs!

Some birds carefully select a place on a tree and construct their nests in various ways. Some constructions are quite complicated. But most of the material used is from plants. The gourd-like nest of the Baya or weaver bird is well known. It is made from long, durable, blades of grass-terrestrial or aquatic. These hanging nests cannot be approached easily. They are delicately balanced over a gaping well, or stream or on a tall or thorny tree. The hanging gourd has a long tubular entrance. The inside is lined by cotton, threads or soft tendrils of creepers. Sunbirds and the flowerpeckers also construct nests of soft materials.

The tailor bird's nest is a miracle of construction. Generally a bush with thick, broad leaves is selected. The nest is built at a place well concealed from enemies and shuttered from the sun and rain, and about 3 feet above the ground. Leaves are folded on the spine and their edges are stitched. Inside it the lining is of soft-material such as cotton, threads, floss and inflorescence of grass. A tailor bird had built its nest on Bixa ovellana tree in our compound, right in the middle of human habitation. The famous ornithologist Dr. Satish Pande studied and photographed it. When surgical cotton was kept on a nearby branch, the birds readily used it for lining! Many times leaves or leaflets of Ramphal, Champak, Ashok or Rohitak (Amoora rohitaka) are stitched to make the nest. Warblers use blades of grass to build their nests. Both the edges of leaves are stitched together using such material as threads, cotton, spider web or even hair!

Woodpeckers, barbets, Yellowthroated sparrow, hornbills, owls use cavities in trees or excavate a hole in branches for nesting. Baskets have a hole in the soft wood trees such as Drum stick, Coral, Sesbania or Ailanthus. Woodpeckers can drill a hole even in hard-wood trees. The Rufous woodpecker lives in the nest of red ants (Crematogaster) made of dried leaves stitched together. Hornbills are large birds. The female hornbill lays her eggs in a cavity in a tree. Sitting inside the cavity she plasters the opening with her own droppings and shuts her up leaving a small slit through which the male feeds her. The small opening also serves as a ventilator.

Nests of waterfowl are to be found in the vegetation near a waterbody or in a wetland or are constructed even on floating vegetation.

Waterhens or moorhens nest in shallow water marshes covered by dense stands of Typha, Cyperus or Polygonum. Coots are normally found in lakes or in the placid waters of rivers. It builds its nest at some height over the water on branched aquatic vegetation. Terns and jacanas have their nests on floating vegetation almost at the level of water. Floating plants such as Eichhornia, water lilies, Water chestnut are taken advantage of. These floating nests are liable to be inundated by water due to waves or strong currents. The birds knit together the branches, leaves and stalks of plants to weave the nest platform.

In this way many birds use vegetation for shelter, for nesting, for hiding and camouflaging themselves and for roosting at night.

The Nurturing of Birds

Body temperatures of birds are the highest among the animal kingdom. It is between 38 to 44 degrees celsius. A bird requires a lot of energy to fly. To maintain the high body temperature and high rate of metabolism and rapid movements of muscles required to be airborne, a bird requires a lot of food. Plants provide this food directly or indirectly through photo-synthesis. Birds constitute one important link in the food chain of many eco-systems. Birds can be classified into two following groups according to their food habits : 1) vegetarians in the main, 2) Omnivorous, 3) Carnivorous/predators and 4) Carrion-eaters.

In considering the relationship between plants and birds we are mainly concerned with the first two categories, viz. mainly vegetarians and omnivorous. Vegetarians : Parakeets, mynas, pigeons and doves, barbets and some other arboeal birds and some duck species subsist mainly on vegetarian food. Doves and pigeons consume grains, grass seeds and some berries. Parakeets and barbets are mainly frugivorous. Guava fruit is favourite of parakeets. Grains are the favourite food of pigeons and doves. Ducks such as Common teal and Garganey, Spotbill and Nukta subsist on leaves, flowers, fruit and seeds of wetland plants. Lemna the tiny floating plant is also known as duck-weed, a favourite food of ducks! The food of ducks consists of several wetland plants such as Polygonum,

Vallisneria, Hydrilla, Cyperus sp. Potamogeton, Nymphea etc. These wetland birds also feed on rice and its tender shoots. Water chestnuts also is a preferred item of food for them. Though mainly vegetarians they also occasionally consume insect larvae and other small animal matter.

Omnivorous birds : This constitutes the largest group of birds. It includes commensals of man such as sparrows, crows, mynas, koels, bulbuls, tailor birds, peafowls, some duck species, poultry, etc. Waterhens, coots, jacanas and wagtails are also omnivorous to a certain extent. Many birds living in forests, on trees and bushes as well as grassland birds are also omnivorous. These include junglefowl, crowpheasant or coucal, hawkcukkoo, hornbills, woodpeckers, some bulbul species, drongo, orioles, babblers, weaver birds, magpie robin, munias, flowerpeckers and sunbirds.

Omnivorous birds derive their energy supplies from carbohydrates in plants and proteins for their growth and reproduction, from their animal food. When animal food such as insect larvae, insects, small organisms, fish and invertebrates and molluscs, is available, birds use mainly animal food and store fat in their body.

A lot of food is available to birds from trees, bushes and climbers planted and/or cultivated by man, especially to birds who are commensals of human beings. Common horticultural or garden trees such as mango, guava, chiku, custard apple, ramphal, jamun and roadside trees such as banyan, peepal, umbar, nandruk, bakul provide abundant food in the form of their fruit to birds. Inflorescence of such trees as drumstick, hadga, flame of the forest, coral, Gmelina, Bombax insignis and malbaricum is also used by birds as food. A number of large and small birds such as flowerpeckers and sunbirds feast on the nectar in the flowers of Bombax, Butea and Erythrina, etc. Certain birds such as sparrows, rosy pastors, large grey babbler, myna, sarus crane and demoiselle crane attack standing crops for grains from the cobs. They also devour insects and their larvae, caterpillars, molluscs, worms, mice and frogs that are pests of crops. Shrikes use babul thorns (Acacia sp.) in an ingencous way. They catch insects, small reptiles and caterpillars and impale them on thorns and eat these whenever they are hungry!

Waterfowl and wetland birds feed on various parts of such plants as aquatic grass, polygonum, water chestnut, nymphea, lotus, lemna; they also devour fish, crabs, molluscs, amphibians, insects, water skaters in a large measure.

Symbiotic Relations

Birds perform the vital function of controlling the population of organisms which damage and are pests of plants. Insects, their eggs, larvae and caterpillars is the favourite food of birds. Insects use the largest component of the animal kingdom with their innumerable species and sub-species. Their reproductive capacity is enormous. The tiny potato insect becomes capable of reproduction in the shortest possible time and can give rise to many generations in a single year! If all the potato insects get enough food to survive and be capable of reproduction there will be sixty million such insects in one year! They can destroy all the potato crop in the world. This catastrophe does not happen because of birds. Insects in their larval stage and caterpillers of butterflies are voracious eaters. A larvae can eat leaves of plants equivalent to double its body weight. Nibbling of leaves, buds, flowers, fruit and seeds inflicts enourmous damage to plants. But birds can eat in a single day enough insect food equivalent to their own body weight. During the breeding season sparrows bring literally hundreds of insects to their nests through a number of sorties to gather them. In this way birds control insect population.

Birds of prey control the population of plant-eaters and therefore, prove beneficial to plants. Owls and owlets, hawsks and kites prey upon rats and mice. Some of these at many time feed exclusively on rats and mice and help plants.

Aquatic birds control the populations of aquatic organisms who feed on plants. Birds fulfill an important role in maintaining the ecological balance.

Pollination is essential for angiosperms for fruiting and reproduction. Flowerpeckers and sunbirds who feed on flower nectar indirectly help the process of pollination. The flowers of Silk cotton, Kapok, White silk cotton, Flame of the forest, Coral, Careya arborea, Mallotus are organised in a peculiar way. Birds try to collect the nectar which is at the base of such flowers. In their efforts to reach the nectar, their wings, beaks, foreheads, etc. are brushed against the flower and its parts transferring pollen to their bodies. Birds transfer pollens to stigmas of other flowers facilitating pollination.

Birds are an important agent in dispersal of seeds. Frugivorous birds such as parakeets, mynas and bulbuls eat the pulp of fruit. Large seeds are taken out and thrown. Smaller seeds of such fruit as guava, wild fig, banyan, peepal, nandruk, etc. are eaten but pass out of the digestive system of birds with excreta. As

they are hard, birds could not digest them. Birds, however, help in their dispersal as they fall at different places wherever birds wander. Many times their seedlings can be seen growing in crevices in walls, obviously deposited their by birds.

With cross pollination trees can bear more fruit and the reproduction is also better. Dispersal enables trees to spread their seeds over a wider area leading to better chances of survival for the species. The ecosystems also remain healthy and balanced. Some of the tree species are completely dependent on birds for seed dispersal. If birds are absent, they are likely to go extinct.

The fruit, seeds and spores of aquatic plants get attached to the feet and legs of migratory birds and are carried over long distances leading to their worldwide dispersal. Birds' excreta can be used as fertilizer for plants. On an island near the coast of Peru in south America large piles of birds' excreta have accumulated (Guano). They are mined for use as a fertilizer.

Birds as pests : Some birds can prove pests of plants. For example, birds which eat leaves, flowers, tubers, fruit, seeds of plants as well as those which prey on pollinator insects. Birds also disperse the seeds of parasitic plants which grow on mango, teak and other trees. Birds who prey on frogs, geckos and lizards may indirectly harm plants as such organisms are useful to plants.

With all this, the benefits that plants receive from birds are so large that the relationship between plants and birds proves beneficial mutually.

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Pole and Wire Associated Birds of the Deccan Area

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Introduction

An association in ecology means a grouping of populations in a community, characterised by particular dominant species. e.g. Anogeissus-Boswellia-Oedina asscoiation quite commonly found in hills around Pune. The present article does not take into consideration the asscoiation as mentioned above, but association as a connection or link between a living organism or group of organisms and a non-living element from its surrounding. Here the group of living organisms chosen is birds and the non-living entity that they are linked to is the pole-and-wire element of the man-managed environment.

The association of birds with pole-and-wire element is around one hundred and fifty years old in this country. During this short period of time, at least 105 different bird species (about 20 p.c. of the total Deccan birds species) have developed association with pole-and-wire element of the landscape.

The types of pole-and-wire element used by the Deccan birds are :

a) Roadside and railwayside telegraph poles and wires

b) Electric poles and wires within our towns, cities and villages

c) High tension lines across the countryside

d) Overhead wires along railway tracks where electricity is used for traction

Area of Study

The area covered by the study coincides more or less with the state of Maharashtra minus Konkan and adjoining districts of Karnataka (Belgaum, Vijapur, etc.) and Madhya Pradesh. Large tracts in the river basins of the Godavari, Krishna, Bheema and Tapi are under cultivation. The low hills dividing the basins are covered with scrub vegetaion. There are also extensive barren areas locally called 'maals'. Large areas in the Satpuda range and in the Vidarbha region are under forests. The area also supports big cities – Pune, Nagpur, Nashik, Solapur, to name a few.

Why Birds have adopted to Poles and Wires?

It was found that the birds from the area have been associated with Poles and Wires variously and differently. The reasons for the association are :

1. As a vantage point to look out for crawling prey on ground below and flying prey in the sky above and around or as a foraging base.
2. For swooping down upon a prey.
3. To make a sally after a flying insect/prey.
4. For consuming a captured prey.
5. Keep a vigil for predators (birds of prey, beasts of prey, man, etc.)
6. Announcing supremacy for guarding the territory or by challenging an invading male/s.
7. Place for courtship display, singing, mating, etc.
8. Afternoon siesta.
9. Intermediate step for approaching nest.
10. As a retiring roost.
11. Nesting.
12. Stopover for migrating birds.
13. Gathering for return migration.
14. For sunning.
15. Means of escape.

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16. Casual use.
(See last table)

Some Findings

Out of the 105 bird species found to have linked with the Pole-and-Wire element, 20 species are mainly pole users. Most of the birds of prey fall under this category. Thirtyfive species can be treated as wire users. Most of these are passerine birds. But the largest number (51 species) is using both, Pole-and-Wire in combination.

Of the 16 user categories mentioned above, 87.61% species are using the Pole-and-Wire element casually, which is the commonest use. The use percentage of different associations is given in Table 1.

Table 1

Type of Association	(species using P-and-W for the purpose)	
	Sp. No.	%
Casual Use	92	87.61
Lookout post/foraging base	70	66.66
Consuming captured prey	59	56.19
Courtship, singing, mating	59	56.19
Airsally after flying insects	58	55.24
As a retiring roost	57	54.28
Means of escape	55	52.40
Swooping down upon prey	50	47.62
Intermediate step for approaching/ leaving nest	30	28.57
Afternoon siesta	29	27.62
Sunning	25	23.80
Keeping vigil	24	22.85
Announcing supremacy etc.	15	14.28
Stopover during migration	10	9.52
Gathering place for return migration	08	7.62
Nesting	05	4.76

The Level of Association

To find out how close a bird species is associated with Pole-and-Wire element total score for each species is counted. Every association is assigned one single score value without any weightage. Out of the 16 associated uses, if a bird, e.g. a commn myna is found to be using 13 of them, then its score is simply 13. The score for every species was thus calculated. The different scores, if categorised into different classes give the level of asscoiation (Table 2).

Table 2

Score Class	Species in the Class		Level of
	Number	Percentage	Association
1-4	28	26.66	Low
5-8	56	53.33	Moderate
9-12	19	18.09	High
13-16	02	1.90	Very high

Comments

1. The Pole-and-Wire element is just a supporting element in the man-managed ecosystem. It cannot be treated as an independent element or system (like e.g. a banyan complex).
2. The number and type of species associated with Pole-and-Wire element depend upon the characters of the surrounding habitat. The major habitat types in the Deccan over which Pole-and-Wire network passes are a) Agriculture, b) Settlement (urban and rural), c) Forests and scrub, d) Barren areas, e) Waterbodies. A line of wire crossing a waterbody would attract birds from that habitat – kingfishers, wagtails, swallows, etc. while another crossing a barren tract would attract larks, ring doves, white-eyed buzzard and so on.
3. Very few species (only about 20%) are highly associated with Pole-and-Wire element. More than half the species have moderate association while a quarter of them have low (or remote!) association with the Pole-and-Wire element.
4. The overall weaker linkage has been reflected in the use also with 'casual use' becoming the commonest use of Pole and Wires (87.61%). Only about 5% species are using poles and wires for nesting purpose, mostly because of its exposed, vulnerable nature. In South Maharashtra, baya weaver birds were found to attach their hunging nests to the electric wires especially in an agricultural belt. In towns and cities mynas, sparrows and bulbuls were found to nest on electric poles (especially street light poles).
5. To conclude it can be said that the linkage between birds in general and pole-and-wire element in particular, is quite weak. The link may be stronger or weaker depending upon the nature of the surrounding country.
6. A few species – namely mynas, crows, doves, sparrows and drongos have developed closer ties with pole-and-wire element. Most of these species are commensal of man.

Table 3 : A List of Pole-and-Wire Birds of the Deccan

Sr. No.	Bird Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total score	Using Pole (P) or Wire (W) or both
1	Pond heron	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	01	P
2	Black-winged kite	+	+	–	+	–	?	+	–	–	–	–	–	–	–	?	+	05	PW
3	Black kite	+	+	–	+	–	–	+	+	–	+	+	–	–	–	–	+	08	P
4	Brahminy kite	+	+	–	+	–	–	+	–	–	+	–	–	–	–	–	+	06	P
5	Shikra	+	+	+	+	–	+	?	–	–	–	–	–	–	–	–	+	06	P
6	Sparrow-hawk	+	+	+	+	–	+	?	–	–	–	–	–	–	–	–	–	05	P
7	White eyed buzzard	+	+	+	+	–	?	+	–	–	–	–	–	–	–	–	–	05	P
8	Scavenger vulture	–	–	–	–	–	–	–	+	–	+	–	–	–	–	–	–	02	P
9	Redheaded merlin	+	+	+	+	–	?	+	–	–	+	–	–	–	–	–	–	06	P
10	Laggar falcon	+	+	+	+	–	?	–	–	+	+	–	–	–	–	–	–	06	P
11	Hobby	+	+	+	+	–	?	–	–	–	+	–	–	–	–	–	–	05	P
12	Kestrel	+	+	+	+	–	?	+	+	+	+	–	–	–	–	–	–	08	P
13	Tawny eagle	+	–	–	+	–	?	+	+	–	+	–	–	–	–	–	–	05	P
14	Yellowfooted green pigeon	–	–	–	–	–	–	?	–	–	+	–	–	–	–	–	+	02	WP
15	Blue rock pigeon	–	–	–	–	–	–	+	+	+	+	–	–	–	?	+	+	06	WP
16	Rufous turtle dove	–	–	–	–	–	–	+	–	–	–	–	–	–	–	?	–	01	WP
17	Ring dove	–	–	–	–	–	–	+	+	+	+	–	–	–	–	+	+	06	WP
18	Red turtle dove	–	–	–	–	–	–	+	?	?	–	–	–	–	–	?	+	02	WP
19	Spotted dove	–	–	–	–	–	–	+	+	+	+	–	–	–	–	?	+	05	WP
20	Laughing dove	–	–	–	–	–	–	+	–	–	–	–	–	–	+	+	+	04	WP
21	Alexandrine parakeet	–	–	–	–	–	–	?	–	–	?	–	–	–	–	–	+	01	WP
22	Roseringed parakeet	–	–	–	–	–	–	?	–	–	+	+	–	–	–	–	+	03	WP
23	Blossomheaded parakeet	–	–	–	–	–	–	?	–	–	?	–	–	–	–	–	+	01	WP
24	Pied crested cuckoo	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	01	WP
25	Indian cuckoo	–	–	–	–	–	?	–	–	–	–	–	–	–	–	–	+	01	W
26	Common hawk cuckoo	+	–	–	–	–	?	+	–	–	–	–	–	–	–	–	+	03	W
27	The cuckoo	–	–	–	–	–	?	+	–	–	–	–	–	–	–	–	+	02	W
28	Plaintive cuckoo	–	–	–	–	–	?	+	–	–	–	–	–	–	–	–	+	02	W
29	Koel	–	–	–	–	?	?	+	–	–	–	–	–	–	–	+	+	03	W
30	Crow pheasant	+	–	–	+	–	–	?	–	+	–	–	–	–	–	–	+	04	WP
31	Barn owl	+	+	–	+	–	?	+	–	+	–	–	–	–	–	–	–	05	P
32	Spotted owlet	+	+	+	+	–	?	+	–	+	–	–	–	–	–	–	–	06	PW
33	Pied kingfisher	+	+	–	+	?	?	–	+	–	–	–	–	–	?	–	+	05	PW
34	Small blue kingfisher	+	+	–	+	?	?	–	+	–	–	–	–	–	?	–	+	05	P
35	Whitebreasted kingfisher	+	+	+	+	?	?	+	+	–	–	–	–	–	+	–	+	08	WP
36	Small green bee eater	+	–	+	+	?	–	+	+	+	+	–	+	–	+	–	+	10	WP
37	Roller or Blue jay	+	+	+	+	–	+	+	+	+	+	–	+	–	+	–	+	12	WP
38	Hoopoe	+	+	+	+	?	?	+	–	+	–	–	–	–	+	–	+	08	WP
39	Singing bush lark	–	–	–	–	–	–	+	–	–	–	–	–	–	–	+	+	03	W
40	Redwinged bush lark	–	–	–	–	–	?	+	–	–	–	–	–	–	–	+	+	03	W
41	Ashycrowned sparrowlark	–	–	–	–	?	?	+	–	–	–	–	–	–	–	+	+	03	W
42	Rufoustailed finchlark	–	–	–	–	–	?	+	–	–	–	–	–	–	–	+	+	03	W
43	Crested lark	–	–	–	–	–	?	+	–	–	–	–	–	–	–	+	+	03	W
44	Sykes's crested lark	–	–	–	–	–	?	+	–	–	–	–	–	–	–	+	+	03	W
45	Indian small skylark	–	–	–	–	–	?	+	–	–	–	–	–	–	–	+	+	03	W

Sr. No.	Bird Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total score	Using Pole (P) or Wire (W) or both
46	Common swallow	+	−	+	−	?	−	−	+	−	+	−	+	+	+	−	+	08	W
47	Wiretailed swallow	+	−	+	−	?	−	−	+	−	+	−	+	+	+	−	+	08	W
48	Streak throated swallow	+	−	+	−	?	−	−	+	−	+	−	+	+	+	−	+	08	W
49	Redremped swallow	+	−	+	−	?	−	−	+	−	+	−	+	+	+	−	+	08	W
50	Grey shrike	+	+	+	+	+	?	+	−	−	+	−	−	−	−	?	+	08	WP
51	Baybacked shrike	+	+	+	+	+	?	+	−	−	+	−	−	−	−	+	+	09	W
52	Rufousbacked shrike	+	+	+	+	+	?	+	−	−	+	−	−	−	−	+	+	09	W
53	Brown shrike	+	+	+	+	+	?	?	−	−	?	−	−	−	−	?	+	06	W
54	Golden oriole	−	−	−	−	?	−	?	−	−	−	−	−	−	−	−	+	01	P
55	Black drongo	+	+	+	+	+	−	?	+	−	+	−	−	−	+	−	+	09	WP
56	Grey drongo	+	+	+	+	+	−	?	+	−	+	−	?	−	+	−	+	09	WP
57	Whitebellied drongo	+	+	+	+	+	−	?	+	−	+	−	−	−	+	−	+	09	W
58	Ashy swallow shrike	+	−	+	+	+	−	+	−	+	+	−	−	−	+	−	+	09	WP
59	Greyheaded myna	+	?	+	+	?	?	+	?	?	?	−	−	−	+	+	+	07	WP
60	Brahminy myna	+	+	+	+	+	+	+	+	+	+	−	−	−	+	+	+	13	WP
61	Rosy starling	+	+	+	+	?	?	+	+	−	+	−	+	+	+	+	+	12	WP
62	Asian pied starling	+	+	+	+	+	+	+	?	?	+	−	−	−	+	+	+	11	WP
63	Indian myna	+	+	+	+	+	+	+	+	+	+	−	−	−	+	+	+	13	WP
64	Jungle myna	+	+	+	+	+	+	+	+	?	+	−	−	−	+	+	+	12	WP
65	Tree pie	+	+	+	+	+	?	?	−	?	?	−	−	−	?	+	−	06	WP
66	House crow	+	+	+	+	+	−	+	−	−	+	+	−	−	+	+	+	11	WP
67	Jungle crow	+	+	+	+	+	−	+	−	−	+	+	−	−	+	+	+	11	WP
68	Common woodshrike	+	+	+	+	−	?	?	−	−	−	−	−	−	−	+	−	05	W
69	Redwhiskered bulbul	+	−	+	+	−	?	+	−	+	+	−	−	−	−	+	+	08	WP
70	Redvented bulbul	+	−	+	+	−	?	+	−	+	+	+	−	−	−	+	+	09	WP
71	Large Grey babbler	+	?	+	+	+	−	+	−	−	+	−	−	−	−	+	+	08	WP
72	Redbreasted flycatcher	+	+	+	+	?	?	−	−	−	+	−	−	−	−	+	+	07	W
73	Whitespotted fantail flycatcher	+	+	+	+	?	?	+	−	−	+	−	−	−	−	+	+	08	WP
74	Paradise flycatcher	+	+	+	+	?	?	−	−	−	?	−	−	−	−	−	+	05	PW
75	Ashy prinia	−	+	+	−	−	+	+	−	−	−	−	−	−	−	+	+	06	W
76	Indian prinia	−	+	+	−	−	+	+	−	−	−	−	−	−	−	+	+	06	W
77	Tailor bird	−	+	+	−	−	+	+	−	−	−	−	−	−	−	+	+	06	WP
78	Indian great reed warbler	−	+	+	+	−	?	?	−	+	+	−	−	−	−	+	+	07	W
79	Magpie robin	+	+	+	+	+	+	+	+	+	+	−	−	−	−	+	+	12	WP
80	Black redstart	+	+	+	+	−	−	−	−	−	−	−	?	−	−	+	+	06	W
81	Collared bushchat	+	+	+	+	+	−	−	+	−	−	−	?	?	−	+	+	08	W
82	Pied bushchat	+	+	+	+	+	+	+	−	−	+	−	−	−	−	+	+	10	W
83	Desert wheatear	+	+	+	+	+	−	−	−	−	−	−	?	?	−	+	+	07	W
84	Blue rock thrush	+	+	+	+	+	−	−	−	−	−	−	?	−	−	+	+	07	P
85	Indian robin	+	+	+	+	+	+	+	−	+	+	−	−	−	+	+	+	12	PW
86	Blackbird	−	−	−	−	−	−	+	−	−	+	−	−	−	−	+	+	04	P
87	Grey tit	−	−	−	−	?	−	−	−	+	+	−	−	−	−	+	+	04	W
88	Paddyfield pipit	+	−	−	−	+	+	+	+	−	+	−	−	−	+	+	+	09	PW
89	Tree pipit	+	−	−	−	+	−	−	+	−	+	−	+	+	+	+	+	09	PW
90	House sparrow	−	−	+	+	−	−	+	+	+	+	+	−	−	−	+	+	09	WP
91	Yellowthroated sparrow	−	−	+	+	−	−	+	+	−	+	−	−	−	−	+	+	07	WP

POLE AND WIRE ASSOCIATED BIRDS OF THE DECCAN AREA

Sr. No.	Bird Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total score	Using Pole (P) or Wire (W) or both
92	Large pied wagtail	+	+	+	+	−	+	+	−	−	−	−	−	−	−	+	+	08	PW
93	Grey wagtail	+	+	+	+	−	−	−	−	−	−	−	?	?	−	+	+	06	P
94	Yellow wagtail	+	+	+	+	−	−	−	−	−	−	−	?	?	−	+	+	06	P
95	Purple sunbird	+	−	+	+	−	−	+	−	+	+	−	−	−	−	−	+	07	W
96	Purple-rumped sunbird	+	−	+	+	−	−	+	−	+	+	−	−	−	−	−	+	07	W
97	White eye	−	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	05	W
98	Baya weaver bird	−	−	−	−	−	−	−	−	+	+	−	−	−	−	?	+	03	W
99	Red munia	+	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	05	WP
100	Whitethroated munia	+	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	05	WP
101	Whitebacked munia	+	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	05	WP
102	Spotted munia	+	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	05	WP
103	Blackheaded munia	+	−	−	−	−	−	−	−	+	+	−	−	−	−	?	+	04	WP
104	Blackheaded bunting	+	−	−	−	−	−	−	−	−	−	−	+	+	−	+	+	05	P
105	Rosefinch	+	−	−	−	−	−	−	−	−	−	−	+	+	−	+	+	05	PW
	Total Score	70	50	58	59	24	15	59	29	30	57	05	10	08	25	55	92		

1. As a lookout post for prey/as a foraging base
2. For swooping down upon a prey
3. To airsally after a flying insect/prey
4. For consuming a captured prey
5. To keep vigil for predators (birds of prey beasts of prey, man etc.)
6. Announcing supremacy for guarding the territory or by challenging an invading male/s
7. Place for courtship display, singing, mating, etc.
8. Afternoon siesta
9. Intermediate step for approaching nest
10. As a retiring roost
11. Nesting
12. Stopover for migrating birds
13. Gathering for return migration
14. For sunning
15. Means of escape
16. Casual use

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Forest and Bird Associations

Prakash Gole

The single most potent force that affects nature is the numerical and intellectual strength of human beings. In pre-historic times fire in the hands of human beings became the single most potent force which transformed the natural world. Closed canopy forests were burnt, effectively changing the character of flora and fauna from shade and humidity-tolerant species to those of sunny, open and wind-dominated landscapes. This change continues even today, with ever-receding forests and ever-expanding open, barren areas and human settlements. Change in the vegetational composition of a forest may be slow, subtle and selective or may be rapid, all-pervasive and indiscriminate. At Bhimashankar, 125 kms NW of Pune, I have seen the effects of both, subtle, low-intensity change in forest associations brought about by local tribals and rapid, high-intensity change brought about by commercial exploitation.

In landscapes not favoured by high rainfall, the transformation brought about by human beings is relatively quicker in changing associations than is the case in high rainfall areas. A moist deciduous forest with a dominant community of Erythrina-Bombax-Lagerstroemia and with a leavening of Adina and Garuga was seen to change to an association of Erythrina-Cassia-Oedina-Boswellia as a result of moderate intensity of grazing and cutting by cattle and man. If grazing and cutting continue and probably increase in intensity, trees may be replaced by shrubby growth and an association of Butea-Grewia-Anogeissus-Acacia may come into existence.

In semi-arid tracts the presence and absence of water is critical in establishing associations. Where a trickle of water is present except for 2 or 3 driest months, Ficus religiosa, Pongamia, Syzygium and Diospyros montana can be found in sparse populations. Where drought conditions prevail over a longer period, Azadirachta, Acacia, Zizyphus and Balanites will constitute a community while in still more arid climate, Zizyphus, Capparis, Euphorbia and Opuntia may be found scattered over extensive areas.

A part of the Bhimashankar forest is protected both as the reserved forest and also as a sacred grove from where people do not normally remove any kind of biomass for religious sentiments. Thus a grove is left inviolate for a considerable period. The earlier studies in Bhimashankar carried out in the fifties of the last century and later studies done in 1990s show very little qualitiative variation in the community structure of this part (sacred grove) of the forest. The dominant community continues to be Mangifera-Syzygium-Olea-Ficus. Members of these species dominate the canopy level of this forest. The next level shows the dominance of Olea-Syszygium-Mangifera-Memecylon-Garcinia-Mallotus. The next lower storey is represented by Dimorphocalyx-Garcinia-Maytenus-Lea; and the ground flora by Dimorphocalyx-Garcinia-Maytenus-Lea and Actinodaphne. Karvea and Thelepaphaele can be seen at the edge and along the tracks. However, a quantitative and qualitative change, in the proportion in which different species and sizes of species were represented in the forest, must have occurred. This subtle change due to the removal of biomass from the grove in recent years also brought about a qualitative change in the fauna represented by birds. Species such as woodpeckers and hornbills were totally eliminated as their food available in old and mature, large-sized and partly decaying trees became hard to get. Fairy bluebird, a species rare in this part of Western Ghats, has ceased to occur also. Disappear-

ance of such species cannot be explained or connected to the disappearance or rarity of a single or even a group of plant species. Only a subtle change in the forest composition or in the proportion in which different species are represented in the forest, can perhaps explain this change. A change in vegetational composition has changed animal associations!

In dense forest one many times comes across hunting parties of birds in which different species are associated and move in tandem. The hunting party one usually encounters in this grove today, consists of Bulbuls, Flycatchers, Babblers and Thrushes. Before 1990 it is possible that Woodpeckers and a greater variety of flycatchers were in place instead of bulbuls and babblers. As subtle changes in forest composition continue, an avifaunal association consisting not only bulbuls-flycatchers-babblers and thrushes but also Barbets and Drongos has resulted.

As rainfall decreases from west to east, on the Bhimashankar plateau, the plant associations change from a dominance of evergreen species to the dominance of semi-evergreen and moist deciduous species. The semi-evergreen middle height forest shows a dominance of Actinodaphne, Syzygium, Mangifera, Symplocos and Heterophragma. Birds found to be associated with this forest included Nilgiri wood pigeon, Rufous turtle dove, Small green barbet, Grey drongo, Red-whiskered bulbul, Black bulbul, Quaker and Scimitar babbler, Verditer and Paradise flycatchers, Phylloscopus warblers, Blue chat, and Small sunbird.

The moist deciduous forest was mainly found below the plateau of Bhimashankar on the western and southern sides of the escarpment. The dominant species of this forest are Terminalia, Dalbergia, Sterculia, Bombax, Bridelia and Madhuca. Birds associated with this forest included Grey-fronted green pigeon, Blue-winged parakeet, Jungle owlet, Malabar grey hornbill, Golden-backed, Black-backed and Pygmy woodpeckers, White-bellied and Hair-crested (Spangled) drongos, Tree pie, Gold-fronted leaf bird, Tickell's blue and Grey-headed flycatchers, Loten's sunbird and Prinias.

Short-height semi-evergreen forest with good canopy cover was found to be dominated by Mallotus, Xantholus, Memecylon, Actinodaphne, Terminalia and Caryota. Birds associated with these included Grey jungle fowl, Collared scops owl, Long-tailed nightjar, Small green barbet, Yellow-browed bulbul, Scarlet minivet, Shama, Blue-headed rock thrush, Ground thrush and Common rosefinch.

Secondary evergreen forests were found to be dominated by Memecylon, Xantholus, Atlantea, Bridelia and Heterophragma. Birds associated with these forests included Grey jungle fowl, Peafowl, Rufous turtle dove, Crow pheasant, Grey drongo, Gold-fronted leafbird, Red-whiskered bulbul, Quaker babbler, Red-breasted flycatcher, Phylloscopus warblers, Blackbird, Flowerpeckers, Small sunbird and Common rosefinch.

Roadside secondary forests showed dominance of Actinodaphne, Xantholus, Macaranga, Erythrina, Ficus, Randia and Zizyphus. Birds associated with these included Black-shouldered kite, Shikra, Kestrel, Red-wattled lapwing, Spotted dove, Plumheaded parakeet, Palm swift, Coppersmith, Tree pie, Small minivet, Iora, Red-vented bulbul, Jungle babbler, Jungle prinia, Tree pipit, Plain-coloured flowerpecker, Purple sunbird etc.

Short-height trackside evergreen forest with broken canopy was characterised by Memecylon, Atlantea, Callicarpa, Maytenus, Allophylus and Plectronia. Birds found to be associated with these were Blue rock pigeon, Laughing dove, Rose-ringed parakeet, Sirkeer cuckoo, House swift, White-breasted kingfisher, Green bee-eater, Indian roller, Baybakced shrike, Jungle crow, Red-vented bulbul, Chiffchaff, Plain prinia, Magpie robin, thick-billed flowerpecker and Purple-rumped sunbird.

Scrubland on the plateau exists both in the vicinity of the foerest and away from it. It is characterised by coppiced tree species interspersed with shrubs. Dominant community consists of Memecylon, Randia, Lasiosiphon, Maytenus, Bridelia and Ficus. Birds associated with this scrub included Imperial pigeon, Rosy pastor, Black, Red-whiskered and Red-vented bulbuls, Paddyfield pipit, Crested (Malabar)lark, Blyth's reed and Booted warblers, Brown rock pipit and Jungle myna.

It is evident that with the opening of the forest canopy, shade-tolerant bird species are gradually replaced by species from more open habitats. In the different forest types described above, a gradual disappearance of members of different plant species had become evident. Sacred groves typify perhaps the least disturbed forest plant communities. As disturbance sets in, members of the species such as Garcinia, Mallotus and Litsea are removed in preference to Mangifera, Syzygium and Ficus. Memecylon, Actinodaphne and Xantholus gradually take the places of trees that were removed. An under-storey of Thelepaphaele and Karvea starts emerging along with Maytenus and Lea. Further disturbance involves loss of some members of Mangifera, Syzygium, Olea and ficus and their replacement by Memecylon, Actinodaphne and Xantholus. Memecylon takes over

in later stages of degradation and comes to dominate forests in high rainfall areas near the crestline.

As rainfall decreases towards the east, evergreens such as Garcinia, Mallotus and Litsea are replaced by Terminalias, Bridelias and Diospyros. Disturbance in this region (rainfall <6000 mm) brings in Callicarpa, Heterophragma and Caryota with Allophylus, Sterculia, Albizzea and Macaranga. With such changes in vegetation, parallel changes in the composition of bird communities can also be noticed. I have already referred to the loss of hornbills and woodpeckers. Further opening of the forest witnesses a gradual loss of larger owls and rare birds such as Bazas and Trogons. If disturbance continues Shama, Yellow-browed bulbul, White-bellied blue flycatcher disappear followed by successive loss of Blue-headed rock thrush, Black-naped flycatcher, Indian scimitar babbler and Nilgiri wood pigeon. Typical forest species are therefore, lost. In very high rainfall areas (>6000 mm) they are not replaced, as in regions very near the crestline of Western Ghats. In slightly low-rainfall regime they tend to be replaced by others as we have already seen. In medium and low rainfall areas succession of change occurs from Red spurfowl to Grey jungle and Peafowl; Nilgiri wood pigeon to Rufous turtle dove to Spotted and Laughing dove; Blue-winged parakeet to Plum-headed and Rose-ringed parakeet; Jungle nightjar to crow-pheasant; Brown wood owl to Great horned owl to Jungle owlet; Small green barbet to Coppersmith to Green bee-eater; Golden-backed and Black-backed woodpeckers to Pygmy and Mahratta woodpeckers; Spangled drongo and Drongo-cuckoo to White-bellied drongo and Black drongo; Jungle myna to common myna and Rosy pastor; Tree pie to Black-headed cuckoo shrike and Little minivet; Black bulbubl to Red-whiskered to Red-vented bulbul; Puff-throated and Tawny-bellied babbler to Jungle and Large grey babbler; Verditer and Tickell's blue flycatcher to Fantail flycatchers; Yellow-cheeked tit to Grey tit; Crimson and Crimson-backed sunbird to Purple-rumped and Purple sunbird; Spotted munia to Indian silverbill; Chestnut-shouldered petronia to House sparrow and Rosefinch to Crested bunting. This change is apparent as forests are replaced by dwarf vegetation. Among vegetation and bird life in Western Ghats and adjacent areas such regressions can be witnessed everywhere in Maharashtra.

References

Daniels R. R. J., Joshi N. V., Gadgil M. 1992 : On the relationship between bird and woody plants species diversity in the Uttara kannada district of South India, Ecology, Proc. Natl. Acad. Sci. USA.

Ghate U., Bhagwat S., Gokhale Y. Gour-Broome V., Barwe V. 1997 : Assessing the Tropical Forest Plant Diversity : A case study from the Western Ghats, India, International Journal of Ecology and Environmental Sciences 23 : 419-444.

Ghate U., Joshi N., Gadgil M. 1998 : On the patterns of tree diversity in the Western Ghats of India, Current Science, Vol. 75, No. 6.

Price T. D. 1983 : The impact of the loss of forest on the birds of the Eastern Ghats of Andhra Pradesh, BNHS, Centenary Seminar Proceedings, BNHS, Mumbai, India.

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पर्यावरण, भूमी, पाणी, वने, कुरणे, सागर, पर्वत, वन्य जीवन यांवर आधारित एक वर्षाचा अभ्यासक्रम

सुरुवात : १ जुलै २००३ पासून

शुल्क : वार्षिक रु. ३५००/-
(रु. २५०० आणि रु. १००० अशा २ हप्त्यांत भरायचे आहे.)

प्रवेश सुरू : १५ एप्रिल २००३ पासून

व्याख्याने : दर आठवड्यास सोमवार, मंगळवार, बुधवार, शुक्रवार

प्रत्यक्ष काम (फील्ड वर्क) : शनिवार किंवा रविवार दर महिन्यातून दोनदा

शिबिरे : एकूण चार : कुरणे, वने, सागर, पर्वत यांच्या परिसंस्थांमध्ये
कालावधी : प्रत्येक शिबिर ४ ते ६ दिवसांचे
खर्च : सुमारे ५०० ते १००० रु. प्रत्येकी

कोणत्याही शाखेतील पदवीधरास प्रवेश घेता येतो.

विद्यार्थी संख्या : एकूण ३० ते ४०

दोन बॅचेस : दुपारी २ ते ४ : १५ ते २० विद्यार्थी
सायंकाळी ६ ते ८ : १५ ते २० विद्यार्थी

आपणांस सोयीची बॅच निवडावी. माध्यम इंग्रजी व मराठी.

अभ्यासक्रमातील विषय व उपविषय सोबतच्या पत्रकाप्रमाणे.

सदरहू अभ्यासक्रम पत्रद्वारेही उपलब्ध आहे.

चौकशी आणि शुल्क भरणे :
इकॉलॉजिकल सोसायटी, द्वारा : प्रकाश गोळे
१/ब अभिमानश्री सोसायटी, पाषाण रस्ता, पुणे ४११००८
दूरध्वनी : ०२०-५६५०४०८
सकाळी १० ते १२, सायं. ४ ते ६

निसर्गाची जपणूक आणि संवर्धन : एक वर्षाचा अभ्यासक्रम
अभ्यासक्रमातील विषय

१. भारतातील नैसर्गिक संपत्ती.
पर्जन्य आणि हवामान : नद्या आणि जलसंपत्ती, भूमी, वने आणि गवताळ प्रदेश, तळी, सरोवरे व जलमय भूमी, पर्वत, सागर आणि वाळवंटे.

२. पर्यावरणशास्त्र आणि निसर्गसंपत्तीचे व्यवस्थापन. मूलभूत संकल्पना. पर्यावरणीय दृष्टिकोणातून निरनिराळ्या समस्यांचे आकलन. पर्यावरण आणि विकास. पर्यावरणावर आधारित अर्थशास्त्र; प्रकल्पांची पर्यावरणीय छाननी, पर्यावरणाची किंमत कशी ठरविता येते? निसर्गसंपत्तीचे पुनरुज्जीवन. चिरंजीवी विकासाची संकल्पना.

३. जलसंपत्तीचे व्यवस्थापन : जलसंपत्ती व्यवस्थापनाच्या पूर्वापार पद्धती. आजचे जलसंपत्ती व्यवस्थापन. पर्यावरणीय व्यवस्थापन. ओढे आणि नदी यांची परिसंस्था. आजच्या व्यवस्थापन पद्धतीतील त्याचे महत्त्व. आवश्यक वनस्पती व त्यांचे व्यवस्थापन. ओढे आणि नद्या यांचे पुनरुज्जीवन. जलसंपत्तीचे नियोजन. जलसंपत्तीचा चिरंजीवी विकास. सरोवरे आणि जलमय भूमी या परिसंस्था. भारतातील या परिसंस्थांची स्थिती. जलमय भूमी तयार करणे, पुनरुज्जीवित करणे आणि तिचे व्यवस्थापन. जलसंपत्तीच्या नियोजनात या परिसंस्थांचे कार्य आणि महत्त्व. ओढे, नद्या आणि सरोवरे यांमधील वन्य प्राणी. त्यांची जपणूक आणि व्यवस्थापन. जलप्रदुषणाची समस्या.

४. गवताळ प्रदेशांचे व्यवस्थापन : गवताळ प्रदेशाची परिसंस्था, गवताळ प्रदेशांचे आर्थिक महत्त्व, पाळीव जनावरे व त्यांची चराई. चाऱ्याची समस्या व तिचे व्यवस्थापन; गवताळ प्रदेशातील वन्यजीवन, गवताळ प्रदेशांचे पुनरुज्जीवन; गवताळ प्रदेशांचा चिरंजीवी विकास.

५. वनस्पतीचे व्यवस्थापन : वनांची परिसंस्था, वनांचे प्रकार व त्यांची वैशिष्ट्ये. आजच्या समस्या. वने आणि जनता. वन व्यवस्थापनातील जनतेचा सहभाग. वनशेती व तिचे व्यवस्थापन; नैसर्गिक वनांचे पुनरुज्जीवन. वन्यप्राणी जीवन आणि त्यांचे व्यवस्थापन. अभयारण्ये आणि राष्ट्रीय उद्याने. जनता आणि या संरक्षक विभागांचे व्यवस्थापन; जनपुरस्कृत अभयारण्ये; वन्यजीवनाच्या गरजा आणि माणसाच्या गरजा यांचा समन्वय कसा होऊ शकेल?

६. सागर : स्वरूप आणि संपत्ती : सागराची परिसंस्था, सागर किनाऱ्यांचे पर्यावरणीय स्वरूप, भरती-ओहोटी आणि सागरप्रवाह; खाड्यांची परिसंस्था, खाड्यांतील निसर्गसंपत्ती आणि तिचे व्यवस्थापन; भारतातील दर्यावर्दी लोक आणि त्यांचे जीवन; सागरी संपत्तीचा चिरंजीवी विकास व उपभोग; सागरकिनाऱ्यावरील नैसर्गिक विविधता व तिची जपणूक.

७. भारतातील पर्वतराजी आणि डोंगर; हिमालय ही एक परिसंस्था; हिमालयातील लोकजीवन; हिमालयातील निसर्गसंपत्तीचा चिरंजीवी विकास; हिमालयातील वन्य जीवन, त्याचे व्यवस्थापन व त्यातले प्रश्न.

भारतातील इतर पर्वतराजी व त्यांच्या परिसंस्था. पश्चिम घाटाचे पर्यावरणीय महत्त्व. पर्वतराजीतील निसर्ग साधनांचा चिरंजीवी विकास आणि त्यांचे पुनरुज्जीवन.

Red Baron : Shauri Sulakhe

Drosera burmannii : Shrikant Ingalhallikar

Verditer flycatcher : Shrikant Ingalhallikar

Drosera indica : Shrikant Ingalhallikar

Barheaded goose (*Anser indicus*) : Dr. Satish Pande