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NESAC Award 2019 Notification No. 1

APPLICATIONS ARE INVITED

LAST DATE **30th** June 2019

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General Secretary

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PLASTIC POLLUTION: A CONCERN FOR EVERYONE

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Introduction

In the last few centuries man has started to produce things he could not find in nature. One of these products is plastic. We read about air, water and soil pollution but the earth is facing critical threats from the plastic pollution. Whenever we are drinking water from the bottle or using our favourite device, we are using plastics. We find them everywhere. Have you ever wondered how these bottles are manufactured or what happens to them once you throw them away? From the time of its manufacture to the end of its journey, that omnipresent plastic bottle spells disaster for the environment. According to the study done by World Economic Forum study, our oceans will have more plastics than fish by 2050. India contributes 60% of the total plastic that is dumped in the oceans. Plastic pollution is not only polluting our waters and damaging marine life, but also the food chain and our overall health of ecosystems. The problem with the use of plastic is that it does not degrade. Its life span is several thousand years.



Nature and Characteristics of Plastics

Plastics are derived from the natural substances as well as man-made sources. The man-made plastics are called synthetic plastics and are in much use these days. When plastic came into existence, it was considered to be the miracle substance. The plastics industry flourished after the Second World War when copper, aluminium, steel, and zinc all became precious and were allocated mainly for military use. The appearance, size and shape of the plastic can be modified according to our need. Further, they can be moulded and designed into infinite shapes and can be drawn in the form of fibres for use in textile manufacturing. It is because of these properties that plastic finds varied uses.

It is our common understanding that plastics do not decompose for several thousand years. It is so because most plastics are derived from petroleum based products (mainly propylene) and its decomposition takes place in the presence of sunlight and not bacteria. The UV rays break the bonds of the long molecular chain.



Otherwise, it is not possible by any other means to hold the strong carbon bonds in polypropylene. On the other side, it is easier to make peptide bonds which are carbon nitrogen bonds. It is something worth thinking that instead of carbon-carbon bonds why plastic manufacturers don't use carbon nitrogen bonds which will be easily biodegradable. It is so because plastics made from peptide bonds will have very short shelf life and thus manufacturers of disposable products may consider this an option. However, since carbon-carbon linkages are more stable, people prefer to use this method of manufacturing plastic.

Today, we cannot imagine our day to day routine existing without plastic. The versatile nature of plastic makes it find utility in automobile manufacture, medicine and health care, construction industry, kitchen appliances, domestic appliances and so on. The

automotive industry uses plastic owing to its durability, energy efficiency and cost effectiveness. Similarly, appliance manufacturers use plastics because of their varied colours, flexibility, availability of several designs, and insulating properties. The construction industry uses plastic because of its durability and appearance.

Most of the use of plastic is for packaging. It will not be incorrect to say that today we are paying more for the packaging than for the product itself. During early days, leaves of plants and animal skin were used as packaging as well as to store the food items for future use. By virtue of plastic only, we are able to consume food coming from various part of the world. World Health Organisation has estimated that about 1.7-million deaths worldwide are because of less consumption of fruits and vegetables. Plastic helps to save humanity from malnutrition as it helps in food preservation.

Increasing Throw away culture and Plastic Pollution

Does plastic packaging ensure extra purity? At any grocery store, we find fruits like apple and banana packed in thin layer of plastic. Is the nature's peeling not enough to safeguard the purity of the fruits. Similarly sprouts, corn, paneer, peeled peas, etc all are covered with thin plastic layer to ensure our health and safety of consuming them. We hesitate to eat street food from road side vendors considering it unhygienic and unsafe. For us the packaged, dried and preservatives laden food is safe to consume.

Not just the food products but all our daily use items like toothbrushes, shampoos, deodorants, etc come in extra plastic cover. Even the tea bags that we consume are having thin layer of plastic and therefore when it is immersed in hot water it does not decompose like any other paper. It is very true that we pay more for packaging than for the product itself. The unnecessary use of plastic is enhanced by the 'use and throw' culture wherein we do not know the fate of one time use materials.

Impact of Plastic Pollution on Environment and Human Health

In spite of the fact that plastic offers societal, economic, technological and medical benefits, the concerns over its excessive use and improper disposal are rising. Think of any product and you will find the component of plastic in it. Plastic bottles, jars, containers, bags and many more items made from plastic end up in landfills or rivers. The assault on the environment starts from the right from the manufacturing of these bottles as the plastic bottle industry uses 17 million barrels of oil every year to make plastics, a process that's also detrimental to the environment.

Plastic bags that we use for grocery shopping, when end up in landfills are mistakenly consumed as food by cows, goats, dogs, etc. Most vulnerable are the marine animals particularly fishes and marine birds. Even, many birds living on the dump yards eat the plastic and spread it even more endangering the birds themselves by the plastic accumulated in their stomachs. The sea turtle is an example of an already endangered species that assumes plastic bag for a jellyfish, which it normally eats. Marine birds are severely struck and certain species all contain plastic in their stomachs. 80 % of the plastic released in the water bodies ends on the bottom of the oceans, where it potentially constitutes a threat similar to that in the water surface. Research has revealed the presence of plastics in the body of aquatic organisms. These particles accumulate in their bodies and if consumed by human beings may also enter into human bodies. This means that they end up in the food chains being detectable in breast milk and umbilical cord blood. When plastics are burnt, a cocktail of harmful gases contains dioxins and furans is released into the atmosphere and on breathing may cause respiratory illness and asthma in human beings.

Microplastics: Micro plastics are plastic particles smaller than 5 mm in size and therefore hard to see with the naked eye. They find use in cosmetics and hygiene products such as peelings, toothpaste, hand soaps, in medicine as a vector for active

ingredients and in fibres. Moreover, micro plastics are also formed as a result of physical, biological and chemical degradation of macro plastic particles, the so-called secondary micro plastics. Researchers have detected higher levels of plastic fibres in popular brands of water. In many cases it may be higher than the tap water also. The worries are there that microplastics may also enter the blood stream and the consequences can be fatal.

Disposal of Plastic

In places, where we have no control with the use of plastic it should be replaced by sustainable alternatives. Otherwise there must be a producer responsibility, meaning that plastics should be used in closed loops, so that all of it is recycled. This can be supported by deposit systems, charges, taxes and leasing policies.

There can be several ways of disposing plastic. If it is unattended, it will go to landfill and will persist therefore several thousand years. On decomposition the chemicals may enter the ground water or may percolate deep into the soil. In both the cases, the effects are dangerous as the ground water pollution makes water unfit for consumption and the soil pollution will make the land unsuitable for agriculture. Further, if any plastic substance is thrown in river, pond or any other water body, it will reach the oceans and will jeopardise the ocean ecosystem. In the above sections, we have seen how the plastic disturbs the marine ecosystem and aquatic biodiversity. The other fate of the plastic that it is taken to the recycling centre for recycling. But there are issues associated with the recycling of plastic. Not all the types of plastic are recycle friendly.

There are issues with the recycling of plastics. For example, if we talk about the single use plastic. It is both environmentally and economically not suitable. Plastics designed for single use are difficult to collect and segregate. Then another problem arises when unrecyclable mixed materials are mixed with plastic. Many times the plastic is mixed with other materials and it becomes difficult to segregate or carry out recycling. Our landfills are overflowing with plastic waste mainly because of mixing of materials which cannot be recycled. For example, disposable coffee cups. The paper as well as water proof plastic lining can't be separated and as a result the whole thing ends up in landfill. Similarly think about sandwich packaging which contains paper, laminated plastic and covered with entirely different kind of plastic. Recycling such plastics can be a nightmare. Then sometimes the size of the plastic also becomes a hindrance. Think about straws which count to millions in landfills, it is not an economic viable solution to collect and recycle them because the cost

of segregating the straws will be much more than the cost of reclaiming the recycled plastic out of it.

Therefore, we must think of appropriate solutions to curtail plastic pollution. Change in packaging material like using plant based packaging can be considered but it may not be that effective. Centralised food production often leads to more plastic consumption. Consuming local fruits, vegetables and buying from farmers' markets can be an effective solution. We consume 5 % of the world's oil for producing plastic. One should minimise the use of plastic bags and containers to the maximum possible level. It must not be thrown here and there. Plastic is strong and durable so should be used for things last for a long period of time but should not be used for disposable items. We can also think about levying Plastic tax. It is necessary to manage Plastic Waste in such a way that it is limited in use and is recycled. In 2016, the Plastic Waste Management Rules, 2016, were notified by the Government to regulate manufacture, sale and disposal of plastic waste.

The lack of enforcement is the major hurdle because people know that there is no punishment of not abiding to the rules. In India there a large number of small vendors and it is difficult to monitor them. For example the ban on plastics works very well with the large retailers but small vendors usually continue to use the plastics. It may be because of the fact that large corporations are conscious about their corporate social responsibility.

Conclusion

Critical thinking and interdisciplinary approach is needed to overcome the menace of plastic pollution. It is therefore important that we begin to think critically and environmentally about the issues that the world is facing. The use and handling of plastics today is out of control and this must be changed so that smart design, circular economy and cradle-to-cradle thinking is predominant. Plastic consumption must be in closed circles, meaning that it does not end up in nature and reuse and recycling must be maximized. Sustainable consumption of plastics must be there. Plastics define our culture but should not define our fate.

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CORAL BLEACHING

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Coral reefs are made by the deposition of free-swimming corals to the marine waterbeds. Corals are invertebrates belonging to the phylum Cnidaria, class Anthozoa. One of the largest coral reefs of the world is the Great Barrier Reef, located in Queensland, Australia. In India, they are seen in the Andaman and Nicobar

Islands and the Lakshadweep island. Coral reefs are very important for the sustainability of marine life. They are home to numerous species of organisms, providing them with food and shelter. They also protect the adjacent shorelines by reducing erosion along the harbours and port lands while simultaneously slowing down the strong current rate, which also causes erosion.

Coral Bleaching occurs when the corals expel out the algae that live in them in a symbiotic relation, while also losing their colour. Bleached corals continue to thrive; however, they starve after bleaching. Two thirds of the corals available worldwide, are under serious threat and one quarters are considered damaged beyond repair. The reason for this is primarily climate change. Corals cannot survive if the water temperature is high. Due to global warming, there is an abrupt increase in water temperature, thus causing the corals to bleach. Secondly, pollutants cause overgrowth of algae, which reduces the amount of sunlight reaching the corals and cutting off its air supply. Another reason for coral bleaching is destructive fishing practices such as overfishing, cyanide fishing, blast or dynamite fishing, which causes a disbalance in the ecological ecosystem of the coral communities.

Global Warming and human activities are not only negatively impacting the terrestrial lives but also a large portion of marine life. This generates a disbalance in the ecosystem and thus directly or indirectly affect the food chain. It is high time that human beings become aware of the damage that they are causing and take immediate actions with regard to it.



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FISH CONSERVATION

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The global fish resources including freshwater, estuarine and marine fish stock do not look very impressive or hopeful currently. Over exploitation and overharvesting of fishes from freshwater, estuarine and marine ecosystems have depleted global fish resources significantly. Several indigenous freshwater and

marine fishes have been aggressively pushed towards extinction and many have been made critically endangered by humans for their ruthless exploitations over past several decades providing very little or negligent opportunities for the various fish populations or more critically in case of isolated fish sub populations to recover. Many breeds and stocks have been devastated so alarmingly that several countries have placed ban on catching or commercially exploiting

certain species. Furthermore, it is important to say that the global fishery or pisciculture industry is not just restricted to freshwater, estuarine and marine fishes only; but, also includes crabs, oysters, shellfish, prawns, lobsters, scallops, octopuses, squids to mention only a handful. Even harvesting and exploitation of sea turtles, and different species of sharks and marine mammals like whales to mention only a handful.

The destruction of the global fish resources has been so devastating that it has impacted the complex human food chains in some specific cases in different parts of the world. One of the biggest destructive forces contributing to rapid depletion of global fish stocks is industrial methods of fish harvesting that are not only detrimental to the fish populations but also destructive to entire aquatic ecosystems. The deep sea fishing vessels equipped with high technology gadgets, highly trained crew members and advanced tools and techniques are capable of mass harvest of fishes and other marine species in huge numbers much beyond the threshold level of their corresponding carrying capacity. Moreover, catching young immature juvenile fishes and egg laying females at prime reproductive age and during peak breeding seasons has been further depleting fish stocks in the global seas and oceans.

Marine pollution by plastics, sewage and accidental oil leaks and increasing volume of marine traffic are also contributing towards decimation of many ecologically sensitive species. The destructive



and non-environment friendly method of fishing like dragging the trawl net that completely destroys highly fragile marine ecosystems at the ocean floor is actually damaging future opportunities of the fish industry around the globe. Since low number of fishes will also mean less economic growth for the global fishing industry. Furthermore, various illegal fishing methods adopted by some indigenous fishing communities and dishonest fishing companies for practising poison fishing or explosion fishing is not only extremely detrimental to target fish species; but is also destructive for numerous non-target species.

Poaching and trafficking for illegal aquarium and pharmacy trade is also causing destruction of global fish stocks. Fishing beyond the fishing season or during off-season depletes stocks significantly. Irresponsible behaviour has also caused accidental introduction of exotic breeds of fishes into sensitive freshwater and marine ecosystems causing mass destruction of indigenous fish breeds being subjected to predation and hybridization with foreign species. In several countries particularly in tropical subtropical temperate ecosystems, indigenous breeds of fishes have been decimated or replaced by podiatry exotic species in several countries. It is true that under the pressure of international conservation agencies as also local and regional non-government organizations working towards the protection of aquatic environments; a number of freshwater, estuarine and marine sanctuaries have been established worldwide.

However, the level of exploitation is alarmingly higher than the rate of conservation of fishes around the globe. The direct release of domestic and industrial sewage into rivers and open oceans is severely polluting freshwater and marine environments respectively; and jeopardizing fish populations. Excessive applications of the agricultural chemicals in the form of pesticides, herbicides, insecticides, fungicides, weedicides and synthetic chemicals as fertilizers are being washed into nearby freshwater resources like rivers, rivulets, tributaries and distributaries, steams, pools, ponds, lakes, swamps, bogs, ditches causing massive eutrophication. This in turn changes the biogeochemical cycling of minerals and alters the physical and chemical parameters of water; often resulting in acute shortage of oxygen that kills fishes and aquatic life in large numbers.

The opportunities associated with the global ornamental fish market are huge for those interested in the ornamental fish business both in India and overseas including Middle East, Far East, China, SE Asia, EU, UK, Australia, USA and Canada. However, the ornamental, fish business is targeting colourful indigenous fish species and not promoting breeding and multiplying internationally accepted commercial breeds. International fish collectors will be certainly interested in new and exotic colourful breeds and surely it will capture international markets in a short time with high economic returns if promoted properly. But there is also an inherent danger of trading with indigenous breeds. In a country that has very little or





almost no respect and value for human life unless you are rich social elites, celebrities or politicians; will the state and the central government agencies of India be able to prevent mass poaching and illegal trafficking of wild fishes. Already the existing illegal wildlife black markets operating across China, Hong Kong, SE Asia is sending death sentences for several wildlife species across the

planet. Traffickers and poachers will start taking serious interest in indigenous wild ornamental fishes and as a consequence could seriously deplete native fish species in their native ecosystem and aquatic environment across the globe. *Acknowledgement:* Sikkim Express & Technology Times; *Photo credit:* S. K. Basu

NUCLEAR FUSION - A HIDDEN SECRET

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The earth gave rise to humans millions of years ago and provided them with every kind of requirement they would need to survive on this planet. Humans, gifted with the most powerful and important weapon, intelligence, used its wits and moulded the environment in a way that best suits him. For centuries, humans have deteriorated the condition of the planet in order to satisfy one's greed and gain profits out of the resources that assumed to be infinite for them. But, till the time they realised that the stock was limited, it was already too late to care for the gone past. Instead, they adopted a new way to cope up with the upcoming problem of shortage of energy, alternate sources of energy. This led to the development of dams for hydroelectricity, solar panels for solar power, nuclear reactors for nuclear fission or the theoretical idea of nuclear fusion.

Nuclear fusion is a reaction in which two or more nuclei are combined to form one or more different nuclei and subatomic particles (neutrons or protons).

The difference in mass between the reactants and products is compensated by the release or absorption of energy. This phenomenon is the primary source of energy produced in stars like the Sun in which hydrogen and helium atoms fuse together to release high amounts of energy for the longevity of stellar energy. This was a very important observation of Arthur Eddington who proposed this fact based on F.W. Aston's measurements and

Einstein's calculations. This process keeps on operating because another proton is released as a byproduct.

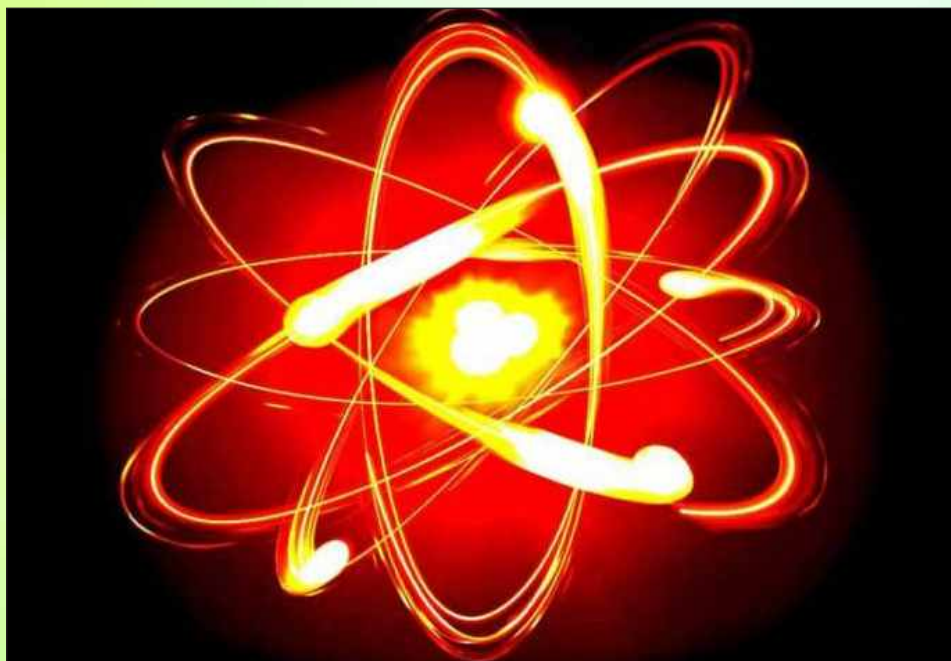
Referring to the fact that nuclear fusion releases a huge amount of heat that can act as an alternative source of energy, scientists are trying their best to construct apparatus for the execution of process which seems a difficult task at the present. Fusion reactors, the devices designed to carry out nuclear fusions use the isotopes of hydrogen such as deuterium or tritium (which can show better reactions as compared to protium). The isotopes are used to create

plasma of a very high temperature using methods like lasers or magnetic methods.

Nuclear fusion has many advantages over other alternate sources of energy particularly when compared to nuclear fission. Some of the crucial advantages include reduced amounts of radioactivity when under procedure, low levels of waste generated, higher outputs of energy and increased limits of safety.

Nevertheless, these benefits are just

theoretical and have no practical application because in spite of numerous attempts, controlled fusion has not been achieved in a practical and economical way. The major drawback of the system is the lack of availability of setups that can withstand the plasma with such high temperature for longer periods of time so that the phenomenon of fusion can continuously occur. The other challenge includes managing the neutrons released as a byproduct in the reactions which may damage the materials used in the reactors.



The attempts at using the energy released during nuclear fusion started as early as in the 1930's by Ernest Rutherford who began with his experiments with a particle accelerator built by John Cockcroft and Ernest Walton. Later Mark Oliphant discovered helium-3 and tritium and that heavy hydrogen nuclei could be fused together. Recently in 2015, Germany conducted the first plasma discharge in a large scale stellarator capable of steady-state plasma confinement namely Wendelstein 7-X under fused conditions. In 2017, China's EAST(Experimental Advanced Superconducting Tokamak) tokamak test reactor achieved a steady 101.2 second steady state high confinement plasma which established a world record in long pulse H-mode operation. In 2018, scientists from MIT(Massachusetts Institute of Technology) were researching to find a way to remove excess heat from nuclear fusion reactors.

As for India, India is one of the nations among the seven parties(European Union, India, Japan, China, Russia, South Korea and the United States) to contribute in the development of ITER (International Thermonuclear Experimental Reactor) which is an international nuclear fusion research and engineering megaproject and will be the world's largest magnetic confinement plasma physics experiment being built in France with a deadline of 2025.

The efforts put up by the organisations and institutions from around the world would certainly result in a future with advancing technologies to use nuclear fusion as an integral part in generation of electricity. The trend of growing importance of generation of energy from renewable sources is diverting the concentration of people from the exhaustible sources.

GREAT INDIAN BUSTARD (GIB)

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The Great Indian Bustard (GIB) is a majestic avian species that finds its home in the Indian subcontinent. Standing over about over 1 m in height, with an average weight of 18 kg for an adult bird, the GIB is the heaviest bird on the planet that can fly. In India, the GIB habitats are currently restricted to the states off Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh and Karnataka. The species is reported to migrate between Western India and Pakistan. Unfortunately, due to a number of anthropogenic as well as national factors, the GIB has been declared as a critically endangered species, seriously threatened with extinction by IUCN. The latest 2018 census status report on GIBs indicates that only 150 individuals are surviving in the wild!

The factors impacting GIB populations in all the Indian states include rapid loss and destruction of natural habitats, habitat fragmentation, uncontrolled anthropogenic or natural grass fires; as well as predation on GIB nest, eggs and chicks and adult birds by local raptors, feral cats and dogs, jackals, foxes, wild cats, coyotes, hyenas, snakes, rats and other predatory species. Furthermore, there are reports of a number of birds being killed every year as they migrate to Pakistan;



where there is little or no protection available for the birds from rampant poaching. Changes in the land use patterns and expansion of agriculture deep inside the GIB natural habitats have negatively impacted their population too due to anthropogenic pressures. Several reports of accidental and deliberate poisoning of the birds have been also reported due to over application of pesticides in the fields and for using poison baits to kill the birds by farmers to reduce crop loss. However, the most dreadful aspect of the GIB declines are attributed to the helpless birds colliding against high tension power lines and wind turbines during their flights that have been built

across their habitats killing them mercilessly in large numbers.

Of course tracking the birds and following their migratory path integrated with their census number would certainly provide a reach dataset that can significantly contribute towards their future conservation policy. However, it is important to note that the number in the wild has dwindle so low that unless significant steps are taken to increase or multiply their numbers, the tracking strategy may prove to be completely futile in the long run. One of the best and time tested effort that needs to be incorporated without failure is comprehensive captive breeding programs in all the states with GIB habitats like Rajasthan, Gujarat, Maharashtra, Madhya Pradesh and Karnataka. Without a successful captive breeding program and their re-introduction into their wild habitats, it will be not be possible to sustain a species with numbers as low as 150 as per the last census. To conservationists the species is hanging between survival and extinction at a make or break point. Selective breeding done under

trained and professional supervision in specially designed breeding and reintroduction centres could serve as an important starting point in saving the species from the brink of extinction.

Both local and international reports suggest that the government of India in association with the state governments harbouring GIB habitats are working towards developing a comprehensive policy interviewing power transmission lines traversing across sensitive habitats and

win turbine mills. It has been decided that birthday voters will be placed on the electrical installations on high tension lines to protect the birds from being electrocuted. Similarly tips of the fans in wind turbines are to be painted orange to warn the birds from colliding into them. Furthermore, education and awareness of the people in the sensitive GIB habitats need to be organized to make people realize the importance of the species in their natural ecosystems and local environment. Farmers, power line and wind farm companies need to develop GIB friendly practices to help the bird survive in their natural habitats by jointly working together in the race to save these majestic species before it is too late. The forest departments

alone will not be able to handle the situation unless all stakeholders join this effort.

Under these circumstances, it becomes extremely important to establish comprehensive conservation program for the GIBs in both Western and Central India. A new initiative adopted by the government of India as a part of conservation measure is the use of radio collar or tags to track their migration to and from India into Pakistan where they are reported to be indiscriminately hunted for meat. Reports indicate that there have been some efforts in the captive breeding program earlier; however, it is much below the need. Comprehensive captive breeding program across its range of distribution is an emerging need for the species with estimated wild population of only 150 individuals. All the Indian states (Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh & Karnataka) with wild GIB habitats need to cooperate, coordinate and communicate for facilitating a Joint Conservation Initiative (JIB) with support from the Central government. We need to act fast with comprehensive conservation policy and strategies before it is too late for this majestic bird species to become extinct like the cheetah in 1951 from the Indian subcontinent.



We do not inherit the earth from our ancestors, we borrow it from our children.
~Native American Proverb

Save Water !

PLANTATION DRIVE BY THE ACADEMY



The Academy Members are requested that whenever they plant a tree on their birthday or any other event, please send us the photographs with report so we can publish the same in our newsletter. This will inspire and encourage many more life members of the Academy to participate in the "Green drive" of the Academy.

Members are also requested to preferably plant a medicinal plant which can benefit each and every one around us. Also they can form a committee in their RWA for plantation of tree on weekends.

Dr. Shefali Gola
Editor, NESA E-newsletter

To,

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APPEAL TO LIFE MEMBERS

NESA Life Members are requested to submit short articles for the NESA e-Newsletter that are consistent with NESA's objectives to improve environment. The articles should focus on topics related to environment and facilitate communication and discussion among researchers, academicians and students. The articles for December edition can be submitted to nesapublications@gmail.com before **25th March, 2019**.

Dr. Shefali Gola, Editor, NESA E-newsletter