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An increasingly accepted view is that traditional taxonomic practices are insufficient on their own to cope with the growing need for accurate and accessible identifications of plant material. DNA barcoding reduces species identification time to hours and, eventually, to minutes. Analysis extends to all life stages and to fragments of organisms. The technology has led to the discovery of overlooked species around the world. The technology has numerous practical applications, from ecosystem conservation to biosurveillance and food safety. Canada's University of Guelph will be the scientific hub for iBOL, which was officially launched on the 25th September, 2010; a timely event for the *International Year of Biodiversity* (IYB). To date, many researchers have been quickly amassing 1000s of DNA barcodes for a growing database of life forms, and developing new informatics tools and technologies. The International Barcode of Life (iBOL) project will involve more than 100 researchers from 26 countries. "iBOL" will significantly advance the world's first reference library of DNA barcodes. iBOL will advance the DNA barcode library from its current 70,000 species to 500,000 species during the next five years. It's estimated that iBOL will gather barcode records for all 10 million species of multicellular life on the planet within 20 years; only 1.78 million of these species have been formally identified over the past 250 years. This supports the goal that any life form, from anywhere on the planet, can be rapidly identified. This investment confirms and supports the international leadership for Canada in the study of biodiversity. The next step is the development of an iBOL's high throughput Automated Identification Technology (AIT) system. Our initial research indicates that the efficacy of an AIT system equates with savings in time and funding allowing us to save resources for alpha taxonomy. Given the potential interconnectivity of web-based applications we suggest an AIT system for plants that utilizes several existing systems: Herbarium Information Management System (HIMS), Barcode of Life Database (BOLD), Laboratory Information Management System (LIMS), and Integrated Botanical Information System (IBIS). We suggest several applications where AIT could serve as a tool for biologists and society-at-large.





WHAT MAKES A GENE? A SYNTHETIC BIOLOGY PERSPECTIVE

04 12

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We asked a simple question. What makes a gene? How did nature determine that she must covert a “specific piece of DNA” into a coding region? Did she sample all the possibilities, retained some and retired the rest? What kind of “algorithm” was used to determine the best fit among a large number of possibilities? What happened to retired sequences? Where are they now? To answer the first question, we decided to explore the possibility of artificially constructing genes from non-coding regions. Our aim was to develop a method that was simple and scalable. The problem was to covert a non-coding sequence into a coding sequence? To meet this key challenge, we invented a novel method that consisted of the following steps (a) amplify a given sequence, (b) find the right vector that supplies basic infrastructure for expression (c) paste the amplified sequence into this vector (d) transfer the artificial gene cassette to the cell (e) confirm the expression and (f) hope for a novel phenotype. Six *E. coli* intergenic regions with no history of transcription were randomly picked up. All the sequences were computationally translated and matched against non-redundant NCBI database to ensure that we did not end up creating a known natural equivalent of these user-defined proteins. Sequences were amplified and inserted into pBAD topo vector and expressed in *E. coli* MG 1655 cells. Protein expression was confirmed by Western blotting. The intracellular expression of one of the proteins resulted in the cell growth inhibition. The growth inhibition was completely rescued by culturing cells in the inducer-free medium. Computational structure prediction suggested globular tertiary structure for two of the six non-natural proteins synthesized. We called these artificially constructed genes EKA (ekam - first in sanskrit). To our best knowledge, this is the first report that describes making genes from junk DNA. These findings lead us to revisit the first question - what makes a gene? Can we extend this theme to pseudogenes, repetitive sequences, introns and subsets of exons, and so on ? What is the best-case scenario and boundary condition of converting non-coding to coding regions? Having provided the proof of the concept, we are studying features that are common to a broad set of coding regions. Once patterns are identified, our questions will move towards understanding of the emergence of genes from evolutionary perspective, and ‘extract’ gene-like regions from a huge mass of non-coding DNA regions. Preliminary results point to the new classification system and an evolutionary understanding that could emerge from these studies.



ARCHIVING AND INNOVATING DIVERSITY: CYBERGENOMICS MEETS THE ORDER OF THINGS

04 13

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For many taxonomists and biodiversity scientists, the discovery in 2003 by Paul Hebert and his team that a short segment of the mitochondrial gene (Cytochrome Oxidase I) worked to rapidly and reliably discriminate between (all) species, signalled a 'renaissance' for the 'taxasphere'. What is certain is that the advent of DNA barcoding set in motion an unprecedented mobilization of biological material coupled with a need to standardise the generation, management and analysis of vast quantities of digital material. Diversity in taxonomic and bio-informatic practice across the globe combined with the complexity of plant compared to animal biology have introduced fascinating but not insurmountable challenges to the Barcoding of Life Initiative. In this paper I draw upon 2 years of ethnographic research into the Barcoding of Life Initiative which I will analyse through a theoretical lens provided by Anthropology and the Sociology of Science and Technology (STS). By focussing on a) the negotiations required to establish standardised practice and b) the production and preparation of biological material by 'parataxonomists' in mega-diverse areas of the world, I will argue that DNA barcoding (and biodiversity science more broadly) is simultaneously a social, scientific and political innovation.



COMPUTER-AIDED IDENTIFICATION SYSTEM FOR TREE SPECIES OF THE WESTERN GHATS, INDIA

04 14

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There is growing scientific consensus that habitats are altered and species are disappearing at rates never before witnessed on the planet. The biodiversity crisis is not just about the perilous state of plants and animals but also endangering of specialists who know them. BIOTIK is an initiative in the emerging area of biodiversity informatics and has enabled biodiversity researchers to overcome such impediments. The BIOTIK aims to develop knowledge base on tree species of the rain forests in the Western Ghats of India, which is one of the "hotspots" of biodiversity. The species identification software "IDentification Assistée par Ordinateur (IDAO)" was implemented to generate identification key for tree species. The identification system, entirely graphic, provides multi-entry points, allows identification of incomplete samples and certain level of observational errors, and enables specialists and non-specialists to make determinations of taxa by generating rules as required at any stage of identification, as like the way by which experts discriminating taxa by using which character(s) should be used in various circumstances. The identikit builds a conceptual plant for every selection of characters in the user querying interphase. Subsequently, at each step of the identification process, Gower's similarity coefficient is calculated for each species based on the user supplied characters. If the user have some difficulties to choose the next character to feed, it's possible to request the software to provide the best character to discriminate taxa, through a negative entropy calculation. In the result interface, for each taxon, in addition to pictures of species, morphological description of species, brief information on ecology and distribution data are provided in English and local languages viz., Kannada, Tamil and Malayalam for wider dissemination of taxonomic knowledge and enhancement of biodiversity assessment capabilities of the region. The BIOTIK identikit is available on-line as an open source web-based application (www.biotik.org), on DVD for personal computer platforms as well as on Ultra Mobile Personal Computer and even it can be accessed through iPod to identify species easily. The identikit is a free shareware (www.biotik.org for downloadable windows version; www.ifpindia.org/biotik for online version). Presently, the BIOTIK identikit- Western Ghats v 1.0 can be used to identify 528 tree species, especially those occurring in the evergreen forests of the Western Ghats. The BIOTIK knowledge base will continue to evolve (by including more species) and play a major role in biodiversity assessment and species conservation efforts through the IT&C.





ISOLATION OF BIO-INSECTICIDE FROM LEPIDOPTERANS: STRIPED TIGER BUTTERFLY (*DANAUS GENUTIA*)

04 01

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Plants protect themselves from insect attack by secreting a multitude of repellent chemicals including toxic and bitter alkaloids and tannins. Non-specialist insects and other animals that attempt to feed on the plant may be repaved and injured through severe gastro-intestinal malfunction or even killed. Cabbage, Mustard, Spinach are well known for their pungent flavour that deters most animals from consuming it. Even modishly plants like, *Cynanchum collialatum* (Milk Weed Plant) of the family *Asclepedeciae* have tannins that repels most insects and animals. All these plants have a basic enzyme called, 'Myrosinase', which react with specific tannins and produce the toxic metabolite. This toxic metabolite repels insects and animals. The caterpillar of Striped Tiger Butterfly (*Danaus genutia*), however, show remarkable resistance to this poisonous alkaloid and genetically it has been proved that these caterpillars sequester these toxic alkaloids in their body as they grow and a fully grown adult Striped Tiger will be a poisonous meal to its predators that attempt to feed on it. This study was conducted for an extensive period of two years from March 2005 to February 2007 under complete laboratory conditions. We tried to utilize this very property of sequestering toxins by the butterflies and were successful in isolating the toxic alkaloids from the dead butterflies in a 100% chilled ethanol – based solution and test them as a potential bio-insecticide against the pest of mustard and spinach, Diamond Black Moth. It worked dramatically well and we plan to proceed with further studies on the composition of the alkaloid by HPLC studies and using it as a possible Bio – insecticide as an alternative to the chemical pesticides, which are known to cause severe health disorders to both animals and humans alike. We are also the first group in India to attempt such a study.





POPULATION GENETICS REVEALS HISTORY OF PLANT INVASION

04 02

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Invasive species change and threaten native biological diversity in many ways, including reducing species diversity, changing hydrology, and altering fire regimes and ecosystem function. In fact, invasion is the second most important threat to biodiversity after habitat loss. Invasive plants displace native species and hence create an imbalance in natural and agricultural ecosystems leading to the formation of large monocultures of invasive plants in the new environment. *Lantana camara* L. is amongst the world's worst invader according to Global Invasive Species Program. It is native of Central and South America and was brought to India during early part of 19th century as an ornamental plant. Gradually it has established in almost all types of ecosystems of India and has been imparting detrimental effects on the native ecosystems by crowding out more desirable species and disrupting succession and decreasing biodiversity. Despite the potential threat associated with invasion information is lacking on most of the aspects of *L. camara*. Particularly, population genetics of introduced species is of great interest because the current distribution of genetic variation could provide novel insights into demographic events that led to their introduction and historical range expansion. In the current study I am looking at population genetics of *L. camara* and its geographic association to reconstruct invasion history. I am focussing on questions like how many times it was introduced into India, singly or in multiple events. So far, chloroplast and nuclear sequence data has generated six and seven haplotypes respectively. These have also shown that *Lantana* population across India is low (nuclear $F_{ST}=0.09$) to moderately structured (chloroplast $F_{ST}=0.14$). Comparison of pairwise F_{ST} between pairs of subpopulations has indicated that populations differ at varying degree among themselves (pairwise F_{ST} : 0.02-0.23). This suggests that the *Lantana* population across India may be admixed to some extent, thus making it difficult to disentangle signatures of putative introductions events. However, distribution of haplotypes across subpopulations also shows the presence of unique haplotypes in few of them. Moreover, clustering analysis using multilocus maximum likelihood method can find out multiple hidden genetic groups and conclusively assign all the individuals into more than two genetic groups along their pre admixture ancestral lines. Genetic information thus suggests multiple introductions of *Lantana camara* into India.



DNA- BASED TECHNIQUES FOR IDENTIFICATION AND CONSERVATION OF ENDANGERED SPECIES IN INDIA

04 03

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India has 447 sanctuaries, 84 national parks, covering 4.5% of geographical area. Wildlife (protection) Act, 1972 governs wildlife protection and protection of endangered species. 173 Mammal species, 101 Bird species, 15 reptile species and 2 Amphibian species have been declared endangered in India. Wild life extinction can be arrested by putting strict control on poaching of wild animals for meat, skin, fur and other products. This is possible only when accurate and authentic species identification methods are in hand and labs with sufficient facilities are established at various places. The identification of vast numbers of unknown organisms using DNA sequences becomes more and more important in ecological and biodiversity studies. One of the great challenges of modern biology is to develop accurate and reliable technologies for a rapid screening of DNA sequence. The following technologies can be used for the detection and identification of species in numerous fields of investigation, such as taxonomy (molecular phylogeny), epidemiology, forensics, archaeology. In recent years, a variety of DNA-based approaches have been developed for the identification of individuals. Several molecular techniques such as Polymerase Chain Reaction (PCR); Restriction Fragment Length Polymorphism (RFLP); Random Amplified Polymorphic DNA (RAPD) ; DNA-hybridization, DNA sequencing and DNA bar-coding have been used for analysis from almost all kinds of biological materials like saliva, feces, meat, blood, milk, etc. Another important breakthrough for the construction of a portable species identification gadget is the development of a new generation of nano material-based electrochemical biosensors. Electrical DNA hybridization biosensors are now capable of converting DNA-DNA recognition events into an electronic signal-transduction process. These techniques are especially pertinent to bio-surveillance where the identification of animals and animal by-products is done in the context of conservation and wildlife management.



STATUS OF SARUS CRANE (*GRUS ANTIGONE*) IN THE BRAJ REGION OF BHARATPUR IN EASTERN RAJASTHAN, INDIA

04 04

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From January to December, 2007 a survey was carried out to assess the present status of the Sarus Crane at Bharatpur district in eastern Rajasthan in northwestern India. A total of 29 sites mostly potential habitats were surveyed in the entire district of Bharatpur. Of these, 12 sites showed the presence of cranes. A sharp decline of about 93% was noticed. All all, Nonera was identified as one of very important sites for cranes both as feeding and roosting ground. Sarus cranes used various habitat types including agricultural fields, harvested fields, wet barren lands with *Cyperus* sp., *Scirpus* sp. vegetation. The paper also highlights conservation issues for cranes in the region.



RETMEDBASE: A DATABASE FOR RET MEDICINAL PLANTS OF SOUTH INDIA

04 05

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The huge quantity of the data generated from the research work demands the proper management, storage, access. Databases will help the user to manage and access data more easier and faster. The importance of managing and coordinating the RET medicinal plant research data raised the need of a database for these 32 selected RET Medicinal Plants. Visual basic 6.0 and MS access 2003 was used for developing this database which is named as "RET Medicinal plant Database"(RETMEDbase). MS Access is a powerful RDBMS. The passport data, evaluation data (morphological chemical and molecular) were entered in MS. Access. Visual Basic 6.0 is simple as well as user friendly and was used as the front end ie. as a user interface and MS Access was used as the back end, i.e., as a data storage part. Database connection is established by using ADO data control, one of the ActiveX control used for data access from databases to VB 6.0. Coding was done in such a way that, the user can access all the data, generated in RET Medicinal plant species from a single window. In the database home window consist of menu buttons for accessing passport data, evaluation data and abstracts of published research papers different RET medicinal plant species. The distribution and prediction maps generated through DIVA GIS software for each species were also incorporated in the database. Other than this the database includes the photos of each RET Medicinal plant(habit and habitat, flower, fruit seed and economical parts) data from exploration, field gene bank, *in vitro* studies, anatomical studies and pollen studies were also incorporated. In short this digitalized database provides information of selected 32 RET medicinal plants of South India in a user friendly manner.





CYBER TAXONOMY – A NOVEL TOOL IN BIODIVERSITY SCIENCE

04 06

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India, a megadiversity country, in the recent years has been on intense development. However, the extensive land use changes have impacted much negatively on the biodiversity locally. This has generated a demand for ways to accelerate the discovery and application of knowledge regarding living organisms. Since taxonomy is the science central to exploring and understanding biodiversity, there now exists a greater demand on this science to supply the increasing need of biodiversity knowledge. Cyber taxonomy is an assemblage of electronic taxonomic tools for accelerating species' discoveries and application of taxonomic knowledge in biodiversity studies. This new approach utilizes standardised electronic tools to access information and generates knowledge bases, integrating the best of the 'Information Technology' (IT) revolution into the taxonomic processes, thus expediting the steps in identification and documentation. This is achieved mainly through electronic publications, electronic databases, factsheets and interactive identification keys. In taxonomy, a character state is best defined and information is conveyed more meaningfully, by appending a good illustration to the verbal part. The recent revolution in the digital imaging scenario, has paved ways to capture good resolution 3D digital images of even minute living forms, using advanced light microscopes. Extended focus softwares like Automontage, Cartograph and Combine ZM, by performing image stacking, can generate 3D images which incredibly add colour, clarity and value to taxonomic publications. Softwares like Fact Sheet Fusion (FSF) enable rapid generation of web-based biological information systems. There are softwares like Lucid Phoenix, which can create interactive dichotomous keys in comparatively easy steps, also facilitating publishing on the internet or CD. These new generation tools act as an efficient interface bridging the gap between the specialist taxonomic community and a wider public through effective dissemination of taxonomic knowledge. This has enabled the conventional taxonomist to communicate more efficiently even on minute forms like parasitic hymenoptera, an insect group whose knowledge hitherto remained largely confined within the scientific community alone. Parasitic Hymenoptera qualify itself, to be an apt candidate for an effective demonstration of the utilities of cyber taxonomy. An Interactive Identification System generated with the softwares and gadgets mentioned above, with regard to 20 common genera of Platygastridae (Hymenoptera), a little known, yet economically significant group of minute egg parasitoids, abundantly found in the paddy agroecosystems of Kerala is presented here.



POPULATION STRUCTURE AND REGENERATION PATTERN OF FOREST COMMUNITIES OF MORNAULA RESERVE FOREST IN KUMAUN HIMALAYA, INDIA

04 07

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Assessment of floristic diversity and regeneration status of trees has become an important aspect of research in view of the changing climatic conditions in the Indian Himalayan Region and throughout the globe. Therefore, an attempt has been made to assess the floristic diversity and regeneration status of trees in biodiversity rich protected area i.e., Mornaula Reserve Forest (MRF), between 1600-2200 m amsl to study the plant diversity and regeneration status of tree species. A total of 123 sites were sampled using standard ecological method. For each site, information on habitat characteristics, altitude and dominant species was gathered. Total 31 forest communities were recorded. Among the identified communities, *Rhododendron arboreum* community represented maximum sites (26), followed by *Quercus leucotrichophora* (18 sites) and *Pinus roxburghii* (16 sites). The remaining communities showed less representation of sites. The tree density ranged from 340-2438 Ind ha⁻¹ and Total Basal Area (TBA) from 19.52-234.31 Ind m². Saplings density ranged from 340.00-2277.00 Ind ha⁻¹ and seedlings, 266.00-1571.00 Ind ha⁻¹. *Rhododendron arboreum* community represented maximum density of trees (2438.00 Ind ha⁻¹), seedlings (1171.00 Ind ha⁻¹) and saplings (657.00 Ind ha⁻¹). The *Rhododendron arboreum* community showed maximum total basal area (234.31 m² ha⁻¹). The richness of the trees ranged from 3-27, seedlings, 3-22, and saplings, 2-21. Species diversity of trees ranged from 0.99-2.93, seedlings, 0.86-2.65 and saplings, 0.44-2.78. These recorded values were almost comparable with the studies conducted in sub-tropical, temperate and sub-alpine regions of the West Himalaya. However, in some cases the values were slightly higher than the reported values. The regeneration pattern indicated that of the 31 forest communities identified, 05 communities showed highest regeneration of the dominant species particularly in sapling layer followed by other species indicating no change; 18 communities showed sufficient regeneration of dominant species but highest regeneration was found in co-dominant species particularly in sapling layer indicating possible replacement by co-dominant species; 01 community showed poor or no regeneration of dominant species indicating their replacement by other species; and 07 communities showed dominance of two species but showing very high regeneration of one species particularly in sapling layer indicating mixed community may shift in dominant type in near future. Long term monitoring of these forest communities for their conservation management have been suggested.



ZOOPLANKTON AND FISH DIVERSITY OF LAKE KOLLERU AFTER RESTORATION (2005-2006)

04 08

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Kolleru Lake (16° 32' and 16° 47' N & 81° 5' and 81° 21'E) is a large fresh water Lake located between two major deltas, the Godavari on the East and Krishna on the West. It is one of the important Wet lands of India as it supports a variety of Flora and Fauna. The lake from 1984 onwards has been subjected to drastic changes. Since 1977 Pisciculture has been introduced by Government as a source of supplementary Income to the fisherman co-operative societies with the encouraging results derived in fish culture in these tanks, private entrepreneurs also entered in to pisciculture by converting all lake area in to fish tanks. As a consequence, the Lake experienced changes in the Topography water quality, Zooplankton and Fishes. In the present investigation (2008 to till continue) an attempt is made to study the qualitative Zooplankton and Fishes of the Lake after restoration (2006) with the conditions existing in the previous days i.e. before 1984. The Zooplankton and fish samples were collected from different areas of Lake in different time intervals. The qualitative studies of Zooplankton and fishes reveals that 12 Species of Rotifers, 10 Cladocerans, 8 Copepods, 7 Ostracods, 1 Clam shrimp and 98 species of Fishes. The increased tendency of faunal diversity of the Lake indicates that the Lake may be come back to its original condition after restoration.





PHYLOGENETIC ANALYSIS OF A HEMIPTERAN BASED ON THE BIOMOLECULE CORAZONIN

04 09

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Insects are an amazingly diverse group of animals that have conquered almost every environment on earth. Their impressive evolutionary success is in no small measure a consequence of unique developmental and reproductive strategies, which have facilitated efficient resource exploitation and radiation into a wide range of ecological niches. Corazonin is a highly conserved and widespread biomolecule in insects. It has been identified in the nervous system and hemolymph of various insect species. There are six types of corazonin identified so far with amino acid substitutions at various points. Molecular characterization of the molecule was done. The Homology searches were performed with BLAST and BLASTX algorithm against the non-redundant version of the sequence databases at NCBI. Multiple alignments of nucleotide and amino acid sequence of corazonin genes selected insect species with *Dysdercus cingulatus* were performed using the software BioEdit. Phylogenetic tree was developed with CLUSTALW using MEGA 4 Software. The results from gene analyses and peptide isolations show that Arg-corazonin is conserved in insects ranging from primitive Polyneoptera such as cockroaches to the most advanced Holometabola such as moths and flies. By contrast, the sequences of signal peptide in corazonin have obviously rapidly diversified in insect phylogeny, as seen from the comparison of different insects with a phylogenetic tree. To investigate whether corazonin precursors contain cysteine residues, the currently available genomic databases of insects were extensively data mined and processed. The corazonin of insect species were detected and compared. An intron between amino acid residues 72 and 73 was found in the *Apis mellifera*, *Bombyx mori* and *Drosophila melanogaster*.





A NOTE ON THE COLOURMORPHISM OF *RAORCHESTES AKROPARALLAGI* FROM WESTERN GHATS

04 10

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The Western Ghats, one of the biodiversity hotspots, is known to harbour almost 325 globally threaten species and also possess a high degree of endemism, especially in the case of lower vertebrates like Fishes, Reptiles and Amphibians. This endemism has been attributed to the prevailing geographical, climatic and phenological conditions providing the necessary humid environment and habitat. Amphibians form an important faunal group of this region, but are incompletely documented; as the tropical forest areas of Southern Western Ghats is known to be a hot spot of Amphibian diversity as a very high number of species been reported from the area and still more awaiting discovery and identification. The family *Rachophoridae* commonly called as tree frogs, consist of more than 300 species of frogs. They are wide spread in tropical regions of Africa and Asia. The genus *Raorchestes* is a member of *Rachophoridae* that are currently represented by 30 species from Western Ghats. *Raorchestes* and *Pseudophilautus* are unique genus in the sense that they have direct development with all growth inside the egg and no free swimming tadpole stage. To differentiate between the two species of closely related *Raorchestes* is extremely difficult, because of their weak morphological difference and henceforth several authors have already emphasised on the importance of non morphological techniques like molecular taxonomy and bioacoustics for species identification. We support the same, by providing a note on the high degree of colourmorphism and similarity that the traditional alpha taxonomy would find hard to reveal. We used evidence from DNA barcoding of mitochondrial genes (16SrRNA and CO1) to investigate the colourmorphism of *Raorchestes akroparallagi* from its range. The frog species *Raorchestes akroparallagi* is known to show a high degree of colour variation in life. We hereby report six colour morphs from the species, with the support mitochondrial markers and photographs. The variation in colouration and the reported six colourmorphs not only reinforces the significance of molecular taxonomy but also brings about the significance of Western Ghats as a Biodiversity hot spot and prioritisation of its conservation.





IBC 2010 - Indian Biodiversity Congress



2010 International Year of Biodiversity

RESTORATION NEEDS OF MONTANE GRASSLAND HABITAT WITH EMPHASIS ON THE CONSERVATION PROBLEMS OF THE NIL GIRI PIPIT IN THE WESTERN GHATS

04 11

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Nilgiri Pipit is an endemic and Near Threatened bird species to the Western Ghats. In this paper, we discussed the major threats to the Nilgiri Pipit based on the ecological study thereby identifying the limiting factors and the management needs. The main problems, which affect the Nilgiri Pipit, are habitat loss and fragmentation, Fire, Cattle grazing and other disturbances. The discussion focuses on factors with an anthropogenic origin, which may be reversed through appropriate management or conservation activities. Thus understanding the effects of these disturbances can offer direct conservation programs in this ecosystem. It also becomes imperative to revive the existing conservation strategies to conserve the Nilgiri Pipit and its habitat grass-slopes with marshy valleys. Because of the overall rarity of marsh habitats in this region, all sizes of remnant marshes are important, and therefore restoration planning should take place on a regional level. Further studies are needed to assess the population, extent of its habitat and movement pattern to identify crucial non-breeding areas and monitor the populations on a long-term basis. A sustainable management option should be under taken with the local support for retaining the existing natural grasslands and reforming the already lost areas by immediate conservation of the species and the habitat. Although our observations are limited, they provide a valuable update on the status and its ecology for heightening the critical phase of the conservation needs of montane grassland ecosystem in the Western Ghats. Research findings suggest that habitat modification, as a result of intensive grazing and burning, is the primary factor responsible for the decrease of this species. The immediate need is to assess the extent of remaining grasslands and determine the distribution and abundance of key species of conservation concern. This habitat forms an essential part of the larger shola-grassland ecosystem which needs to be conserved for the long-term survival of the Nilgiri Pipit and many other endemics. Hence, it is recommended that more of the montane grasslands should be given full protection and, restored with community participation.



CLONAL PROPAGATION OF *ACHYRANTHES ASPERA*. L AND *ACHYRANTHES BIDENTATA*. BLUME – VALUABLE MEDICINAL PLANTS

04 12

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Achyranthes aspera. L and *Achyranthes bidentata*. Blume belongs to the family Amaranthaceae, are found abundantly in wastelands. They are used in the treatment for asthma, bleeding, boils, bronchitis, cold, cough, dropsy, dog bite, dysentery, ear complications, head ache, leucoderma, pneumonia, renal complications, scorpion bite, snake bite, skin diseases and also in facilitating delivery. Addition of *A. aspera* would enhance the efficacy of drug of plant origin. The present study focuses on the in vitro propagation of *A. aspera* and *A. bidentata* which enables the mass production of these species. Explants were surface sterilized with 0.1% HgCl₂ for 3 minutes. Prolific multiple shoot regeneration from nodal explants were observed on MS medium supplemented with BAP at concentrations 3 mg/l and 5 mg/l where 8 to 9 shoots were obtained after 8 weeks of culturing for *A. bidentata*. In case of *A.aspera*, 9 to 12 shoots were obtained after 7 to 8 weeks on MS medium with same BAP concentrations as of the former one. Rooting was induced on MS fortified with IAA (0.5 mg/l) + GA₃ (1 mg/l). These propagated plants were hardened and later transferred to the field for mass production.





FISHERIES CERTIFICATION – A TOOL TO CONSERVE MARINE BIODIVERSITY

04 13

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India with a coast line of 8055 Km supports millions of people in the fishery sector and contributes significantly to the national and state GDP. However the marine fisheries production has reached a plateau and only marginal increase can be predicted in future. Moreover biodiversity is important for the future sustainability of the marine resources including commercial species of fish. The main factor that threatens fish biodiversity globally is unsustainable fishing practices. Fisheries certification can be used as a tool to conserve the sustainability of the fish resources hence the biodiversity. With the strength of our global network and partnerships with local NGOs, World Wide Fund for nature (WWF) is well equipped to facilitate fisheries certification in both developing and developed countries. WWF's Fisheries Certification programme can help fisheries certification through the Marine Stewardship Council (MSC) certification process. This has shown great success in a few short years. WWF-India began the certification programme to set up a concept of sustainable fisheries in every corner of the country. On the matrix of labelling eco-friendly fishery and fishery practice, a survey was conducted during November 2003 to April 2004 to identify ecologically sustainable fishing practice in the coastal zones of West Bengal, Kerala, Gujarat and Tamil Nadu. The objective of the survey was to identify fisheries from different states of India that are ecologically sustainable with respect to their catch, culture, crafts and gears, community participation, and environmental. This survey identified potential candidates for MSC certification as well as increased stakeholder awareness about fisheries conservation and MSC certification. The pre-analysis programme recommended moving forward with pre-assessments with the oil sardine (*Sardinella longiceps*) fishery and needle squid (*Doryteuthis sibogae*) fishery, both located in Kerala. The paper describes the methodology of fisheries certification and how this can be employed as a tool to conserve the fish biodiversity.





CONSERVATION OF SACRED GROVES THROUGH PARTICIPATORY APPROACH - A CASE STUDY FROM KALLARA GRAMAPANCHAYATH IN KOTTAYAM DISTRICT

04 14

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Sacred groves are small patches of forests conserved through man's spiritual belief and faith. They are rich in rare and endemic species of plants and represent a tradition of conservation, management and even sustainable development of natural resources. The present study focuses on the sacred groves of Kallara Grama Panchayath, Kottayam district, Kerala aiming at their conservation aspects. It highlights the floristic diversity of groves along with its soil nutrient status. A public participatory approach was followed providing an opportunity for the public including students to get involved in the ecological studies of the groves. As a primary field study, 10 sacred groves were identified and assessed for biodiversity documentation as a part of the National Environmental Awareness Campaign 2007-2008 (MoEF). Among the identified groves, 5 were selected for detailed floristic and soil quality assessment. All the groves were limited in area and most of them were in degraded condition. For the vegetation study qualitative and quantitative methods were employed. Soil samples were collected from 10 different sites in each grove (five inside and five outside the groves) and parameters like pH, Organic Carbon, available Nitrogen, Phosphorus, Potassium and Total Heterotrophic Bacterial Count were analysed following standard methods. Apart from this, seminars and workshops, awareness classes, questionnaire surveys were also conducted as part of this programme. Vegetation analysis identified 61 plant species in 32 families. *Hydnocarpus pentandra* showed maximum frequency and density. *Strychnos nux-vomica* is the most abundant tree in the sacred groves and they also house 6 endemic species. Soil parameters studied were found higher inside the grove compared to outside areas. Field study in the groves was done with the help of students, teachers and local people in the Panchayath. Public meeting helped to explore local people's knowledge about groves and their attitudes towards its conservation. Awareness classes led by experts were also organized for the public and students in the Panchayath. Report writing (*Nature study at sacred groves*) and an environmental quiz competition were organized for students and prizes were distributed for the winners. A technical report of the programme and database of biodiversity in MS Access involving information about the flora in the groves were published in a public meeting. Results obtained from the primary questionnaire survey and interaction with local people indicated that people were more conscious regarding the importance of sacred groves. The study brings out the awareness and concern of the protection of these natural and cultural relics by all means. These groves are remnants of forests which inspire and infuse us with the sense of love and conservation of nature. Concerted efforts from the public administrators to develop strategies for the protection and conservation of sacred groves are to be evolved and implemented.



IN VITRO PROPAGATION AND CONSERVATION OF *DIOSCOREA* WILD SPECIES

04 15

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The genus *Dioscorea* L. belongs to the monocotyledonous Dioscoreaceae, the most prominent family within the Dioscoreales. More than 600 species exist world wide. *Dioscorea* species are famous for their production of tubers, bulbils, rhizomes etc. They are used as food in many countries. The wild species of *Dioscorea* are famous for their production of steroidal sapogenin, which is the precursor in the commercial synthesis of sex hormones and corticosteroids. In the present study, 3 wild species of *Dioscorea*- *D. bulbifera*, *D. tomentosa* and *D. glabra* were used. Meristem culture of these 3 species was done for virus elimination in modified M.S media (M.S + 0.1 μ M NA + BA + GA₃). Among the three species *D. glabra* showed poor organogenesis compared to others. Nodal cultures of *D. bulbifera* and *D. tomentosa* produced *in vitro* tubers. Micro tuber production varied with the species. The *in vitro* produced tubers of *D. bulbifera* were used to study the effect of kinetin and charcoal. Besides bulbils, *in vitro* developed shoot tips were also used. For the study, two types of media were used (Medium I which contains activated charcoal (1g/l) and different concentration of kinetin, medium II which contains different kinetin concentration only). Among the two media, the medium I responded very well to both bulbils and shoot tips. Bulbils showed high morphogenesis on 0.1 concentration of kinetin. Maximum number of roots (4) was produced in the concentrations of 0.1 and 7. In the present study, different sugars and sugar alcohols were used for studying the effect of these on the morphogenesis of *Dioscorea* species- *D. bulbifera*, *D. tomentosa* and *D. glabra* and also to find a medium composition which is to be useful for their conservation. The different sugar used were sucrose, maltose & market sugar at a concentration of (30 g/l) and sugar alcohols were Sorbitol and Mannitol at a concentration of 30 g/l (MS+ sugars/ sugar alcohols + 1g/l a.c). Effect of the sugars differ with the species and type of sugar used. Among them sucrose and market sugar responded well with higher subculture periods. Maltose supplemented media was found to be better suited as the conservation media for *Dioscorea*. The sugar alcohols Sorbitol and Mannitol showed poor response on the three *D.* species. The *in vitro* developed plantlets can be hardened and can be transferred to the natural environment. Thus they can be conserved for the continuous availability. Biotechnology can be made of for tackling the inherent problems of genetic conservation, multiplication and improvement in this crop group.



GEOGRAPHIC INVENTORY OF CERTAIN CRITICALLY ENDANGERED MEDICINAL PLANTS IN THE AGASTHYAMALAI HILL RANGES OF THIRUVANANTHAPURAM DISTRICT, KERALA – A GIS APPROACH

04 16

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The tropical rainforests of India, the Western Ghats in particular is one of the richest gene banks of medicinal plants in the world. Medicinal plants are distributed across diverse habitat and their spread is governed by geographic factors such as physiography, soil, climate, etc. However, the natural habitat of medicinal plants is facing serious threat primarily due to human intervention. Degradation of forest ecosystems at the expense of resource utilization has in its totality led to the deterioration of watersheds, loss of continued productivity and loss of biodiversity thereby endangering wild life, including rare and endangered species of certain valuable medicinal plants. It is in this context that a geographic inventory of these biogenetic resources has become essential for framing policies for location specific biodiversity conservation. The Agasthyamalai Hill Ranges of the Southern Western Ghats have an almost insular set of geographic conditions that contributed to the making of a set of peculiar ecological niches, which mark out the area from other parts of the district. The distinctive geo-climatic conditions have blessed the region with rich biodiversity and biomass potential within a restricted range of distribution. The local climate is significantly correlated to relief and hence distinct climatic zones could be identified along the hill slopes that reflect the distribution of floral communities. The present study attempts a geographical inventory of three critically endangered medicinal plant species, viz., *Coscinium fenestratum*, *Piper barberi* and *Trichopus zeylancus* (ssp. *travancoricus*) found in the Agasthyamalai ranges. The study also aims to identify the potential sites of their distribution by integrating GPS and GIS techniques. The findings are primarily based on the detailed field study to assess the geographical factors of growth such as altitude, slope, seepage direction, nearness to water sources, nature of the terrain; edaphic factors like soil pH, texture, colour, basal area cover, etc; and climatic factors such as rainfall, temperature and humidity. Human disturbance, canopy cover and associated plant growth, which is indicative of species diversity and species density were also taken into account. Incorporating the above parameters a geodatabase has been designed and a map showing potential sites of growth of the three critically endangered medicinal plant species prepared. The study revealed that *Coscinium fanastratum*, *Piper barberi* and *Trichopus zeylanicus* (ssp. *travancoricus*) follow strict geographic habitats in the moist evergreen forests. Irrational and unscientific methods of collection have led to the drastic decline of their population in the wild. Geographic inventorisation of the medicinal plants affirmed that *in situ* strategies is the most effective method for long term conservation.



BIOSEARCH: E-CATALOGUE OF MARINE BIOTA OF INDIAN WATERS

04 17

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Marine biodiversity is known to be the richest among all the living ecosystems. There is a rich marine biota in different parts of the ocean, from surface to the deepest part and from estuarine to the offshore regions. Understanding the biodiversity and functioning of communities as well as the ecosystem requires a firm base in taxonomy and systematics. The knowledge of ecology, external morphology, internal anatomy, biochemistry, cytology, genetics, embryology, palynology as well as the behavior of the organism help to a great extent in understanding the modern concepts of biodiversity along with the traditional. Now, there is a growing public awareness of the importance of the earth's biological diversity and the need for its preservation. However, ill-planned strategies and over exploitation by potentially damaging human interference with the biosphere has given rise to serious concerns about their sustainability. Maintaining and managing our rich biodiversity requires accurate and continuous updating of data. Thus, a web based data management system would meet this requirement. It could also simplify accessibility and improve management efficiency of biodiversity data. bioSearch is the first Indian database which covers the marine and estuarine biodiversity of India with 15,700 species records. The main aim of this database is to provide online coherent digital information regarding the organism with simplicity and it can be accessed at www.biosearch.in. It is a fast growing; user-friendly database developed using PHP (Hypertext Preprocessor) which caters to everyone's requirement from general public to researchers. It deals with taxonomic, biological, ecological and economic importance of marine organisms. The information is compiled from published literature present in the form of research articles, monographs, books, species checklists, and technical reports. *Bio-Search* provides information about the habitat of the species and also their IUCN status, which can aid in the conservation of the organism. Suitable standards and protocols have been considered to maintain this database. The data can be further analyzed for data mapping, geographical information systems (GIS) and niche modeling by digitally conveying information about the diversity and distribution of the species.



MICROBIAL DIVERSITY OF URBAN SOIL CONTAMINATED WITH DOMESTIC WASTE IN PATAN CITY AND ITS BIOTECHNOLOGICAL APPLICATIONS IN WASTE DEGRADATION

04 18

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Microorganisms are the minute living creature with high prospective in harmonize surrounding ecosystem. Microorganisms acquire competence to degrade varieties of compound and the recover value of ecosystem. The present study deals with isolation and identification of various microorganisms from two contaminated soil of urban lakes located at Patan City. The lakes were reestablished and are polluted recently and contaminated with several domestic wastes from the city. Microorganisms were isolated using standard methods and physico-chemical properties of soil surrounded to vicinity of lakes were also analyzed. The preliminary finding reveals variety of microorganisms such as *Bacillus*, *Salmonella*, *Pseudomonas*, and *Escherichia*. Apart from these the study may also leads to identification of some microorganisms that may have the capability of degrading domestic waste which can be further explored for their biotechnological implications.



MICROBIAL DIVERSITY OF SOME URBAN LAKES OF PATAN CITY AND ITS BIOTECHNOLOGICAL APPLICATIONS IN WASTE MANAGEMENT

04 19

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Microorganisms are the smallest living entity with enormous potential in balancing ecosystem. Microorganisms possess capacity to degrade complex molecules and improve quality of surrounding ecosystem. The present study deals with isolation and identification of various microorganisms from two urban lakes located at patan city. The lakes were restored recently and contaminated with variety of domestic wastes from the city. The microorganisms were isolated using standard methods; along with it routine analysis of physico-chemical properties of water were carried out. The preliminary finding reveals variety of microorganisms such as *Salmonella*, *Serratia*, *Escherichia*, *Enterobacter* and *Shigella*. Apart from these the study may also leads to identification of some microorganisms that may have the capability of degrading domestic waste which can be further explored for their biotechnological implications.



SPATIAL ANALYSIS OF BIODIVERSITY DISTRIBUTION FOR EFFECTIVE ECOSYSTEM MANAGEMENT- A CASE STUDY OF PEPPARA WILD LIFE SANCTUARY

04 20

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Biodiversity conservation encompasses a broad spectrum involving both biotic as well as abiotic resources. Therefore, conservation strategies should be holistic rather than sectoral. Priority should be given to *in situ* conservation for those regions rich in biodiversity. India has a prominent place among the top 12 mega diversity countries of the world. Spatial analysis is an essential component for the assessment of biodiversity potential of any region. The typical patterns of biodiversity and endemism have conferred the Western Ghats as one among the 34 biodiversity hotspots. Agasthyamalai biosphere reserve, a compact block of hills situated in the southern most tip of the subcontinent has one of the richest flora in the Western Ghats. The study area, Peppara wildlife sanctuary forms part of Agasthyamalai biosphere reserve and constitutes the catchment of Peppara reservoir constructed across Karamana river to augment drinking water supply to Thiruvananthapuram City and suburban areas. The natural vegetation in this area ranges from southern secondary moist mixed deciduous forest to southern subtropical hill forest, presenting a diverse habitat for several rare and endemic flora. Anthropogenic intrusion poses serious threat to this species rich habitat. Research in protected area would fill up the information gap on the structure and function of the ecosystem that are required for the effective biodiversity management. The study intended to analyze the spatial distribution of biodiversity, strictly based on vegetation zones. The species richness and diversity has been assessed and a map showing biodiversity zones prepared by GIS techniques. Location specific conservation strategies seem imperative for the protection of natural habitats under serious environmental stress. Hence the framework for management strategies of these threatened regions should include eco-development and participatory management components.





BIODIVERSITY PROSPECTS AND PROBLEMS WITH SPECIAL REFERENCE TO ANDAMAN & NICOBAR ISLANDS

04 21

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The Andaman and Nicobar Islands are located in the Indian Ocean, and geographically is considered part of Southeast Asia, close to Aceh in Indonesia and separated from them by the Andaman Sea. It comprises two island groups, the Andaman Islands and the Nicobar Islands, separated by the 10° N parallel, with the Andamans to the north of this latitude, and the Nicobars to the south. There are 572 islands in the territory, of which only approximately 38 are permanently inhabited. Andaman and Nicobar Islands are blessed with a unique tropical rainforest canopy, made of a mixed flora with elements from Indian, Myanmarese, Malaysian and endemic floral strains. So far, about 2,200 varieties of plants have been recorded, out of which 200 are endemic and 1,300 do not occur in mainland India. The islands treasure the rich luxury of ant and rare species of flora and fauna but due to anthropogenic hindrances, its regeneration initiate precaution and protection, which is dealt at length in this paper with its causes and concerns.



MASS MULTIPLICATION AND REINTRODUCTION AS A STRATEGY FOR BIODIVERSITY CONSERVATION

04 22

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Sahyadri group is working in the field of species and environmental conservation. The genus *Ceropegia* with its peculiarly formed flowers of magnificent architecture is represented in India by about 48 species of which 30 are endemic to the country. Almost every endemic species is restricted distribution and fall under IUCN category of RET plants. Most of them are critically endangered. Continuous reduction in individuals being located at the locality was experienced. In the present scenario of habitat modification and destruction, *Ceropegia* species is facing a serious threat of extinction. Low rate of seed setting and lack of proper habitat for seedling establishment are some of the limiting factors in the population establishment and survival of the species. Therefore *Ceropegia* Species falling under RET category with fragmented population were selected for the conservation program. Presently the only way enduring for conservation and survival of *Ceropegia* species is micropropagation and there re-introduction in nature. This led to undertake a program for its conservation via *ex situ* multiplication and it's reintroduction to natural habitat. Under this program the Team of Sahyadri GENES undertook mass multiplication using tissue culture technique and the team has reintroduced approximately 3000 plantlets to its natural habitat with the help of Forest Department and local people. Emphasis was given to make aware and participate eminent personalities from various fields along with local people and students in the program to ensure the monitoring of the reintroduced plants.





SPECIES SPECIFIC MICROSATELLITE MARKERS – A TOOL FOR AMPHIBIAN CONSERVATION GENETICS

04 23

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Genetic diversity is considered as one of the three fundamental levels of biodiversity. The overall health of a population is mainly depending on the conservation of genetic variability. It can be estimated by the mean levels of heterozygosity in a population; ie, the mean number of alleles per locus, or the percentage of polymorphic loci. Microsatellites are tandem repeats of simple dinucleotide, trinucleotide, tetranucleotide, per nucleotide or hexanucleotide which occurs abundantly and at random throughout the eukaryotic genomes. They are highly polymorphic in nature. They are typically short in length and ideal for designing flanking primers for in vitro amplification by the polymerase chain reaction. We have developed fourteen pairs of species specific microsatellite primers for the frog species *Ramanella variegata* and seven for *Micrixalus nudis*. *Ramanella variegata* (Stoliczka, 1872) is distributed across south East Asia, whereas *Micrixalus nudis* (Pillai, 1978) is endemic to Western Ghats. As a matter of fact, no population the unavailability of molecular markers such as species specific microsatellite markers. The polymorphic conservation genetic studies aiming to address taxonomic uncertainties and to study genetic variability.





COASTAL SAND DUNE LEGUMES – A VITAL SOURCE OF NUTRACEUTICALS

04 24

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The coastal marine ecosystems are biologically diverse and the most productive areas. A variety of psammophytic strand vegetation (e.g. mat-forming creepers, sedges, shrubs and tree species) have adapted to ecological conditions prevail in coastal sand dunes (CSD). The dominant tropical CSD vegetation belongs to the families Asteraceae, Cyperaceae, Fabaceae and Poaceae. The CSD legumes are of special interest due to a variety of traits useful in folk medicine, pharmacology, industry, nutritional benefits and ecosystem restoration. Vegetation in nutrient poor sandy soils with high salinity creates favorable niches for a group of fungi growing at the interstitial spaces called arenicolous fungi. The Arbuscular mycorrhizal (AM) fungi influence plant distribution, sand aggregation and sand stabilization in CSD. Nitrogen fixing diazotrophs, rhizobia and *Frankia* are of special interest in biogeochemical cycles of CSD. Besides these fungi, mutualistic endophytes colonize the living tissues and help to increase adaptability and prevent diseases of CSD vegetation. One of the benefits of biodiversity conservation of CSD is the contribution of legumes to nutraceutical research. *Canavalia* and *Sesbania* seeds serve as an important dietary proteins. Crude protein (21-28%) and calorific value (1370-1632 kJ/100g) of raw beans of *Sesbania bispinosa* and *Canavalia cathartica* are higher than some edible legumes and cereals. They are also excellent source of dietary fibers promoting faster transmission of food through bowel. Among the true proteins, albumins (8-16%) are highest followed by the globulins (3-6%). Seed accessions of these plants possess adequate quantity of essential amino acids (EAA), essential fatty acids and some minerals. Among the polyunsaturated fatty acids oleic, linoleic and linolenic acids were common. Presence of eicosatrienoic acid and docosahexaenoic acids gained special interest. High P/S ratio is known to lower the risk of cardiovascular diseases. Besides edible value, some of the antinutritional factors like con A and canavanine of *Canavalia* seeds are valuable tool for antitumor, antiviral and anti-herbivore research. Legumes and their derivatives such as L-DOPA, serotonin and lupeol are antileukemic and antitumor in nature. Polyphenols are important phytochemicals due to their free radical scavenging activities. CSD plant species gain traditional importance as green manure, mulch, fodder, pasture legumes and potent cover crop to check soil erosion in dry and sandy areas. Habitat destruction through human-interference such as agriculture, land reclamation, industrialization, waste disposal, pollution (e.g. oil, sewage and plastic), shore fencing, sand/shell mining, resorts, vegetation clearing and fishing activities accelerates the loss of CSD flora and ecosystem. Restoration of native vegetation is very important to conserve landscape, fauna and microflora of the CSD. After realizing the drastic impact of human-interferences and worsening situation, Government, NGO and policy makers should sincerely attempt to restore CSD ecosystem by building green wall of native vegetation than granite wall to preserve the ecosystem for the benefit of future generation.



BIOPROSPECTING SELECTED MEDICINAL PLANTS OF AGUMBE REGION OF WESTERN GHATS FOR ANTIBACTERIAL ACTIVITY

04 25

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Agumbe region of Western Ghats is a highest rain fall area in Karnataka, harboring a rich diversity of medicinal plants. Many plant species of this region are used in traditional medicine in the treatment of microbial infections. The aqueous extracts of fourteen important traditionally known medicinal plants were subjected to antibacterial activity assay by cup diffusion method. The test bacteria were *Escherichia coli* (MTCC: 7340), *Staphylococcus aureus* (MTCC: 7410), *Salmonella typhi* (MTCC: 3416) and *Bacillus cereus* (MTCC: 121). Among the test plants *Persea macrantha* (Nees.) Koestrm. and *Combretum latifolium* L. recorded significant inhibitory activity against both gram positive and gram negative bacteria. Further work is in progress to identify the suitable solvent for isolation of the antibacterial active principle and to characterize the same.





BIOPROSPECTING SELECTED MEDICINAL PLANTS OF AGUMBE REGION OF WESTERN GHATS FOR ANTIBACTERIAL ACTIVITY

04 26

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RET PLANT DIVERSITY IN SACRED GROVES OF NORTH MALABAR, KERALA, SOUTH INDIA

04 27

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Sacred groves are one of the finest examples of traditional *in situ* conservation practices for near – climax pristine vegetation. These are the last shelters of natural forests and the indicators of the rich vegetation that had existed in the past. Extensive studies on their biological and ecological roles, made it clear that these act as abode of rare, endemic organisms and treasure trove of medicinal plants. These are one of the most important refuges to a variety of wild yams, pepper, mango germplasm and a vast variety of fauna and flora. Identification and documentation of RET species is important in the conservation of biodiversity as these have specific ecological niches. During the period January 2007 to December 2009 floristic exploration studies were carried out throughout the North Malabar of Kerala, within the geographical limits 11°18' to 12°48'N latitude and 74°52' to 76°07'E longitude. Main objective of these studies was to elucidate the medicinal plant, RET, endemic plant diversity of these groves and also to explore the threats to them. Thirteen famous sacred groves with an extent of over 2 acres were selected for detailed study, of which 7 were in Kannur district while rest in Kasaragod. The floristic diversity of these groves was documented, identified with the help of regional floras. In order to expose the economic importance, knowledgeable local people were personally interviewed with questionnaire and data sheets. The data gathered and statuses of the plants were ascertained by referring authentic publication. From present investigation it is clear that these groves act as germplasm store house for 99 endemic plants. Of these 28 falls under RET categories as there are 11 vulnerable, 9 rare, 4 endangered, 3 critically endangered plants and *Tabernaemontana heyneana* Wall. a nearly threatened one. Most striking feature is that not a single RET species is common to the groves studied and 14 are restricted to any one of the groves. *Tabernaemontana heyneana* Wall. has highest distribution as it showed its presence in 8 groves. Locality wise analysis made it clear that sacred grove of Kasaragod abode 23 RET plants while 15 by that of Kannur. *Kammadam* sacred grove, one of the largest sacred groves of Kerala forms most important gene pool due to the presence of 13 RET species. Of the 28 RET species 18 are highly traded for medicinal purposes. Like other groves of Kerala anthropogenic activities like collection of firewood, dumping of waste and many antisocial elements are the major threats for the gene pool of these fragile ecosystems. Thus conservation of biodiversity of these sacred groves is an urgent need.



GIS-A TOOL FOR BIODIVERSITY STUDY

04 28

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Biological Diversity or Biodiversity is the variety of life in all its forms, levels and combinations, which includes ecosystem diversity, species diversity, and genetic diversity. Biodiversity studies require cataloguing of collections to establish relationships among different datasets. The Geographic differentiation of plant populations reflects the dynamics of gene flow and natural selection. Sampling of geographically distinct populations is a practical approach to understand biodiversity or genetic variation. The analysis of spatial information with GIS tools introduces new strategies for understanding and exploiting patterns of geographic diversity and can be carried out efficiently with personal computers and GIS software. Indian Institute of spices Research has germplasm collections of spices crops like Black pepper, cardamom, *Garcinia* etc. A GIS study was conducted with all the collection data already available in the institute by plotting the places of collection on the map with ArcGIS software. GIS- derived environmental attributes such as elevation and climate of the collection sites were used to classify the accessions. Based on the environmental parameters prediction maps for the availability of spices crops were prepared. Confirmative surveys were conducted to Western Ghats and Eastern Himalayas which gave excellent results of the predictions. The results show that micro environment has a direct influence on the morphological and biochemical characters of the aromatic crops.





POTENTIAL FOR COMMUNITY AND CONSERVATION RESERVES IN THE SOUTHERN WESTERN GHATS (INDIA)

05 01

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Protected areas represent the world's economic and political commitment towards the conservation of biodiversity. The Western Ghats is the hotspot with the highest human density and highest human population pressure, and is therefore in need of conservation priority. 'Community' and 'conservation' reserves are reserve systems in India which integrate local communities and private organizations into protected area management. The potential for community and conservation reserves was evaluated at existing reserve forests and private forest fragments at Kodaikanal, Theni and Valparai, which are open-access areas in the human-dominated landscape of the southern Western Ghats. Perceptions towards the establishment of reserves were determined. Semi-structured questionnaires and focus group discussions were conducted with local communities, forest department officials and conservationists working in the area. Data was collected on a range of variables and issues based upon the characteristics of local communities that would be central to the integration of resource-use, community participation and biodiversity conservation. From the list of 25 sites, initially those sites where a target species occurred, and where local communities were willing to participate in protected area management were selected and then further ranked for the range of variables. Ten potential, community and conservation reserves were subsequently identified. Forest department officials and conservation researchers were however, unsure whether the system of conservation/community reserves would work towards the benefit of conservation. A "pilot model" is recommended at a potential site before its declaration as a community/conservation reserve.





ENHANCING COMMUNITY STAKES FOR CONSERVATION: PARTICIPATORY APPROACH IN KAZIRANGA AND MANAS NATIONAL PARKS

05 02

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Kaziranga and Manas National Parks are the two world heritage sites located in Assam in Northeast India, famous for their diverse flora, fauna and scenic beauty. However, the protection and preservation of this rich biodiversity is a major challenge which cannot be met without the cooperation and support of the local communities residing in the fringe villages near the parks. This has been one of the major objectives of the ATREE-UNESCO project implemented in these sites. For any meaningful engagement with the local communities the first step has to be to gather as much information as possible on the local communities. Their socio-economic conditions, their dependence on the forest as well as the prevailing means of conflict must be carefully studied and analysed. In this context, the method of Participatory Research Appraisal (PRA) which uses interdisciplinary, exploratory studies relying on community interaction and indigenous knowledge is very effective. The approach utilizes semi-structured interviewing techniques with extensive data analysis. Undertaking PRAs in select villages of Manas and Kaziranga have been greatly helpful in understanding some key issues regarding conservation and development. One of the significant observations is that conservation, rural development, basic amenities and issues of rights must be studied together since they are interlinked in various dimensions. Conservation cannot be fruitful until the other factors are considered in an integrated manner. Another important observation can be explained through the usage of centre-periphery theory. If the national park be considered the centre and the adjoining villages constitute the periphery than there must be a balance between the centre and periphery. The national park being a world heritage site, attracting tourists from all corners of the world and earning a lot of revenue cannot coexist with the local communities inflicted with poverty, malnutrition and ignorance. The long term effects of this dichotomy can be disharmony which can be a threat to the biodiversity of these areas. Another critical observation is that human-wildlife conflict in the form of crop depredation, cattle-lifting and human fatality are the biggest hindrance in mobilizing the local communities towards conservation. However, innovative techniques for mitigating such conflict have been generally appreciated. Some of the initiatives undertaken to engage the fringe village communities in these sites include micro-enterprise and alternative livelihood schemes, eco-friendly agricultural initiatives like vermicompost, vaccination for livestock, scholarship scheme for young students of fringe villages and human-wildlife conflict mitigation through bio-fencing, anti-depredation watch-towers, community awareness among other measures. However along with this steps, infrastructure development and health care are the salient needs of these fringe villages. The majority of the local communities are interested in conserving their rich heritage. They are enthusiastic towards change and development. The need of the hour is development and capacity building of the villagers. This will ultimately lead to the sustainable conservation and management of the unique biodiversity found in these sites.



IMPLICATIONS OF THE SCHEDULED TRIBES AND OTHER TRADITIONAL FOREST DWELLERS (RECOGNITION OF FOREST RIGHTS) ACT, 2006 ON CONSERVATION AND LIVELIHOODS OF KATTUNAIKKA AND KURUMA TRIBES IN NOOLPUZHA PANCHAYAT, WAYANAD DISTRICT, KERALA

05 03

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Scheduled tribes in India constitute 8.2% of the total population belonging to over 600 diverse ethnic groups. They remain highly dependent on the forest for subsistence goods and for collection of Non Timber Forest Produce (NTFP) for trade and wage labour. In 2006, with the arrival of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 they are entitled to both individual rights and community rights to forest. This paper tries to study the various provisions of the Act to determine the extent to which it has succeeded in striking a balance between livelihood security and the conservation goals in Kerala. With numerous land laws passed in Kerala, it tries to understand the relevance of the Forest Rights Act with respect to the State political scenario. It discusses the question of 'cross cutting': how the Forest Rights Act, 2006 stands vis-a-vis other forest legislations (Wildlife Protection Act, 1972 etc). It unfolds the problems related to on ground implementation of the Act and understands the true spirit in which the process of implementation is taking place. Both qualitative and quantitative methods of enquiry were used. These include questionnaire survey, focus group discussions with the Forest Rights Committee members, structured and semi-structured interviews with various government officials belonging to the Forest and Tribal department. It was observed that the FRA would have benefited more tribals if the State Laws were implemented prior to this Act. Various lacunae were observed at the lower level of implementation. The FRA albeit having benefited many tribals has not helped solve the issue of landlessness and land alienation in the district. With the full effect of the law, it can possibly cause a change in the land use pattern which can lead to further fragmentation of the habitat, causing blocks in the traditional migratory routes on the Asian Elephants. But with right to individual land holdings, it was gathered that small scale self-cultivation could provide an alternate source of income in turn reducing pressure on NTFPs. While the provisions of the FRA cross-cuts the Forest Conservation Act, 1980; it does so only on paper. Dominance of the forest department over issues pertaining to diversion of land for non forest purposes still persists. This will continue to happen until a change in philosophy of the forest management takes place. True implementation of the FRA in its original spirit intended is yet to happen in the State.



PLANT BIODIVERSITY MANAGEMENT AND CONSERVATION INITIATIVES BY THE RURAL PEOPLE: A VILLAGE CASE STUDY FROM BARAK VALLEY, ASSAM

05 04

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Homegardens are worldwide recognized as sustainable agroforestry systems. However information on traditional homegardens in North-East India is limited. Traditional homegardens in Barak Valley, Assam, Northeast India are characterized by a large diversity of herbs, shrubs and multipurpose trees, of which many are rare and lesser known/ underutilized species. The present study was carried with the objective to analyse the diversity and management patterns of woody species with special reference to underutilized tree species in the traditional homegardens managed by the tea laborer communities of Dargakona village in Barak Valley, Assam, Northeast India. A maximum of 5 vertical layers and 171 woody species from 54 families were identified. The dominant multipurpose trees such as *Artocarpus heterophyllus* and *Mangifera indica* provide a range of products that fulfill the farmers' dietary, social, religious and economic needs besides providing several ecosystem services. The management of different bamboo species is a common tradition in the community. A total of 43 underutilized/ lesser known woody species were recorded in the study area, which are mostly found growing naturally in the unmanaged areas of the homegardens. Few households in the study village maintain an extended homegarden zone which is a site of domestication of wild trees of timber and non-timber values besides providing several ecosystem services. The plant resource managed in the homegardens are an important land use initiative of the tea garden laborers and is not done with a view to conserve but because of their multiple uses and long term product benefits. The homegardens were found to be subsistence based sustainable systems which mimic the natural forests in their structure and complexity. Such traditional agroforestry systems play an important role in the conservation of biodiversity in the face of the increasing deforestation and degradation of natural habitats for developmental activities.





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Kadars, a primitive tribe residing in Vazhachal Forest Division depend on natural resources especially Non Timber Forest Produce (NTFPs) for their sustenance. WWF India initiated a participatory sustainable resource use and monitoring study involving the tribal community members to understand their dependency on the natural resources and facilitate the communities to come up with sustainable management strategies. Based on the study, it was seen that there is a need for value addition of some NTFPs especially honey and to strengthen the existing VSS's by building their capacity on institutionalizing the process of honey collection, processing and marketing. Forest Department has played an important supporting role in all of the above. Eight Vana Samrakshana Samiti's (VSS) have been involved, trained and a mechanism in consultation with Forest Department has been evolved. Exposure visits were also arranged where the local community and some members of the Forest Department went to Keystone Foundation to understand the concept of Sustainable honey harvesting and processing. The honey collection is carried out by the members of Thalavalakulipara VSS, Watchumaram VSS and the Sholaiyar VSS and sold to the Forest Development Authority (FDA). The honey processing is carried out by Pogalapara VSS. The marketing of the honey is carried out by the Athirapalli VSS and Vazhachal VSS. The honey processing unit was set up at Pogalapara by the FDA. Presently 314 tribal families are benefitting from the newly established honey processing unit. The entire exercise of mapping the resource use, understanding its impacts with the communities have helped the Kadars, themselves to understand the impacts of overharvesting and fires, poor harvesting practices etc. The Forest Department has also tried to include some findings in their VSS micro plans. This has helped in bringing in some small conservation measures like adopting sustainable harvesting techniques, better fire management and more community involvement in forest protection measures.





ETHNOZOOLOGICAL ANALYSIS AND CONSERVATION STRATEGIES IN SOME PROTECTED AREAS OF THE SOUTH INDIAN GHATS

05 06

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Four protected areas, viz., Biligiri Rangaswamy Wildlife Sanctuary, Bandipur and Rajiv Gandhi National Parks, and Mudumalai Tiger Reserve situated in the Western and Eastern Ghats of South India were selected for the present analysis. Ethnozoological analysis of the tribal communities relating to biodiversity conservation as part of their lifestyle cum livelihood option revealed a strong economic and socio-cultural connection. An overview analysis of the conservation measures in the study areas concerning, awareness, ecotourism pros and cons, and cultural diffusion was undertaken as part of the present study.





PEOPLES' BIODIVERSITY REGISTER - A PROGRAM OF EMPOWERING PEOPLE FOR MANAGING THEIR BIORESOURCES

05 07

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Peoples' biodiversity register (PBR) is indeed a record of traditional knowledge and practices of sustainable use of local bio resources and conservation of biodiversity. People's biodiversity register (PBR) is also a record of knowledge, perceptions and priorities of local people about biodiversity, its utilization and conservation. PBR is a program in tune with the objectives of the Convention on Biological Diversity (CBD) urging all parties, including India and some 200 other countries. Each Village Panchayath of India should have the PBR according to the Biodiversity Act-2002 implemented by the Central Government of India in 2004. Three important significances of Peoples' Biodiversity Register are [1] To respect, preserve and maintain the knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity. [2] To promote the wider application of such knowledge, innovations and practices with approval and involvement of the holders [3] To encourage the equitable sharing of the benefits arising from the use of such knowledge, innovations and practices. There is considerable knowledge about biodiversity in different sections of village community who are directly dependent on it. Loss of traditional knowledge and practices of sustainable utilization of biodiversity are also an equally serious concern. Documentation of traditional knowledge of utilization, conservation and development of biodiversity is the important theme of Peoples' Biodiversity Register. These registers, therefore also form an appropriate instrument for generating a significantly large missing component of our understanding for designing conservation efforts





MANGROVE VALUE AND CONSERVATION STRATEGY BY LOCAL COMMUNITIES IN AYIRAMTHENGU, KERALA

05 08

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Mangroves are forest community within the intertidal region of tropical and subtropical areas. This study provides the values, functions and attributes of mangrove ecosystem and the importance of the local people in biodiversity conservation in the mangrove of Ayiramthengu in the coastline of Arabian Sea at Kollam. The totally direct observation method was carried out from 2002 to 2009, for finding mangrove values and the role of local communities in the conservation of mangrove forests. 12 principle mangrove species and 08 mangrove associates represent the mangal communities of Ayiramthengu region. A wide range of services have been provided to coastal communities by mangrove ecosystems. The value of the sum of compatible uses of the above goods and services forms the 'Total Economic Value' (TEV) of mangrove forests. Based on the different kinds of uses, TEV of Ayiramthengu mangroves can be classified into *use* and *non-use values* (UV and NUV respectively) categories. The UV argument, which is worth protecting regardless of its value to humans, can be subdivided into *direct* and *indirect* uses. While NUV, which reflects the value of an ecosystem to humans and irrespective of whether it is used or not, can be separated into *existence* and *bequest* values (EV & BV respectively). The following challenges to biodiversity conservation in the mangrove forests are: *Over-use, Lack of identity of mangrove resource and Lack of tools for mangrove economic evaluation*. The economic, social, and environmental value of mangrove must be assessed over short- to long-term scales and use these assessments for awareness rising at local communities as well as all of them must remember impact and key guidelines for protecting mangroves, such as: Reclamation and dredging, Waterfront development, Flood mitigation and Mangrove restoration. The present study reveals that the mangroves of Ayiramthengu are greatly influenced by the coastal environment and fulfill important socio-economic and environmental functions; therefore, it is considered that the protection of this site from threats must be enfaced. This study also provides the state of key guidelines for protecting biodiversity of mangroves by the local people. Over-use, lack of identity of mangrove resource and lack of tools for mangrove economic evaluation are the main destruction factors of the mangrove in this region. This study suggested that the end goal is to involve communities in direct management of resources. Furthermore, this study highlighted the role of awareness-raising in local communities in Ayiramthengu biodiversity conservation. There should be a willingness to move from old ideas on the use of this natural resource by villager and other people, which are largely dependent on this ecosystem. Awareness-raising campaigns must be developed for local communities using local languages, religious leaders and cultural events.





EXPLORATION OF AVIAN DIVERSITY IN URBAN AREAS OF NORTH GUJARAT: A COMMUNITY BASED CONSERVATION APPROACH

05 09

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Birds are one of the most fascinating creatures in the living world; they also play an important role in every ecosystem. Studying and identifying birds can serve as one of the important and interesting aspects of exploring biodiversity and creating awareness for biodiversity conservation. The region of north Gujarat is less explored for biodiversity study and lack of awareness may be one of the reasons behind this. Further the area harbours variety of avifaunal species including some critically rare migratory species. The region falls under semi arid regime in the country which also supports some unique habitat and diverse species composition. The present study was carried out as an effort to explore the avian diversity in some human dominated urban places in the region by involving local community and school children to create awareness about biodiversity and its conservation. Data were collected through regular visits to identified sites and bird species were observed using binoculars and identified using standard reference books. Along with the bird identification, we also recorded their residential status, family and status according to IUCN and Indian wildlife Protection Act (1972). The urban areas are highly disturbed by human activities; we recorded more than 50 resident and about 25 migratory bird species belonging to 20 different families. It was found that about 8% families were highly diversified having highest numbers of different residential and migratory bird species. Data were also analysed to know the feeding guilds of both terrestrial and aquatic bird species. The study is still in progress in other villages involving school children that would be useful for both, exploring bird diversity and creating awareness among local community.





DOES NAGOYA PROTOCOL SUFFICES NEEDS OF PROTECTING INTELLECTUAL PROPERTY RIGHTS ASSOCIATED WITH BIODIVERSITY IN INDIA?

06 I1

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The Tenth Conference of Parties of Convention on Biological Diversity was convened at Nagoya, Japan during November 2010. In this International Year of Biodiversity, the Nagoya CoP - 10 had an importance due to emphasis on some of the key aspects such as International Protocol on Access and Benefit Sharing (ABS) arising out of commercial utilization of Biological Diversity and associated traditional knowledge. The presentation mainly discusses the pros and cons of the Nagoya Protocol in connection to the existing legal provisions mainly in India. The ongoing work also explores the needs of capacity building and further issues of concerns which could be needed to be highlighted at the international fora mainly Convention on Biological Diversity.





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2010 International Year of Biodiversity

BIOLOGICAL RESOURCES AND TRADITIONAL KNOWLEDGE: AN OPEN ACCESS MODEL FOR ACCESS AND BENEFIT SHARING

06 12

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A major snag of the CBD and the resultant national legislations is a shift in focus from the ecological and scientific value of biodiversity to its mere commercial value that led to the establishment of the sovereign rights of nation states over their biological resources in 1992 in Rio de Janeiro. This undermines the role of sharing and distribution of genetic resources among human societies in sustaining agricultural production and global food security as nations of the world are linked in a complex network of plant genetic interdependence. Evidently, for any society, the benefits of unbridled access to genetic resources far outweigh that of restricted access and benefit sharing. The parties often treat biological resources akin to nonrenewable resources like oil, timber, or coal undermining the fact that genetic resources are truly renewable and its use in a given system does not limit chances elsewhere. Unless the undue emphasis on access and benefit sharing is balanced with the concerns of interdependence of humanity on global biodiversity and its conservation, this sticking issue would come in the way of achieving the objectives of the CBD. Regulating access to genetic resources and equitable sharing of benefits arising out of the commercial utilization of biodiversity has been the major stumbling block in the negotiations under the Convention on Biological Diversity (CBD) while the long term vision of halting all extinctions by 2050 remains blurred. However, the high hopes of sharing of commercial benefits arising out of biodiversity and associated traditional knowledge is turning out to be unrealistic. Hardly any successful model of benefit sharing that is a sustainable source of supplementary income for the rural communities is known. India is one of the richest countries in terms of biodiversity and the associated traditional knowledge. However, the Indian experience in this regard is not promising. India enacted the Biological Diversity Act in 2002, mainly to regulate access and benefit sharing. Despite imposing severe restrictions on access to biodiversity in the country, India is yet to make any significant progress in sharing commercial benefits of biodiversity among its stakeholders. The widely publicized case of the "Indian ginseng", hailed as the first ever example of benefit sharing with an indigenous tribal community too has turned out to be a cropper. Benefit sharing is also fraught with problems of disputes and ambiguity of ownership of the biological resources or the associated traditional knowledge, especially when shared amongst different communities or nations which makes the idea extremely complex and difficult to implement. To overcome this an open access model for the biological resources and the associated traditional knowledge is suggested. The best way to protect traditional knowledge, the source code of biological information, is to make it available on public domain. If we examine the cases of biopiracy related to neem, turmeric etc it is obvious that the reason for granting patents (biopiracy) was that the information related to these were not easily available on the public domain. Through local level capacity building promoting community enterprises local communities can make better benefits out of the biological resources rather than the 'alms' collected and distributed from the corporate by the state. Hence it is imperative to bring the biological diversity back to the common heritage of mankind.



PATENTS VERSUS COMMUNITY RIGHTS, A MAJOR CHALLENGE IN THE CONSERVATION OF PLANT GENETIC RESOURCES IN THE POST TRIPS ERA

06 13

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A global analysis conducted on the risk of extinction of plants has revealed that the world's plants are as threatened as mammals and one of the five of the world's plant species is threatened with extinction. This is a matter of great concern especially for the medicinal plants which occupy a specified niche and are under continuous threat of natural forces and anthropogenic influence. One such important reason is the mass scale over-exploitation of medicinal plants for commercial purposes, especially for the drug industry. The treatment of the genetic resources as a public domain property by the Trade Related Intellectual Property Rights (TRIPS) Agreement of World Trade Organisation (WTO) makes these resources more vulnerable to misappropriation. This contravene the mandate given by Convention on Biological Diversity(CBD) treaty which endorses the member states' sovereign rights over these resources and recognises the collective rights on these resources. The Sampled Red List Index for Plants (on extinction and threatened species)is one of the efforts at international level that gives conservationists and scientists an important tool to check further loss of biodiversity. However, there is an equal need to evaluate the role of patent system in conserving these genetic resources. Thus, individual rights(patents) versus collective rights as proposed by TRIPS and CBD respectively would form a major discussion area, in course of this research review. The methodology of this paper is a literature survey on these issues followed by an analysis of the major policy texts, and evaluation of the completed and ongoing case studies from developing countries. A perspective on India would also be a specific part of the discussion, despite the fact that India has its legislation on the access to genetic resources in place. Based on theoretical research, this study would highlight some of the recommendations as deemed suitable for the developing countries, while synergising the objectives of TRIPS and CBD as well as keeping the goal of Millenium Developemnt Goals (MDGs) for conserving medicinal plants. The findings of the paper would provide an insight into some of the possible solutions to the challenges in conservation of these genetic resources in the developing countries and would come up with success stories in conservation techniques for medicinal plants as role models, failed attempts in sustainable conservation of these resources and suggest suitable alternatives for these, a multiplicity of measures to exercise the sui generis options for the conservation of genetic resources, the research gaps in the exercise of community rights over medicinal plants in developing countries, ways by which the local communities knowledge about medicinal plant can be integrated with the mainstream scientific research, ways by which the conservation of these resources improve the livelihood prospects of the local people, and ways by which, patents if used, as in case of bioprospecting, define a clearcut policy for benefit sharing arising from the use of medicinal plants. Overall, the paper intends to weigh the pros and cons of patent rights and community rights for the conservation of plant genetic resources(medicinal plants),an important component of biodiversity.





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CONSERVATION AND UTILIZATION – SUCCESSFUL CASE STUDIES FROM THE WESTERN GHAT REGION OF KERALA

06 01

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Conservation for the sake of conservation has become an unsustainable option especially with respect to agro biodiversity. Be it food crops, cash crops or medicinal crops only if the society uses them in the day to day life, they should be conserved. In other words, it is the culture, particularly the food habits, health care and life style of the surrounding population that decides the existence of a particular cultivar/land race. This paper illustrates few case studies carried out at Kerala Agricultural University in testimony of this concept. The subsistence hill agricultural system prevalent at Vattavada, situated in the high ranges of Idukky in Kerala depended on natural biological resources for food, nutrition, health care, energy, fibre and housing. A wide array of crops viz. cereals, vegetables, fruits, tubers, medicinal and aromatic crops etc. were grown and there existed a variety of cultivars and land races in many of these crops. The onslaught of chemical Agriculture has caused erosion of agricultural biodiversity of the area and curtailed the range of choice of farmers. The self reliance of the farmers in owning and sowing seeds of his choice is replaced by dependence on seeds of multinational companies. Genetic heterogeneity which was inherent in the traditional farming system has been lost, threatening the food security of the population. Nutritionally complimentary dietary associations of the tribals have been upset drastically by the new cultigens Many of the traditional varieties like the six month potato have been irrecoverably lost. In another participatory conservation programme carried out in Wynad district among the Kurichiya tribals, attempts to diversify their present farming system through reintroduction of tubers especially dioscorea spp, leaf vegetables, rice, fruit plants has been successful. The ongoing programme, done through the Pannippad tribal *Vana Samrakshana Samithi* under Manantavady range also is a replicable package attaining multiple targets of food and livelihood security along with biodiversity conservation. Findings of another project carried out in spices revealed that local strains of black pepper viz. *Thevanmundi* of Idukky, Malabar pepper of Wynad etc finds premium place in the export market for their intrinsic qualities. *Ellakkallan*, a local variety of ginger in grown in Idukky is another good quality cultivar exported in view of its quality aspects. In the fields of medicinal plants, a successful attempt on domestication of the rare medicinal orchid *jeevakom* (*Seidenfia rheedii* Sw. Szckh) resulted in making this valuable drug plant available to the Ayurveda industry in sufficient quantities, at the same time conserving whatever is available in the forest. The drug, which is considered as *abhavadravaya* (unobtainable) by Kerala physicians is at present either deleted or substituted with other drugs. In yet another biodiversity augmentation programme carried out through the tribal *Vana Samrakshana Samithi* in Tirunelli forests, the native medicinal species required for the tribal healers in the area have been planted in the forest area. A tree species *Edingil* (*Pterospermum rubiginosum*) which was abundant in the region is now being over exploited for bark extraction. With the active participation of the stakeholders nursery techniques have been standardized in this species and the seedlings have been planted in the forest. This fruitful intervention also ensured protection of the vast treasure house of ethnic knowledge available. The paper concludes that agro-biodiversity conservation should go hand in hand with the utilization of conserved species. For any conservation programme to be viable in the long run, the associated indigenous traditional knowledge also needs to be popularized.



PROTECTED MARINE FAUNA IN THE ILLEGAL CURIO TRADE: A MARKET SURVEY FROM INDIAN MARITIME STATES

06 02

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To curtail the escalating exploitation of marine fauna in curio trade, species that are threatened were given protected status under various schedules of the Indian Wildlife (Protection) Act, 1972. However, some of these protected marine species are still traded illegally as curios. Some information exists on the magnitude of trade (legally/illegally) of ornamental seashells and corals in the international market, but nothing much is known about the marine curio trade in India. In this connection, a survey of curio markets along the coastal states of India was carried out during 2006-2008 to assess and to quantify the magnitude of protected marine fauna in the curio trade. Survey confirmed the presence of 18 species (out of 24 species) of protected mollusks, corals and seahorse (all corals and sea horse are protected) in the illegal curio trade. Among mollusks, *Fasciolaria trapezium* (82% markets) occupied the retail market, followed by *Cassis cornuta* and *Trochus niloticus* (73% markets). Branching corals and sea horse were present in 82% and 9% of markets respectively. From a turnover perspective the most important protected mollusks species in trade were *Cassis cornuta* (share of total: 35.15%) and *Fasciolaria trapezium* (11.66%). Among coastal states more numbers of protected species were identified from the state of Tamil Nadu (89%) Nadu followed by Gujarat and Goa (61%). More number of marine curio markets (n=9) and marine curio shops (n=254) were also identified from Tamil Nadu. Major source of these protected species were identified as Gulf of Mannar, Palk bay and island territories of Andaman and Lakshadweep. Marine curio trade is an income-generating source for many along the coastal region. Tourists who buy seashells and corals from these vendors are un-aware of the ecological significance and protection status of these endangered species. Awareness for customers, alternate source of income for the traders and shell collectors and stringent enforcement can curb the illegal marine curio trade.





TRADITIONAL KNOWLEDGE OF HEALTH AMONG THE TRIBES OF KERALA: CONTINUITY AND CHANGE

06 03

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Culture and society are dynamic. Culture and society change over time due to several factors - exposure, invention, experimentation and change in surrounding environment. In this paper I discuss the nature and the changes occurred in the tribal healing practices in Kerala in relation with other prominent systems of health management. Following the advent of the colonial power the social and political situation changed a lot in Kerala during the Nineteenth Century. The administrative policies of the Madras Government deprived the tribal people of the rightful access to land and forest to a great extent. The scarcity of food inside the forest tended the tribals to seek food from outside world. It directly led to the interaction between the tribals and the non-tribals. Then influx of non-tribal from the plains resulted in more contact with modern culture. This was also a time of socio- religious awakening in the state. Malayalam as a distant language was flourishing under the print media provided by the Christian Missionaries. To able to speak and write in Malayalam language was a matter of pride and was attached to status in society for the tribal groups in the state. In this way many ethnic and tribal groups left their traditional dialects and accepted the Malayalam as their mother tongue. Acceptance of the tradition of the mainstream society was also a means to raise one's status in the newly emerged society. These were some of the instruments through which tribal people wanted to raise their status. There are numerous instances that show that by abandoning the tribal gods and goddess, by leaving tribal customs, the tribal people could attain the status of lower caste groups in greater Indian society. In this rush for identity formation the tribal people lost their language and customs. A close observation will reveal that several caste and tribal groups having similar customs and traditions. Social scientists have forwarded a term similar to this situation as tribe – caste continuum. But this area of study escaped from scholarly attention in Kerala. The newly created identity formation did not serve the purpose to the tribal people. The converted tribal were, too, placed in the lower strata of the society and ultimately experienced more severe exploitation and negligence from greater Hindu society and elite groups. The same way they also lost their age old dignity as a 'self- sufficient society'. The introduction of Western Medicine has multiple impact on the community in general and ethno medical system in particular. During the first half of the Nineteenth Century nobody bothered to avail its facilities, as people thought that its was not ideal to their culture. So there was a period of non contact between the tribal community and the advocates of modern medicine. In this phase they continued the use of ethno medicine for the treatment of illness afflicting them. During the second half of the Nineteenth Century Christian missionaries provided medical care as means to gain the sympathy of tribal people with a view to ultimately convert them to Christianity. While taking up 'English medicine' tribals consult daivakkaran so that the efficacy of the biomedical cure is enhanced with charms and 'mantras'. Although some educated tribals had a better grasp of biomedical principles the majority of the tribals, including the tribals of Wayanad, continue to understand disease in this dual manner. Nationalists went to work in the tribal areas with the aim of winning popular support for their cause. Gandhi condemned the west precisely for the same reason it had prided itself for so long, i.e. modernization and industrialization. It was argued that the Congress under Gandhi's leadership not only came to represent the various classes and caste groups but also open to accommodate the various ideologies representing these groups. He seldom used the term science or technology. One of the very few occasions on which Gandhi touched the issue of science and people directly were when he talked to some students at Trivandrum in 1925 and when he visited the Indian Institute of Science at Bangalore in 1927. We found that health initiatives of this sort did not become a major feature of subsequent nationalist work in tribal Kerala. The major problem in this respect was that Gandhian nationalists were before 1947 almost entirely excluded from the extensive tribal areas under princely rule, so that they had no chance to carry out any sort of social work there. However, even after they were able to enter these tracts after independence, no medical work was carried out in the early years. Dominant classes have a strong interest in extending their hegemony over the tribal people, and health and healing provides one means towards this end. Tribal societies have their own concept of disease and its treatment ranging from supernatural remedies, inoculation, prayers and so on. These psychotherapeutic methods of healing are carried out not only through individual members but also by the involvement of the entire community. Despite the advent of modern medical facilities, ritual continues to be popular, as it satisfies a demand for community based healing over and above the more individualistic forms of healing provided by Allopathy.





BIODIVERSITY AND CULTURAL LINKAGES IN INDIA

07 11

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There seems to be a symbiotic link between culture and biodiversity as is evident from the deep concern religions show for nature and its preservation. This is particularly so in the case of Hinduism. The Upanishads and epics, for example, are replete with references that emphasise the need to respect and protect environment. In fact, the Hindu pantheon of gods is believed to have begun with sun, wind, land, trees, plants and water and later included wildlife. In many parts of Kerala, sacred groves known as sarpakavu came to be set up where poojas and other religious forms of worships were conducted. Arguably, this marked the beginnings of man's early concern for protecting biodiversity. Quite significantly, a tree sapling found in the Panchakanam forests of Goodrikkal range in Quilon in Kerala, has been identified as the Biblical gopher tree that was used by Noah to build a ship. Before the arrival of Aryans in India, people took up occupations in tune with their aptitude and temperament. People dedicated to such vocations were technically classified as Brahmanas, Kshatriyas, Vaisyas and Sudras, possessing equal status in society. Some historians opine that the advent of Hindu priesthood occurred when men learnt to make fire by percussion method. Probably men utilized forest fires in the beginning to meet their inevitable wants. The fire acquired from the forest flames had to be maintained by special arrangements. Those protectors of the much needed fire had in later stage come to be known as Agni Hotris, opines Dr. Sudhir Birodkar. The Agni Hotris became the hereditary fire-keepers and their descendants became the Brahmins according to him. It was they who introduced the way food was cooked by fire. The importance of fire in the preparation of food was established and so was the fame of the Agnihotris. The folk medical practitioners belonging to the tribals and others have been using plants and herbs for centuries for curing illness. It is known as Ayurveda which is widely practised in India even today. It is estimated that there are over 45,000 plant species and nearly 82,000 animal species, that is 7 percent of the world's flora and 6.5 percent of the world's fauna are in India's forests. More than 30 percent of the above plant species are unique to Indian and 60 per cent of this is used by village communities for timber, food and medicinal purposes. Twenty five percent of US prescription drugs are said to have active ingredients from Indian Plants. The symbiotic relationship between man and nature seems to be a thing of the past. Reasonable and judicious devices have to be formulated to allow future generations the pleasures and riches of nature and culture. Biodiversity is a strong pillar of cultural heritage of India. Both depend on each other. Since a large part of the world in ancient times were occupied by Indians, India's cultural heritage also spread across. We can be proud that we are leaders in the world in cultural heritage. The linkages between Indian culture and biodiversity are discussed in the paper.





FOLKLORE LANDSCAPE OF KERALA

07 12

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In Kerala - a region of inhabitants with ancient cultural imprints - the 'aborigines' in the mountainous regions of Western Ghats, numbering about forty groups of tribes, and the rural agriculture folks and craftsmen have the traditions of centuries old eco-culture. Each community has its own tradition of music ways of ritual practices, and myths. The natives living in tune with nature have a very strong oral tradition, material culture, customs, performances and traditional knowledge encoded with a number of cultural and historical imprints. Their indigenous knowledge systems and culture impart a lot of information about their eco- history and social history; and this folklore about their landscapes was handed over from generation to generation. Their knowledge about the historical events is rich and scientific. Their myths and folk songs are indicators of their intuitive knowledge and fictionalised version of factual past history. There are numerous performing arts of the ethnic communities, and among them both ritualistic and non-ritualistic performances such as *Theyyam*, *Thira*, *Mudiyettu*, *Padayani*, *Poothan kali*, *Kalickettu*, *Kaliyuttu* folk dramas/performances like *Kakkarissi*, *Porattunatakam*, *Malavazhiyattom*, *Kothamoori* and *Chimmanakkali* etc are prominent. Almost all these performances are in some way or other connected with agrarian structure of the society and a portion of the harvest is offered to the deity and this has an effect of faith healing for the whole folk society. Ancient tribes had practiced a number of magic, shamanistic performances under the priesthood of the leader to ward off evil spirits considered to be responsible for various diseases. This practice accompanied by the administration of medicines extracted from plants can be termed as Relief Magic. *Adiyar*, *Kanikkar*, *Malayan*, *Kadar* are the main tribes in Kerala having medicine-magic practice combined. *Gaddika*, *Chattu*, *Muramkulukkippattu* are the prominent relief-magic theatre performances. *Muramkulukkippattu* also known as *pey pattu* (the songs to expel evil spirits) or *Vilakkumuram pattu* (Song performed in front of lamps) is practiced by Malayan, an aboriginal tribe living in places such as Peechi, Palapilly and Kodasseri high ranges of Thrissur district of Kerala. The paper provided detailed overview of the cultural landscape of Kerala.



HUMAN DIVERSITY AMONG THE PRIMITIVE TRIBES OF THE WESTERN GHATS AND THEIR CULTURAL DIVERSITY

07 13

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The Western Ghat region is very significant in Kerala not only on account of its rich natural resources but also because of the large human habitation including those of very backward and small tribal communities. The Immediate environmental problems due to indiscriminate denudation of forests that face the people Kerala in general, and the tribal people in particular today, are soil erosion, recurring floods, severe and unprecedented droughts, land slides, irregular and unpredictable climatic variations, desertification etc. The denudation of forests has also occurred in Kerala consequent upon the population explosion resulting in migration and a mad scramble for virgin lands. The process of denudation of forests assumed alarming proportions in Kerala and the average forest cover is estimated to be below 15 per cent as against the national figure of 22.8 per cent. According to the National Forest Policy, the country should have 33.33 per cent of the land surface under forest cover, to arrest further denudation, the Forest Conservation Act was passed in 1980, under the provisions of which no forest can be diverted even for tribal development without the prior approval of the Government of India. In Kerala, the appropriation of forest land for planting rubber, tea, coffee and other crops has also caused denudation. The problem of loss of forest due to dams and hydel power projects in Kerala is of great concern, as it affected the topography and rain fall. An attempt has been made in this paper to describe and analyse the Change in the Eco-system and Bio-diversity in the Western Ghats and their effects on the life and culture of the two primitive tribes viz, Cholanaickan of Nilambur valley Malappuram district and Kurumbar inhabiting the Attappady valley of Palakkad district. The Cholanaicker are food gatherers and hunters where as the Kurumbar are food gatherers and shifting cultivators. These primitive tribes have been seriously affected the denudation of forests and introduction of crop diversity in the valley.





LINGUISTIC DIVERSITY AND BIODIVERSITY: KERALA IN FOCUS

07 14

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This paper is trying to approach the linguistic diversity of Kerala on the background of its biodiversity. Linguistic diversity is considered recently as a concrete indicator of cultural diversity. Now all the linguistic and cultural diversity of Kerala are being in a threat along with its biodiversity. After the studies of David Hermon and Luisa Maffi (from 'Terralingua') we have become more conscious to the idea that linguistic diversity is directly related to biodiversity. Hermon has plotted the maps of languages on the basis of biodiversity and has argued that both are closely related. Maffi published this plotting in her famous work. Here I am trying to elaborate the arguments of Hermon and Maffi with the help of comparing the world and continental maps of biodiversity available from UNEP and WWF with the language maps from the 'ethnologue' project of SIL (Summer Institute of Linguistics). While we focus on Kerala, there is some fieldwork from the scholars of University of Kerala on the diversity of Malayalam dialects and relative independence of so called tribal languages. This introductory paper deals with the already conducted fieldwork and proposes to adapt an integrated methodology like making of the Vital Index of Traditional Environmental Knowledge (VITEK) by Terralingua team. The biodiversity zones of the tropical areas like Central America, Central Africa, Eastern Himalayas, The Western Ghats, Myanmar, The Indonesian Islands, Papua-New Guinea and The Polynesian Islands have the maximum linguistic variety. Papua New Guinea is the country which has the largest number of indigenous languages (830) with Indonesia in the second place (719 indigenous languages) along with their tropical biodiversity. In India, Eastern Himalayas, forest areas of Jharkhand and Chhattisgarh and Western Ghats were blessed with both biodiversity and linguistic diversity. Most of the 438 indigenous languages of India were found here. As language diversity is an indicator of cultural diversity most of the indigenous cultures of India originated here. In pre colonial Kerala, there is a lot of evidence to assume that, there were more languages and cultural diversity than today. Through introducing the plantation agriculture in the Western Ghats, colonial administration started the destruction of the biodiversity of the area. The process of standardisation of dialects, languages and cultures with the imposition of colonial modernity (unicultural centralised model) is evidently the reason of destruction of cultural diversity in the regions mentioned above. Diversity of language is a survival strategy like the diversity of natural world. It is a right of every community to keep their language / dialect alive to express their different perspectives for their survival.





DEVELOPMENTAL PRESSURES ON THE CONSERVATION OF BIODIVERSITY IN AND AROUND PROTECTED AREAS WITH REFERENCE TO BANDIPUR TIGER RESERVE, KARNATAKA, SOUTH INDIA

07 01

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Extensive undisturbed areas of primeval forest gave safe harborage and guarantee to the survival of wild creatures in the past. Gradual conquest of forests and waste lands and great improvements in methods and rapidity of transport have left few areas in the peninsula of India free from intrusion by man. The magnificent animal life of tropical and subtropical lands including our country is being driven to its ultimate retreat in fast diminishing forests and is threatened with extermination. The shrinking habitat area forces the wild life to venture into new habitats. Small or fragmented habitats surrounded by cultivation are simply incompatible with the conservation of large mammals (Sukumar, 1994). New settlements that spring up along traditional migration paths of elephant herds are naturally subjected to damage before the animals find other routes or restrict their extensive seasonal movements. Bandipur is an elevated part of the Deccan plateau in the southern most boarder of Karnataka between east longitude 76° 12' 17" and 76° 51' 32" and north latitude 11° 57' 02". It is situated in the Chamaraajnagar- Mysore districts of Karnataka along the Mysore-Ooty highway at the foot hills of the Nilgiri Mountains. This National Park is flanked by Karnataka's Nagarahole National Park to its North West, Tamilnadu's Mudumalai wild life sanctuary and Satyamangalam Forest division to south east, and Kerala's Wayanad wild life sanctuary to its south west. Together, these four protected areas constitute the Nilgiri Biosphere Reserve, which is arguably the best remaining stretch of habitat for the Asian elephant and the tiger. It is also India's first Biosphere Reserve encompassing an area of about 5500 km². The park is surrounded by thickly populated human settlements with cultivation along northern and western boundaries with cultivation up to the edge of 'D' line. There are about 200 villages within a radius of 5 km. from the boundary of the park with around 2, 00,000 human and 3 00,000 cattle population causing tremendous pressure on the park. Other human disturbances like poaching, national and state highways passing through the forest, religious activities, large scale farming near buffer zones, tourism and their byproducts like private resorts, , trekking etc., , amateur studies, forest fire, fishing, mining and illicit felling of trees act as great blocks in the conservation efforts of the Karnataka Forest Department. People are affected within this 5 km radius all along boundary due to wild life depredation into fields and villages causing crop damages cattle kills, human injury and deaths. A detailed account of the various reasons for human animal conflict in and around Bandipur National Park and their impact on the conservation of biodiversity in this and similar protected areas in our country will be discussed in the paper.





BIODIVERSITY CONSERVATION BY THE INDEGENOUS COMMUNITIES OF JHARKHAND: A STUDY ON THEIR SACRED PRACTICES THROUGH AGES

07 02

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From time immemorial it was found that the indigenous communities of an area live in close association with nature and involves in the protection and conservation of wildlife and wild land. Jharkhand is unique among the wilderness areas of India because of its topographic features, forests, wildlife and natural home of diverse kind of tribal communities. A study carried out on various tribal communities and other ethnic communities of Jharkhand through personal interview of the different focus groups of people and in addition, data were also taken from the secondary sources to assess the biodiversity conservation ethos. It was found that most of the ethnic, anthropogenic communities of Jharkhand unknowingly conserve biological diversities through the sacred association, their Totems, Taboos and scared grooves. It was also found that an intricate link exists between the anthropogenic communities with the wild land and wildlife through their tradition, belief, art and culture. This system of belief in tribal or Indigenous communities proved to be a measure in biodiversity conservation and protection of more than thousand species of plant and animal from long-long time. But with the socio-economic development through industrialization and technological innovation break the social system, Totems and Taboos of Indigenous people which possessed threat for the survival of their totemic plant and animal. Now a day, a very common practice applied for wildlife conservation is the establishment of natural reserves like national park, wildlife sanctuary and biosphere reserve by the whole world but in present day, it is a truth that we could not preserve these natural heritages without the support and involvement of local native communities. In conclusion, the need of the present day is to utilize or revive the traditional systems applied by the tribal communities for the conservation of wild land, wildlife and the whole ecosystem. In order to effectively manage and conserve biodiversity, a long term plan to be needed for revival of the traditional system of ethnic communities.





BIO-DIVERSITY OF VASTHRABARANAM AND NRUTHA IN BHARTHANATYAM FROM TAMILNADU, KATHAKALI FROM KERALA AND YAKSHAGANA FROM KARNATAKA AND MAINTAINING GOOD HEALTH THROUGH DANCE -DANCE THERAPY

07 03

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Vasthrabharanam differs one dance form to another but also have some similarities, wearing different abaranam at acupressure points can stimulate the nerves at intern will help to maintain good health. Similarly wearing a typical dance dress also will help to stimulate varies pressure points to maintain good health. The deatail study of dances like bharathanatyam, kathakali and yakshagana are done which represents their states like tamilnadu, kerala and Karnataka by their costumes , make-up and ornaments. Bharatanatyam is a classical dance form of South India, said to be originated in Thanjavoor of Tamil Nadu. It was known as “Daasiyattam” since performed by Devadasies in temples of Tamil Nadu long ago. The name ‘Bharatanatyam’ is derived from three basic concepts of Bhava, Raga and Thaala. Kathakali is the classical dance-drama of Kerala, South India, which dates from the 17th century and is rooted in Hindu mythology. Kathakali has a unique combination of literature, music, painting, acting and dance. Yakshagana is a musical dance drama popular in coastal and Malenadu regions of Karnataka, India . It is believed to have evolved from pre-classical music and theatre. Yakshagana is popular in the districts of Uttara Kannada, Udupi, Dakshina Kannada, and Shimoga of Karnataka and Kasaragod district of Kerala. AIM of our study is to find out and record the similarities in costume style , abaranam and its variations in these 3 dance forms. The materials and methods for this study include collection of the vasthram and abaranam used in different styles and comparison and contact health clinic which practices dance therapy for treating people. Bio-diversity of nrutha parti.e “Allaripu” in dance, the word alaripu means “a flowering bud”. It is an innovatory piece meaning it is performed before a dancer begins a whole performance. It is considered to be a warm up piece for the dancers. Costume – bharathanatyam-From the ancient texts and sculptures, one can see that the original costume did not cover most of the dancers’ bodies ,heavy saree that severely restricted the dance movements. There are several varieties of Bharata Natyam costumes. Kathakali-The headgear worn by the various characters in Kathakali are excellent specimen of intricate wood carving, an ancient speciality of the region. Even the shiny finishing with trinkets takes hours of painstaking labour by expert craftsmen. Most of the ornaments donning each character are made in this fashion too. Yakshagana has similarities with Kathakali, with its large sized skirts, colored headgear and painted faces. The costume comprises of a ‘dhoti’ (loin cloth), a pyjama, a jacket and a loose skirt. Jewelry, Bharata Natyam dancers wear a unique set of jewelry known as “Temple Jewelry” during the performance. Kathakali- Each artist performing Kathakali wears ornaments full of beads over the shoulder. The jewelry includes necklace, bracelets, bangles, gold colored breastplates and a bunch of tiny bells tied to each ankle. Female characters are simpler in their costumes but more elaborate in their jewelry. Yakshagana- The artists playing the mythological characters sport an array of ornaments. An important ornament is the ‘bhujakeerthi’, which looks like a wing and is worn over the elbow. It is plain-surfaced when used in ‘Mudalapaya’ (dance form played in eastern Karnataka) and rough containing spikes when used in ‘Paduvalapaya’. Physical activity has many physical and mental health outcomes. However, physical inactivity continues to be common. Dance, specifically cultural dance, is a type of physical activity that may appeal to some who are not otherwise active and may be a form of activity that is more acceptable than others in certain cultures. The data collected in the above study will be presented in this paper.



SPIRITUAL DIMENSIONS OF BIODIVERSITY CONSERVATION – A CASE STUDY

07 04

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The tradition of sacred groves is prevalent in many states of India. Innumerable plant and tree species of medicinal importance and wild relatives of cultivars are being conserved in these invaluable resource pockets due to religious faith. Alappuzha being the only district in Kerala without natural forests at present, a study was undertaken to understand the floristic richness of the sacred groves which are the only remnants of natural forests once present in the region. An exhaustive field survey carried out covering all the 91 villages of the district revealed the existence of 1128 sacred groves with an area of 83.55 ha. A total of 687 plant species belonging to 493 genera and 127 families were recorded from these groves. Two critically endangered tree species namely, *Syzygium travancoricum* Gamble and *Vateria indica* L. were present among the 27 endemic species to Western Ghats. A rare climbing legume, *Kunstleria keralensis* C.N. Mohanan & N.C. Nair was identified from one grove. Wild relatives of cultivated species like *Myristica malabarica* Lam., *Garcinia xanthochymus* Hook.f. ex Anders. and *Trichosanthes cucumerina* L. could also be recorded. *Buchanania lanceolata* Wight, a vulnerable species with its distribution limited mainly to sacred groves in Kerala was present in a few groves of Alappuzha. Among the 687 species of plants, 281 are known to possess medicinal values. Out of the 194 tree species, 57 are being used as timber, 26 as small timber and 68 yields non-wood forest produce (other than medicinal). Phytosociological studies were conducted separately for the agro-ecological zones. In the Coastal sandy region, *Calophyllum calaba* registered the maximum value for IVI followed by *Artocarpus hirsutus*, *Quassia indica*, *Holigarna arnottiana* and *V. indica*. Simpson's index and Shannon Wiener's index estimated from this region were 0.078 and 3.004 respectively. *Hopea ponga* ranked first with reference to IVI in the Onattukara region followed by *V. indica*, *A. hirsutus* and *H. arnottiana*. Proportion of lianas was also significant. Simpson's index worked out for Onattukara region was 0.121. The value for Shannon Wiener's index was 2.587. The maximum value for IVI was registered by *H. ponga* with reference to the third region, Southern midlands also, followed by *V. indica*, *C. calaba*, *Alstonia scholaris* and *H. arnottiana*. The values worked out for Simpson's index and Shannon Wiener's index were 0.117 and 2.751 respectively. Considerable variation was observed with reference to the area of the groves and it varied from 0.003 to 36 acres. Around 57 per cent of the groves measured an area of less than 5 cents (200 m²). Two-hundred and thirty six groves (21%) were small groves having an area of 5 to 10 cents. Eighty-one groves (7%) were identified as moderately large (21 to 50 cents). Large (51 to 100 cents) and very large groves (> 100 cents) accounted only for 3 and 2 per cent respectively. However, the smaller groves proved their significance by harbouring rare and critically endangered tree species indicating the requirement of utmost protection irrespective of its area.



'DASHAPUSHPAM'- A CULTURE, CUSTOM AND A RELIGIOUS CONCEPT EXCLUSIVE FROM KERALA AND THE SCIENTIFIC SPIRIT BEHIND

07 05

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'Dashapushpam' literally means 'Ten flowers'- in this context, the word implies 'Ten flowering herbs'. The twigs of ten herbs together or otherwise are being used by a specific community in Kerala for various religious ceremonies and rituals from time immemorial, that are closely interlinked with birth, growth and death of an individual. They grow abundant in the wild during monsoons. A close analysis shows that all these plants are having therapeutic uses and are widely used in Ayurvedic preparations in Kerala. Studies have shown that some of these herbs are treasure houses of active phytoconstituents and researches are going on, to understand more about the healing properties of 'Dashapushpam'. A recent investigation by the author has revealed the antimicrobial properties of the herbs against nine species of pathogenic fungi and seven species of pathogenic bacteria. Discussions with experts in the field of Ayurveda, the respected septuagenarians and octogenarians of the community, related literature in vernacular language, and previous organised researches and the author's own research have formed the basis for this study. The present paper briefly enumerates the various religious rituals and customs during which the herbs from this category are inevitable, common medicinal uses, outcomes of some recent researches and thereby attempts to bring in an awareness of ancient wisdom of realizing the close knit relationship between nature and man and the urgency of triggering modern wisdom to conserve their biodiversity with a scientific spirit in this era of climate change and global warming for the welfare of the present and future generations.





SPIRITUAL AND ECOLOGICAL DIMENSIONS OF SACRED GROVES IN BIODIVERSITY CONSERVATION, WITH SPECIAL REFERENCE TO THIRUVANANTHAPURAM CITY

07 06

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Sacred groves form specific ecological niches closely knitted with the life and culture of Keralites, which once used to be a ubiquitous phenomenon in ancestral households. They symbolize parcels of Tropical evergreen forests with distinct vegetation strata. These are potential sites for several rare, endemic and endangered species. At the same time, sacred groves act as islands of ethnicity in which the local communities protect these environmental systems out of their spiritual perception. Thiruvananthapuram, the southern most and capital district in Kerala, houses 151 sacred groves distributed over varied geographic zones. A random selection of sacred groves in Thiruvananthapuram city has been done for the perusal of their spiritual and ecological dimensions. The Biodiversity conservation status of these ecologically viable sites has also been assessed on the basis of their geographic and floral characteristics. The involvement of local communities in upholding their religious ethos and thereby conserving sacred groves as heritage spots has also been qualitatively analyzed. The study revealed a strong correlation between the ethnic beliefs and the conservation status of sacred groves. Thriving strands of these ecological units still form the basis of biodiversity conservation in the present stressed out and strained atmosphere of city life.



HYDROLOGICAL IMPORTANCE OF SACRED GROVES OF WESTERN GHATS

07 07

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Sacred groves, often climax forest patches preserved in the name of god are distributed throughout the Western Ghats. Apart from their role in biodiversity conservation, groves also offer various ecosystem services which are still underexplored. Water conservation is one of the most well documented services provided by the groves although scientific studies have not done yet in this regard. Documentary evidence shows that groves support numerous perennial streams, ponds and wetlands in Western Ghats region thus maintain livelihoods of rural communities associated with this tradition. This water conservation potential also helps to maintain the rich biodiversity in the grove area by providing suitable microclimate for diverse group of organisms. We have assessed the water conservation potential of the sacred grove in comparison to non-sacred area in terms of ground water availability, soil moisture content and land use patterns with an aim to justify the age old practices of sacred grove conservation. Comparative analysis has been carried out in two associated upland forest patches in Honnavar taluk of Uttara Kannada district of Karnataka, representing a sacred and non-sacred forest patches. The sacred forest patch is associated with Karikanamman Temple, one of the famous pilgrimage centres, while the non-sacred forest patch is in the neighbouring Sambegadde. Forest composition, soil hydrology, ground water and socio-economic parameters have been considered for this study. Sampling of vegetation was carried out in three altitudinal gradients (50-200m, 201-400m, >400m) by following standard methods. Top soil (0-20cm) moisture has been measured by gravimetric method. Ground water monitoring has been carried out on monthly basis in selected wells and household survey was conducted to gather information on landholding, crop pattern and water utility details. The evergreen nature of the sacred forest patch (Karikan) is in a sharp contrast to its neighbouring forest patch (Sambegadde), where it is mostly secondary and deciduous in nature. Karikan hill side forest has shown 36.17% endemism, 92% evergreenness and hygrophilous dipterocarps are dominant there. Topsoil moisture content in pre-monsoon season has shown higher moisture retention in the evergreen primary forest patch in comparison to the Sambegadde forest patch. Household survey result has shown a distinct characteristic in water usage and crop pattern. Sacred forest downstream area is dominated by horticultural crops having higher water requirement while Sambegadde is dominated by rain fed agricultural crops due to scarcity of water during non-monsoon season. The outcome of this investigation highlights the linkages between hydrologic regime with the local ecology, biodiversity and culture. Primary evergreen forests with good canopy cover and litter layers at Karikan have significant role in moisture retention as well as in maintaining hydrologic regime evident from perennial streams and higher ground water table. Perennial water availability has a decisive role in the economy of downstream area evident from the prevalence of cash crops requiring higher quantum of water. However, long term monitoring is required to substantiate the linkages between ecology, biodiversity with hydrology at local and regional levels.





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CONSERVATION OF BIODIVERSITY IN SELECT SACRED GROVES OF KAKKODI PANCHAYATH, KOZHIKODE, KERALA – CASE STUDY

07 08

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Sacred groves of Kerala are treasures of biodiversity and a gene pool of many endangered, threatened and endemic species of plants. The local people, through religious and cultural practices have been conserving many sacred groves of the State from time immemorial, but many of them are on the verge of destruction due to socio-cultural changes and anthropogenic interventions. The new land reforms in Kerala and the religious beliefs and taboos of younger generations are major threats impeding the protection and conservation of these groves. They are the storehouses of medicinal plants and contain wild relatives of crops that can help to improve cultivated varieties. Most of the sacred groves represent the relics of the once gregarious and abundant evergreen forests of the Western Ghat. In this context, their protection, conservation and management warrant top priority. The size of the sacred groves in Kerala varies from .01 to 20 hectares. The available inventory on sacred grove indicates that maximum numbers of sacred groves are distributed in the northern districts of the State, especially the Malabar region. The present study was centered round select sacred groves of Kakkodi Panchayath of Kozhikode district (11° 08' and 11°50' North latitude & 75°30' and 76° 08' East longitude) of Kerala State, southwest coast of India. After the preliminary survey, six sacred groves, viz., Kottukulangara Ayyappan Kavu, Kanipbothu Kavu, Kuzhiyanikkal Kavu, Chempoli Kavu, Nettiadath Kavu and Aranthodi Kavu were selected for detailed study based on the nature of management measures taken for the conservation of the Sacred Grove and its biodiversity. In the present study, major flora of select conserved sacred groves has been collected, identified enumerated and compared with the flora of non-conserved sacred groves and major factors that influence the conservation and destruction of sacred groves has been presented. Major flora of the study area includes 131 species of plants belonging to 118 genera and 60 families. Among these 127 species were Angiosperms, 2 species were gymnosperms and 2 species were Pteridophytes. Results of the present study reveals that among the 43 inventoried sacred groves in Kakkodi Panchayath, most of them are well conserved, some are partly-conserved and others threatened due to various anthropogenic pressures such as developmental activities, urbanization and population explosion. Most of the sacred groves of the study area are moderately conserved, while few of them have become the victim of encroachment and exploitation at various levels. Conserved sacred groves possess rich floral diversity. Non-conserved sacred groves now exist as remnants of the sacred groves. Considering the various dimensions of the sacred groves in Kakkodi Panchayath, it is clear that by following the conservation strategies in conserved sacred groves the people of the locality can save the threatened ones from the verge of further degradation.



A DISCOURSE ON ECOLOGICAL PURSUIT IN THE MAGICIAN'S NEPHEW BY C.S. LEWIS

07 09

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The paper seeks to examine the visionist treatment of nature in the Magician's Nephew by C.S. Lewis, the British writer. An analysis of the book highlights the writer's deep concern for conserving nature. It focuses on the sense of domination prevalent in man, which impede the affinity between humans and environment. The short novel exhibit how man destroys and disrupts nature to meet his selfish ends. Further, it provides the preservation procedures to pursue environmental restorations. Lewis aspires to depose man's supremacy and dissolve the deposed hierarchical oppositions between nature and human. The interference of the book is not only to mover from self centredness to eco-centred responsibility but also to promote eco-based perception and applications.





COMPARATIVE STUDY AND BIODIVERSITY OF THE RITUALS PERFORMED IN DIFFERENT PARTS OF SOUTH INDIA

07 10

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A ritual is a set of actions, performed mainly for their symbolic value. It may be prescribed by a religion or by the traditions of a community. The term usually excludes actions which are arbitrarily chosen by the performers. India is well known for its rich culture and religion and also spirituality. There are a lots of festivals celebrated in India and each festival is celebrated in different way according to the culture at that particular state. The everyday rituals performed to lord in temples also differ from one place to another. There are different ways of offering to lord like that of using vedic rituals in some parts , in in thantric method and also manthric. We have made an comparative study within south Indian temples (Karnataka, Kerala, Tamil Nadu and Andhra Pradesh) about there way of performing the rituals. We have also enlisted the manthra's used in the ritual and have given the different ways of chanting the manthra's by different people. The aim of our study is to record the procedures and rituals followed in prominent temples in these three above states and mark the similarities and differences in biodiversity. The materials used for our study include visit to the temple and collection of information about the method of performing rituals and make tabular column and compare. The recorded data is presented in this paper.





SIGNIFICANCE OF BIODIVERSITY /ECOLOGICALLY IMPORTANT, BIOLOGY CURRICULUM IN SCHOOLS

08 11

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This presentation has two major issues to highlight. Each of these two issues is aimed at two different sectors of people important for the conservation of Biodiversity. The presentation is about education – on the importance of the right kind of curriculum in biology and geography to achieve the purpose of finding a working roadmap for conservation. The significance of how a right curriculum can lead to specialised professional in this field-such as dedicated taxonomists, entomologists, ecosystem managers, knowledgeable lawyers to address issues of biopiracy, patents etc. The first issue whose target audience would be policy makers, Ministers from Environment and Education , aims to show how knowledge of Biodiversity of the Indian sub-continent is essential for the development of both a vision and a paradigm to check loss of biodiversity. The thirst to acquire this knowledge has to begin from schools. This means looking at what is taught in schools especially in middle and high school biology and geography classes. Should cockroaches and frogs and rats along with hibiscus and pea flowers continue to ensure that students shy away from biology out of sheer boredom or can there not be a more vibrant biology course that seeks to look at other creatures and evoke the curiosity for nature? My doctoral research for a new curriculum in biology has shown that the latter is possible. The second issue is aimed at NGOs and nature societies that have strived hard to keep interests in nature alive through fascinating camps, books and workshops. To these people I wish to point out that there need to be a greater understanding of classroom demands, syllabus demands while conducting such workshops. Such exercises should be conducted in a way that it serves the purposes of subject materials also; this is not to say that it does not serve any purpose; it most certainly is valuable; however given the current situation the way these groups operate needs to change. The presentation aims to provide concrete suggestions for the issues raised through examples, case studies, documentations and research results.





BIODIVERSITY ASSESSMENT THROUGH EXPERIENTIAL ENVIRONMENTAL EDUCATION FOR SCHOOL STUDENTS – A CASE STUDY FROM PUDUCHERRY, INDIA

08 01

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Promoting students commitment to protect local biodiversity is an important goal of Education for Sustainable Development (ESD) in India and elsewhere. The main focus of this experiential education was to create understanding, knowledge, necessary skills, and motivation to participate to identify various plants and bird species around the school campus and at local level. In order to create the skills to assess the diversity of plant and bird's species among students, the hands-on-experience and field exposures methods were identified in this study. We developed a comprehensive framework such as pre and post test with control design to assess the efficacy of student's knowledge, skills and participation to assessment of local plants and birds. Since the pre-test indicated little lesser than average understanding, knowledge, skills and participation in the relevance of biodiversity, the observed increases in post-test results these experiential education could be attributed to our EESD efforts.





RELEVANCE OF CONSERVATION EDUCATION PROJECTS IN INDIA

08 02

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Conservation Education is a major field of activity which needs to be ingrained in the habits and daily lives of the people in order to follow the path of sustainable development. Unfortunately, in developing countries like India, protected areas have become like green islands surrounded by a sea of humanity. There are no better learning laboratories for nature education than natural ecosystems themselves. Nature reserves become excellent resource bases for educational explorations related to wildlife, ecology and conservation. So, the relevance and need for an Education programme is to facilitate the promotion of conservation and awareness among various target groups and it needs to broadly address the two broad based issues. One of the important target group for this awareness, are the students and youth of today as it is they who will in future persuade the political establishments to initiate a national dialogue on sustainability. The youth in India constitute a sizeable number of the total population. Sensitizing this group on environment issues is the need of the hour. Environment education and creation of public awareness on conservation of nature and natural resources are essential pre requisites for the capacity building of the community to contribute to the success of the nation's policies and efforts for sustainable development. TERI conducts several short- and long-term projects with schoolchildren and holds workshops and training programmes for teachers and students focusing on various environmental issues. In the proposed paper, suggestions will be made how both centralized and state level projects on conservation education can be run effectively with help of organizations such as TERI. There are several successful models that can be effectively replicated for stronger and visible positive results. The direct beneficiaries of these projects will be both rural and urban school children, teachers, parents and the general community in the target area. This entire 'education' exercise will operate through a dual approach. Biodiversity education modules will be developed and a direct on-field project will be implemented. To start with, at the pilot phase, few schools will be selected to participate in this project. These schools will be a mixed group of elite, and government aided schools in and around Delhi. Based on the findings and success of this study, it will be replicated to other parts of the country in a phased manner. Workshops and awareness material will be developed to inform the target group a wide range of issues linked closely to their everyday lifestyles. Participants from both urban and rural setups will be attending these workshops. This will serve a dual purpose of sensitizing the urban children to the richness of the natural resources and enabling the rural children to understand the environmental problems in cities and how they are linked to the destruction being caused to natural reserves, at a global scale. The detailed methodology and break-up of the proposed activity sets will be discussed at the conference. The role of ICT as a winning tool to bridge the gap between the informed and the intended target group be emphasised. The overall impact of these conservation education projects will be to: provide basic education opportunity for children; Develop a positive outlook in children towards the environment and their natural surroundings; and Direct and strengthen the creativity and ideas of children into tangible positive local action projects aimed at improving their immediate environment. The outcome of the project is expected to provide new approaches and method for non-formal education and creation of public awareness on sustainable life styles, which would make an impact on our policies of public education in this vital area of national and global significance. The need of the hour is to popularise the science of biodiversity so that it benefits not only the students and schools but the associated communities. Hence it becomes important to popularise the science of bioresources and biotechnology to make it acceptable to the masses.





BIODIVERSITY CONSERVATION AT THE GRASS ROOT LEVEL

08 03

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The conservation of biological biodiversity constitutes an essential aspect of sustainable development worldwide. It is biodiversity that basically determines the structure and function of all the ecosystems. It's main ecological balance and evolutionary processes and has spiritual, cultural, aesthetic and recreational values. Biodiversity is the foundation on which the future well being of human society rests. It has a powerful role in building sustainable human societies. The biodiversity rich regions are mostly located in the under developed countries which are characterized by persistent poverty and high rates of population growth which is the stumbling block for the conservation on Biodiversity. The Rio De Janeiro, Brazil Earth Summit 1992 drafted the Convention on Biological Diversity which was signed by over 90 % of United Nation member countries including Canada which is celebrated as International Biodiversity Day every year. Human society's fate being depend on the health of bioresources, it is essential that we evolve effective implementation of biodiversity work plan for better management and sustainable use of bioresources. It is in this very year that creating awareness to the people is crucial to biodiversity conservation because unless it is made aware to the people, it is unlikely that individuals, households, industries, companies or governments will take action to do so. The present study was carried out in the five districts of Manipur for one year with emphasis on the geographical location of the schools. Every month classes were organized in the form of lectures, hands on activities, quiz, movies, documentary etc to make the students familiar with bioresources and its important applicant. At the end of each class feedbacks received from the students were very positive and the students are more aware of the need to conserve bioresources after attending the classes. Some of the remarkable outcome of the study was that the students promise to stop killing wild animals as they used to do before as a custom or for pleasure which is the main cause in the decline of wild animals. We need to inculcate such awareness from the grass root level i.e. school children's as they are the pillars for our future generation and the knowledge imparted to them will be long lasting as their mind is fresh. As a conservation programme, the concept of biodiversity and Bioresources should be effectively included in the school syllabi. Moreover, the students should be exposed to the rich biodiversity regions and teach them the immense values of wide varieties of plants and animals and their benefit to the human welfare.



AN APPROACH PAPER ON ENVIRONMENTAL AND BIODIVERSITY EDUCATION IN SCHOOLS (1 - 12 CLASSES)

08 04

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Need of environmental education discussed in the paper include the following: (i) To correct the educational system from skill development to exploit the nature to make; (ii) the child live harmoniously in nature- protecting and enriching the fellow organisms; (iii) Lack of awareness and understanding of the natural resources, law of nature, purpose of life; (iv) Inculcating the value of love towards nature- knowing, understanding, experiencing the beauty of oneness with nature; (v) Realizing oneness with nature is oneness with god- our concept of 'Moksha'; (vi) Present status of environmental education; (vii) There is no specific curriculum or syllabi for environmental education at school level; (viii) Some universities and institutions are providing under graduate and post graduate courses in environmental studies and bio-diversity studies; (ix) The number of students seeking admission for these courses are very negligible (a reliable data is not available at present); (x) Curriculum at present is framed mainly accordance with western concept. Our cultural perspective is not reflecting there, utilitarian values rather than 'Dharmic' values are predominant. The need for reorienting environmental education curriculum is disused in the paper, with appropriate suggestions for each grade.





EFFORTS FOR THE CONSERVATION OF BIODIVERSITY OF KUTTANAD REGION OF VEMBANAD-KOL RAMSAR SITE BY AWARENESS CAMPAIGNS AND PEOPLES PARTICIPATION

08 05

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Vembanad- Kol wetland is the largest of its kind in the western coast of India .Kuttanad is the southern part of this wetland and is one of the largest rice bowls of Kerala. The Vembanad Lake, the surrounding paddy fields, marshes, islands, canals and rivers form the Kuttanad wetland ecosystem. This area offers diverse habitats for plants, birds, fishes, mammals, reptiles and other minor forms. Kuttanad is famous for its natural beauty and now is an international tourist destination. The biodiversity of this region is under great threat due to developmental activities connected with tourism. Awareness creation is one of the major aspects of biodiversity conservation. Kottayam Nature Society, a registered NGO is doing environmental education and public awareness programmes for the conservation of the wetland biodiversity. One of the major programmes of the society is the annual water bird count in the wetland region. In addition to professional bird watchers, students and other people participate in the programme. More than a bird census, it is a wetland awareness programme. This is being organized for the past ten years by the assistance of the Kerala Forest and Wild Life Department. Each year's report is also published. The Kerala State Biodiversity Board supported the society to locate water bird roosting/breeding sites in the Kuttanad region. Incentive was distributed to 20 persons at different locations of the wetland who protected the roosting/breeding trees of water birds. This is the first of its kind in India and the aim is to attract more people to conservation activities. Financial support was given by the Kerala Forest and Wild Life Department. The society is now preparing a biodiversity action plan for Vembanad wetland region in association with the Kerala Forest and Wild Life Department. Under this programme awareness classes on wetland conservation were organized in 25 schools adjoining to the wetlands. A hand book on the water birds of the Vembanad region titled, "Vembanad Neerpakshikal" was also published by the society. This is for free distribution among school students and other interested persons. Plan for establishing "Thanneerthada Samrakshana Samithi" in different panchayaths of Kuttanad region is under discussion. The society also implemented legal measures against wetland filling and land alteration activities. Saving the biodiversity rich island of the Vembanad Lake, Pathiramanal from the hands of hotel lobby and blocking the reclamation of Methran Kayal for a mega tourism project are successful examples. The aim of this presentation is to emphasize the essentiality of awareness programmes and participation of people in conservation activities.

