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KARNATAKA STATE BIODIVERSITY STRATEGY AND ACTION PLAN (KBSAP)

(As a part of National Biodiversity Strategy and Action Plan - NBSAP)

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In collaboration with

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1. Background and Introduction

The Centre for Ecological Sciences at the Indian Institute of Science was invited to serve as the nodal agency at the Karnataka state level for the formulation of a strategy and an action plan to conserve, sustainably use and promote equitable sharing in benefits from the use of biological diversity resources as a part of the national effort co-ordinated by the Ministry of Environment and Forests, GOI. The nodal agency worked under the overall guidance of a Steering Committee chaired by the Chief Secretary of the Government of Karnataka. The Karnataka effort attempted to generate perspectives, ideas and concrete suggestions for practical actions from a broad cross-section of Karnataka's society through a four-pronged approach. This involved (a) commissioning of papers from technical experts and administrators, (b) sponsoring of case studies by NGOs (c) organization of field studies involving local community members with the help of 43 High Schools distributed throughout the state, and (d) obtaining feedback from general public to background articles published in newspapers and the 14 episode All India Radio programme. Since biodiversity covers a vast canvas, we identified six themes encompassing its different facets to derive inputs in a more focussed manner. These six themes included: (a) Protected areas (b) Medicinal plants (c) Freshwater fishes (d) Wetlands (e) Cultural traditions of conservation, and (f) Land races of cultivated plants. All the inputs thus generated fed into six state level thematic workshops in Kannada involving representatives from all segments of the society. The workshop deliberations culminated in drafting of the state level strategy and action plan, which was placed before a state-wide convention on November 11, 2001.

Further details of the methodology thus employed are provided in Sections 3 and 4 and the Annexures.

2. KARNATAKA STATE BIODIVERSITY STRATEGY AND ACTION PLAN

KEY CONCERNS

- **Need to focus not just on flagship species, but the entire spectrum of biodiversity:** It is necessary to move beyond the traditional focus of conservation activities on species such as tiger and elephants to the entire diversity of microorganisms, plants and animals. We would then need to attend to communities such as those of *Myristica* swamps in Western Ghats. Such hotspots that are rare and unique are critically endangered due to anthropogenic pressure resulting in the loss of species. Such areas need to be closed from any human activities.

- **Need to focus on protected areas which are important repositories of biodiversity:** Fire is a major threat to the forests and bio-diversity conservation, the habitat protection and management of critical hot spots needs to be strengthened to reduce the fire damage to the bio-diversity

- **Connectivity of Protected areas.** The protected areas are highly fragmented causing genetic isolation or organisms leading to genetic disjunction, therefore it is essential to develop protected areas corridors to connect the fragmented eco-systems or habitats

- **Need to go beyond Protected Areas, to the entire landscape and waterscape:** At present the conservation initiatives are confined to flagship species resulting in the loss of associated species in a given habitat. Therefore the strategy should be develop bio-diversity management plans and strategies at the landscape and habitat level to maximize the conservation benefits**.** While the landscapes having rich bio-diversity of both plants and animals species need to be conserved through intensive conservation efforts, it is not possible to declare all of them as sanctuaries or national parks. Instead they may be declared as Ecologically Sensitive Areas.

- **Need to focus on neglected eco-regions:** The conservation efforts have so far tended to focus on the forested tracts of the Western Ghats. It is necessary to also look at the environmental needs of drier Deccan Plateau areas, especially in the black cotton soil tract, to the agro-ecosystems and the livelihood concerns of the farmers.

- **Need to devise a variety of policy instruments, over and beyond regulatory measures**. **.** The Major threat to Forest Bio-diversity conservation including plants and animals comes from the anthropogenic pressure. Indiscriminate use of forests resources by the community in meeting their livelihood is a major concern which needs to be addressed in a holistic manner. The alternatives to the livelihood needs are to be developed and made available to the community in order to reduce the pressure on the bio-resources At present the policies governing protected areas are inadequate and lack a focus on eco-development and participatory approach. Therefore the protected areas management should be subjected participatory management regulations**.** The present policy of protected area management does not address man-animal conflict adequately. The existing provisions do not compensate the people adequately and immediately, hence mechanisms need to be developed to address the issue in a holistic manner.

- **Need to ensure that biodiversity focussed efforts contribute to the enhancement of quality of life of the broader masses of people:** Especially including women and the weaker segments of the population – through empowerment; participation in planning, implementation and monitoring; through social recognition; through promoting sustainable livelihoods, through economic incentives. Many of the bio-diversity resources are commonly used by the local people especially the poor people, therefore the strategy should be to improve the productivity of bio-resources and to develop sustainable use practices to encourage the local use of the bio-resources.

- **Need to combine conservation and sustainable use approaches:** Many of the plants and animals species are having very high commercial value in the international market. Some of the rare medicinal plants are indiscriminately harvested and exported clandestinely. Therefore the bio-diversity conservation strategy should address the issue of banning the commercial uses of some of the rare species.

- **Need to ensure cross-sectoral co-ordination:** Grazing is one of the major threats to the bio-diversity as the regeneration is completely affected by continuous grazing by the cattle. Among the cattle the goats are regarded as biggest threat to the regeneration forests, therefore the bio-diversity conservation needs to be linked to the cattle management policy.

- **Need to mainstream biodiversity concerns in the developmental process**: Mining activity and the quarrying in and around the forest is causing irreparable damage to the bio-diversity. Therefore the bio-diversity strategy and action plan needs to address these problems with proper policy support**.** At the same time, it is essential to keep in mind such developmental imperatives as the urgency to step up agricultural productivity.

- **Need to operationalize the " Precautionary Principle":** This principle suggests that while dealing with novel situations, such as the use of GMOs, we would not have available full evidence of their likely impacts. Under such circumstances, it is appropriate to err on the side of the caution. However, we must also look at all the available evidence, including that from other parts of the world, and keep in mind the imperatives of enhancing productivity.

- **Need to operationalize the " Polluter Pays Principle":** Costs of biodiversity conservation should be charged to those responsible for its destruction through a variety of impacts such as pollution.

- **Need to deal with newly emerging challenges such as Intellectual Property Rights (IPR) issues and Genetically Modified Organisms (GMO):** We need to adopt a balanced approach to such challenges, keeping in mind the developmental imperatives of enhancing productivity.

STRATEGY AND ACTION PLANS

STRATEGY. 1:

EXPANDING AND IMPROVING KNOWLEDGE OF THE CHARACTERISTICS, USES AND VALUES OF BIOLOGICAL DIVERSITY

- Current understanding very limited in terms of groups of organisms, localities, people- biodiversity interactions including uses, ongoing changes, forces driving changes
- No mechanisms to bring together scientific and folk knowledge
- No mechanisms to monitor on-going changes
- No mechanisms to tackle newly emerging challenges such as spread of novel genes consequent on the release of genetically modified organisms(GMO)
- Tremendous scope to use modern tools of information technology.

ACTION PLAN I:

PROPOSED PROGRAMMES, PROJECTS AND ACTIVITIES

I.A. BIODIVERSITY INVENTORYING AND MONITORING PROGRAMME

- A multi-scale, multi-agency, nested programme addressing the entire landscape and waterscape

- With a focus on protected areas, other biodiversity rich areas and habitats

- Involving periodic monitoring of the landscape and the lifescape

- Linked to a computerized, distributed information system with regulated access

Project I.A.1 Compilation of a Scientific Inventory

- Involving forest-fishery- agriculture departments; Botanical and Zoological Surveys , Universities, Agricultural Universities and research institutions

- Linked to an on-going monitoring programme

Project I.A.2 Inventorying and monitoring GMOs

- GMOs a significant emerging challenge

- Bio-safety Protocol calls for developing national capacity to assess impacts of GMOs

- Opportunity to capitalize on Karnataka's scientific and technical strengths

Project I.A.3 Compilation of Community Based Inventories

- Involving schools and colleges, local knowledgeable individuals, community leaders, Village Forest Committees, Panchayat institutions;

- Focussing on medicinal plants, fish and shellfish, sacred groves, ponds and other sacred sites, sacred trees such as Ficus and sacred animals like monkeys, crop genetic diversity, especially of fruit trees such as jackfruit, mango, Garcinia, tamarind

- Linked to an on-going monitoring programme

- Technical experts involved in Scientific Inventories (Project I.A.1) interacting with school and college teachers will serve to link scientific and community based inventories

Project I.A.4 Documentation of folk and other public domain knowledge of uses of biodiversity

- Need to conserve significant knowledge resources
- Need to organize this knowledge so as to sustain just IPR claims and to challenge unfair ones
- Need to properly regulate access to the information in order to prevent unfair practices
- Need to equitably share benefits of the use of folk and other public domain knowledge of uses of biodiversity

Project I.A.5 Identification and Inventory of Biodiversity Indicators of Pollution

- Aquatic micro- and macro-invertebrates, fishes, birds and lichens

Project I.A.6 Identification and Inventory of Biodiversity Indicators of Habitat Quality

- Indicators of quality of different habitat types, e.g. birds and butterflies as indicators of quality of forest habitats

Project I.A.7 Identification, Inventory and Monitoring of Exotic Invasive Species

- *Parthenium, Eupatorium, Lantana,* Water Hyacinth, African Catfish etc.

Project I.A.8 Establishment of Herbaria, Museums and Electronic Data Bases

- Maintenance of specimens as well as scanned images

I.B ECOSYSTEMS MAPPING

Project I.B.1 Satellite imagery based mapping of forest habitats

- Vital to consider habitat continuity and fragmentation

- Vital to monitor and regulate encroachment

Project I.B.2 Satellite imagery based mapping of aquatic habitats

- Vital to consider habitat continuity and fragmentation

- Vital to monitor and regulate encroachment

Project I.B.3 Establishment of a Geographical Information System for ecological habitats

- Indian Remote Sensing Satellite imagery linked to Geographical Information System a useful tool

- Linkage of programmes of ground truthing to the compilation of scientific and community based inventories

Project I.B.4 Inter- habitat connectivity studies

- Interpretation of data base created in Projects I.B.1, 2 and 3

1.C. SOCIO- ECONOMIC STUDIES PROGRAM

Project 1.C.1 Documentation of traditional conservation- sustainable use practices

- Such as sacred groves, ponds and other sacred sites, sacred trees such as *Ficus* and sacred animals like monkeys,

- Sustainable use practices, such as protection to fishes migrating upstream for spawning

- Also areas conserved and managed by communities for livelihood resources

- Role of women in promoting conservation and sustainable use

Project I.C.2 Studies on social motivation for continuation- revival- forces promoting dissolution of traditional conservation- sustainable use practices

- Changing religious beliefs, community structure, market forces

Project I.C.3 Documentation of traditional systems of management of knowledge of uses of biodiversity

- Practices of transmission and economic transactions relating to traditional knowledge of uses of biodiversity

- Role of women in such systems

Project I.C.4 Studies on livelihood implications of biodiversity loss

- Biodiversity loss often adversely affects livelihoods, e.g. of fisher-folk, basket weavers and forest produce gatherers

- Maintenance of biodiversity can make an important contribution to poverty alleviation

Project I.C.5 Studies on health implications of biodiversity loss

- Biodiversity loss often adversely affects health, e.g. through loss of herbal medicines or of nutrition in form of fish or multiplication of vectors of diseases consequent on eutrophication of water

Project I.C.6 Studies on implications of tenurial arrangements for biodiversity loss

- Tenure and access rights regimes have significant influence on motivation to conserve or destroy

- An understanding of such issues critical for designing Strategy IV, and projects like IV.2

Project I.C7 Documentation of response of people to newly emerging challenges such as IPRs and GMOs

- Understanding essential to build capacity to face new challenges

1.D.TRENDS AND FORCES DRIVING BIODIVERSITY CHANGE

Project I.D.1. Documentation of major changes taking place over time and forces driving such changes in the major ecosystems, namely forests, grasslands, arable fields, orchards and plantations, streams and rivers, tanks and lakes, rural and urban habitation

- To be carried out in conjunction with scientific and community based inventories and ecosystem mapping

Project I.D.2. Documentation of major changes taking place over time and forces driving such changes in the major biodiversity resources such as medicinal plants, timber and non-timber forest produce, fish and shellfish, waterfowl, larger mammals

- To be carried out in conjunction with scientific and community based inventories and ecosystem mapping

STRATEGY II: ENHANCING & INTEGRATING EXISTING AND PLANNED *IN-SITU* AND *EX-SITU* BIODIVERSITY CONSETRVATION EFFORTS

- Current limited coverage of protected areas
- Need to broaden focus to private and revenue lands, to much smaller sites
- Need to focus on all forms of aquatic habitats, fresh-water, estuarine, coastal and open sea
- Need to focus on agro- biodiversity
- Need to focus on micro-organisms

ACTION PLAN II: PROPOSED PROGRAMMES, PROJECTS AND ACTIVITIES

II. A. IN-SITU CONSERVATION PROGRAMME

Project II.A.1 Establishment of supplementary conservation sites in low rainfall tracts

- Need to enhance protection to Deccan plateau ecosystems

Project II.A.2 Conservation of Sahyadri Ecologically Sensitive Area

- Ecologically Sensitive Area as a new modality for environmental protection
- Biodiversity rich area at the trijunction of Karnataka, Goa and Maharashtra

Project II.A.3 Establishment of conservation sites protecting special habitats

- Examples include *Myristica* swamps and estuarine *Gajani* lands

Project II.A.4 Establishment of marine protected areas

- Candidate sites include Netrani Island near Bhatkal and Anjadiv Island near Karwar

Project II.A.5 Establishment of estuarine protected areas

- Candidate sites include Sharavathy estuary noted for the presence of the highly valued ladyfish, *Sillago sihama*

Project II.A.6 Establishment of turtle breeding beaches conservation sites

- Sea-walls and a variety of other developments may adversely affect access of turtles to beaches

- Turtle egg harvesting needs to be regulated

Project II.A.7 Establishment of sea bird breeding colonies conservation sites

- Off shore islands

Project II.A.8 Establishment of irrigation tanks biodiversity conservation sites

- Karnataka's 40,000 odd tanks a significant habitat for aquatic biodiversity

- Organized as networks, in cascades

- Need to earmark a proportion, say 5% for biodiversity conservation

- Need institutions and instruments to motivate people to co-operate

Project II.A.9 Establishment of Gunduthope tree genetic diversity conservation sites

- Traditional system of protection of tree genetic resources
- Often linked to protection of tank catchments

Project II.A.10 Establishment of fruit and spice tree genetic diversity conservation sites

- Karnataka rich in genetic resources of fruit and spice trees such as *Artocarpus, Mangifera, Garcinia and Myristica*

Project II.A.11 Development of medicinal plant conservation areas

- In-situ conservation of medicinal plant resource rich sites representative of different vegetation types

Project II.A.12 Establishment of heronaries conservation sites

- Need to devise system to protect water bird breeding colonies, often on private land as at Kokre- Bellur

Project II.A.13 Establishment of bat colonies conservation sites

- Need to protect unique bat colonies such as at Bhimgad, Khanapur Tq., Belgaum district notable for Wroughton's free-tailed bat and Theobold's tomb bat

Project II.A.14 Establishment of on-farm crop genetic diversity conservation sites

- Need to establish pilot sites of organic agriculture harbouring high levels of crop genetic diversity with novel institutions and instruments including green markets to motivate people to co-operate; and to encourage/facilitate ongoing farmers' or NGO initiatives towards this?

- Need to establish pilot sites for on-farm conservation of indigenous livestock breeds and encourage/facilitate ongoing pastoralists' or NGO initiatives towards this

Project II.A.15 Conservation of Sacred Groves

- Devarakadus of Kodagu and Nagarbanas of Dakshina Kannada furnish interesting examples

Project II.A.16 Conservation of Sacred Ponds

Project II.A.17 Conservation of Sacred Stream and River Stretches

- Kapila river at Shishila in Belthangadi taluk and Todikana in Sullia taluk of DK are interesting examples

- Other rare indigenous species could be introduced to such refugia as appropriate

Project II.A.18 Conservation of Sacred Trees

- Trees of genus *Ficus* a keystone resource

- Traditionally protected on a very extensive scale

- Need institutions and instruments to motivate people to continue conservation traditions

Project II.A.19 Conservation of Special Security Areas

- Examples include Anjadiv island under Sea-Bird Project of Indian Navy, prohibited zone around Kaiga Nuclear Plant and Defence Establishment areas in Bangalore city

Project II.A.20 Conservation of Urban Biodiversity

- Need to protect biodiversity rich urban habitats, such as lakes and temeple trees

Project II.A.21 Biodiversity-friendly management of community controlled sustainable use area such as village forests and grasslands

- Examples include Halkar village forest in Kumta taluk of Uttara Kannada district

Project II.A.22 Biodiversity-friendly management of privately controlled woodlands such as soppinabetta, kumki and hadi lands

- Bringing extensive tracts of such privilege lands under more biodiversity-friendly management

Project II.A.23 Control of Exotic Invasive Species

- Need to bring under control invasive exotics in a variety of habitats

II. B *EX- SITU* CONSERVATION PROGRAM

Project II.B.1 Establishment of medicinal plants genetic resources centres in degraded forest areas and as avenue plantations

- Extending institutional arrangements such as Village Forest Committees to promote cultivation of medicinal plant in degraded lands

- Potential to include medicinal trees such as *Phyllanthus emblica, Terminalia bellerica and T. chebula* in avenue plantations

Project II.B.2 Establishment of medicinal plants genetic resources centres in irrigation tank catchment areas

- Potential to promote medicinal plant cultivation in conjunction with catchment protection

Project II.B.3 Establishment of medicinal plants genetic resources development centres

- Ethno-medicinal plant gardens at taluk and district centres

- In association with medicinal plants conservation centres mentioned in Project II.A.11

Project II.B.4 Establishment of Honge (*Pongamia pinnata)* and Neem genetic resources centres;

- Potential to conserve genetic resources of these multi-purpose tree species in conjunction with Climate Change and Desertification projects

Project II.B.5 Conservation of *Ficus* tree resources through avenue plantations

- Trees of genus *Ficus* such as banyan a keystone resource
- Traditionally protected on a very extensive scale as avenue plantations

Project II.B.6 Upgrading Botanical Gardens, Zoos and Safari Parks

- Focus on propagation of rare and endangered species
- Phase out practices such as maintaining animals in cages

Project II.B.7 Establishment of fish and shell-fish gene banks

- In representative aquatic habitats

Project II.B.8 Establishment of cultivated plants genetic resources centres

- In association with agricultural research centres as well as community gene banks
- In representative agro-ecological zones
- Fully involving women who often serve as selectors and preservers of seeds
- Fully involving tribals and marginal farmers who often continue to maintain traditional cultivars

Project II.B.9 Biodiversity- oriented urban forestry programmes

- Promotion of biodiversity components in various elements of urban forestry programmes such as avenue, highway, tank foreshore, industrial and educational institutional and temple plantations

Project II.B.10 Breeding of indigenous livestock, poultry and pet breeds to maintain the animal genetic resources and to make them available to people

STRATEGY .III: PROMOTING SUSTAINABLE USE OF BIODIVERSITY RESOURCES

- Need to promote sustainable use of biodiversity resources in the production landscapes and waterscapes
- Need to promote biodiversity friendly management on state and community controlled lands and waters

ACTION PLAN III: PROPOSED PROGRAMS, PROJECTS AND ACTIVITIES

- Need to focus on ensuring sustainable and biodiversity friendly patterns of use of living resources such as medicinal plants, timber and non-timber forest produce, fresh water and marine fishes and shell-fishes

- Need to co-ordinate relevant actions pertaining to knowledge base, in-situ and ex-situ conservation, policy and legislation, capacity building, education, awareness and communication outlined in various components of the Strategy and Action Plan

Project III.1 Promoting sustainable utilization of natural populations of medicinal plants

Project III.2.Promoting sustainable utilization of timber resources

Project III.3.Promoting sustainable utilization of non-timber forest produce

Project III.4.Promoting sustainable utilization of fresh-water fish and shell-fish populations

Project III.5.Promoting sustainable utilization of marine fish and shell-fish populations

STRATEGY IV: FORMULATING AN INTEGRATED POLICY AND LEGISLATIVE FRAMEWORK FOR THE CONSERVATION, SUSTAINABLE USE, AND EQUITABLE SHARING OF BENEFITS OF BIOLOGICAL DIVERSITY

- Need to broaden biodiversity conservation efforts, to link them to sustainable use and equitable sharing of benefits

ACTION PLAN IV

PROPOSED PROGRAMS, PROJECTS AND ACTIVITIES

Project IV.1 Injecting biodiversity concerns in the functioning of civic bodies

- Reform of the existing policy and legislative frameworks of civic bodies ranging from gram sabhas, gram panchayats, municipalities, and municipal corporations to zilla parishats from the perspective of conservation and sustainable use of biodiversity

Project IV.2 Establishment of State – District – Panchayat level Biodiversity Management Institutions

- Biological Diversity Bill 2000 proposes establishment of State Biodiversity Boards and Local Biodiversity Management Committees

- Potential to nurture new broad based institutions with civil society participation to tackle the emerging challenges

Project IV.3 Development of a Realistic System of Economic Instruments such as: Access Fees, Incentives to encourage prudent and Penalties to discourage non-sustainable Utilization of Biological Resources and Biodiversity

- Need to develop new instruments, including positive incentives

- Need to ensure that biodiveristy conservation and sustainable use efforts help enhance the quality of life of women and the weaker segments of the population

- Need to reform land tenurial arrangements to promote conservation and sustainable use of biodiversity resources

- Resources generated through ecotourism could support conservation efforts

- Panchayats or Village Forest Committees or Joint Fisheries Management Committees could be motivated through authority to charge access/ collection fees

- Panchayats or Village Forest Committees or Joint Fisheries Management Committees could be authorized to levy fines on violators

- Panchayats or Village Forest Committees or Joint Fisheries Management Committees could be given special awards for good performance

- Panchayats or Village Forest Committees or Joint Fisheries Management Committees, or individuals could be given special social recognition for biodiversity conservation endeavours

Project IV.4 Incorporating considerations of habitat connectivity and broader spectrum of biodiversity issues in Environmental Impact Assessments

- Current Environmental Impact Assessment procedures pay inadequate attention to the broader spectrum of biodiversity

- Current Environmental Impact Assessment procedures do not consider issues relating to habitat connectivity

Project IV.5 Creation of a policy and regulatory framework for the protection of fresh-water biodiversity

- Fresh water habitats under tremendous pressures as sources of water and sinks for pollutants

- Fresh water habitats under tremendous demand for alternate land uses such as agriculture or urban infrastructure

- Fish and shell fish under pressure as food organisms

- Destructive fishing methods such as dynamiting, lack of closed seasons are examples of problems

- Fisheries Department focus on enhancing production through aquaculture and more efficient harvesting methods

- Current wild life protection measures give little consideration to aquatic biodiversity

- Need to elaborate new institutions, e.g. Joint Fisheries Management Committees, and new instruments

Project IV.6 Creation of a policy and regulatory framework for the protection of coastal and marine biodiversity

- Coastal and marine habitats under tremendous pressures as sinks for pollutants
- Fish and shell fish under pressure as food organisms
- Destructive fishing methods such as use of nets of small mesh and lack of enforcement of closed seasons are examples of problems
- Fisheries Department focus on enhancing production through aquaculture and more efficient harvesting methods
- Current wild life protection measures give little consideration to marine biodiversity
- Need to elaborate new institutions, e.g. Joint Fisheries Management Committees, and new instruments

Project IV.7 Creation of a policy, incentives and regulatory framework for the protection of biodiversity on private, community and other non- forest lands and waters

- Need to develop new instruments, including positive incentives
- Need to protect biodiversity rich sites of limited extent such as sacred groves or heronaries
- Such sites are often on private or revenue lands
- Biological Diversity Bill 2000 provides for managing such biodiversity rich sites as heritage sites

- Rules for protection of archaeological sites provide interesting possible models for protection of such sites as sites of special scientific and cultural significance
- Need to elaborate new institutions and instruments

Project IV.8 Creation of a policy and regulatory framework for joint management in biodiversity rich forest areas and in protected areas

- Need to elaborate new institutions and instruments by extending Joint Forest Protection and Management efforts to biodiversity rich areas

Project IV.9Creation of a policy and regulatory framework for management of biodiversity in forest areas

- Need to phase out practices such as clear-felling and auctioning of rights of collection of non-timber forest produce

Project IV.10 Creation of a policy and regulatory framework for in-situ protection of agro- biodiversity

- Agricultural development focus on enhancing production through HYVs, thereby eroding traditional crop genetic diversity

- Need to elaborate new institutions and instruments including promotion of organic agriculture and green markets
- Need to facilitate the conservation of indigenous breeds of livestock poultry and pets

- Need to fully involve tribals, marginal farmers and pastorals who often serve as stewards of agro-biodiversity resources

- Need to fully involve women who serve as managers of seeds and who value crop diversity for its nutritional value

Activity IV. 1 Policy Advocacy

- Need to promote new perspectives on biodiversity through public debate on relevant policy issues

ActivityIV.2 Formulation of Guidelines on Compensatory Activities to offset Biodiversity Loss

- Current provisions, for instance, for compensatory afforestation do not adequately reflect the need to make up the loss of biomass as well as biodiversity

Activity IV.3 Land Use Planning and Biodiversity Conservation and Integration thereof in the Plans of Concerned Agencies

- Need to develop appropriate guidelines for consideration by the broad spectrum of Governmental line departments whose activities impinge on biodiversity resources

- Need to focus on habitat integrity and connectivity

- Need to implement recommendations accepted in the course of environmental impact assessments

- Need to elaborate concepts like carrying capacity

- Need to create mechanisms for inter-sectoral co-ordination, e.g. with new bodies such as Karnataka Herbal Authority

STRATEGY V: STRENGTHENING CAPACITIES FOR INTEGRATING AND INSTITUTIONALIZING BIODIVERSITY CONSERVATION AND MANAGEMENT

- New perspectives and new activities require development of new institutional and human capacities

ACTION PLAN V: PROPOSED PROGRAMMES, PROJECTS AND ACTIVITIES

V.A INSTITUTIONAL CAPACITY PROGRAMME

Project V.A.1 Institutional capacity development for Civic Bodies

- Need to develop the capacity of civic bodies ranging from gram sabha and gram panchayats to municipalities, municipal corporations and zilla parishats to be alive to biodiversity concerns

Project V.A.2 Creation of a Geographical Information System data base on boundaries of forest and revenue land holdings

- Confusion in demarcation of land holdings in Revenue and Forest department records a significant threat to biodiversity rich areas

- Modern information technology tools such as Geographical Information System could resolve these difficulties

Project V.A.3 Creation of satellite imagery based database on boundaries of Protected Areas

- On-going encroachments a significant threat to biodiversity rich areas

- Satellite imagery provides reliable evidence on timing and extent of encroachment and would be a powerful tool to control them

- Important to prevent disruption of habitat corridors

Project V.A.4 Creation of satellite imagery based database on boundaries of wetlands

- On-going encroachments a significant threat to biodiversity rich wetland areas

- Satellite imagery provides reliable evidence on timing and extent of encroachment and would be a powerful tool to control them

Project V.A.5 Creation of satellite imagery based database on the coastal zone

- On-going encroachments a significant threat to biodiversity rich coastal areas

- Satellite imagery provides reliable evidence on timing and extent of encroachment and would be a powerful tool to control them

Project V.A.6 Establishment of State and District level Biodiversity Information Systems

- A computerized distributed biodiversity information system linking multi-scale, multi-agency inputs a vital tool

- Capitalizing on Karnataka's strengths in information technology

Project V.A.7 Building the capacity to handle IPR issues

- Need to create awareness and build the capacity in all sectors: Scientists and Technologists, Government officials, private sector and local knowledgeable individuals

Project V.A.8 Building the capacity of Coast Guards for protection of marine biodiversity resources

- Currently there is no machinery to enforce regulations relating to fishing activities in the open sea

- Need to build the capacity of Coast Guards to play this role

Project V.A.9 Promotion of NGO role in enhancing the quality of functioning of biodiversity management institutions at various levels

- Significant role of NGOs as watch dogs, as agencies to work with public to protect biodiversity

- Need to systematically create avenues for NGO involvement at state, district and Panchayat levels as members of committees, through public hearings and other mechanisms to ensure full access to pertinent information

Project V.A.10 Enhancing the quality of Environmental Impact Assessment

- Ensure independent selection of organization undertaking EIA by some authority such as the State Biodiversity Board

- Ensure independent peer review of EIAs by some authority such as the State Biodiversity Board

- Create institutional mechanisms to monitor proper implementation of EIA based recommendations

Project V.A.11 Promotion of NGO role in enhancing the quality of Environmental Impact Assessment Exercises

- Need to systematically create avenues for NGO involvement as members of committees, through public hearings and other mechanisms to ensure full access to pertinent information

Project V.A.12 Promotion of NGO role in enhancing the quality of monitoring of pollution Impacts on biodiversity

- Need to systematically create avenues for NGO involvement as members of committees, through public hearings and other mechanisms to ensure full access to pertinent information

V.B HUMAN RESOURCES DEVELOPMENT

Project V.B.1 Development of Capacity on Biodiversity Planning:
I. Private Sector Stakeholders

- Need to involve private sector stake holders such as Pharmaceutical, Bioinformatics, Biocosmetics, Seed or Ecotourism companies

Project V.B.2 Development of Capacity on Biodiversity Planning:
II. Government Decision Makers at State, district and village panchayat levels

- Need to familiarize decision makers at the various levels with new perspectives and activities

- Need of exposure to concepts of carrying capacity

Project V.B.3 Development of Capacity on Biodiversity Inventorying and Monitoring: School and College Teachers

- Educational institutions have an important role in generating time and locality specific information on biodiversity resources through scientific observations as well as by working with local knowledgeable individuals

- Need to train and equip teachers and students to play this role

Project V.B.4 Development of Capacity on Biodiversity Inventorying and Monitoring: Government agency personnel

- Government agencies have an important role in generating time and locality specific information on biodiversity resources through scientific observations as well as by working with local knowledgeable individuals

- Need to train and equip Government agency personnel to play this role

Project V.B.5 Development of Capacity on Biodiversity Inventorying and Monitoring: Folk ecologists

- Tribals, fisher folk, farmers, pastorals have significant stocks of knowledge on local biodiversity resources

- Important to develop their capacity to contribute to community based biodiversity inventorying and monitoring efforts

- Important to develop their capacity to contribute to community based conservation and sustainable use efforts

Activity V.B.1 Formation of a committee to develop curricula and educational material

- Need to revisit educational curricula to include first hand observations on biodiversity elements as well as interactions with local knowledgeable individuals as a component of educational activities

- Need to develop programmes and material for neo-literates and other adults
- Need to document positive experiences such as Kodagu devera kadus

- Need to develop special material for local knowledgeable individuals

STRATEGY VI.

MOBILIZING AN INTEGRATED INFORMATION, EDUCATION AND COMMUNICATION SYSTEM FOR BIODIVERSITY CONSERVATION

- Need to promote biodiversity management as a broad based, participatory activity grounded in a sound base of information; an activity appropriate for the modern biotechnology and information technology age

ACTION PLAN VI: PROPOSED PROGRAMMES, PROJECTS AND ACTIVITIES

VI.A BIODIVERSITY CONSERVATION AWARENESS AND INFORMATION PROGRAMME FOR LOCAL COMMUNITIES

Project VI.A.1 Biodiversity Inventory and Monitoring educational material and training programmes for School and College Teachers and Students

- Need to develop appropriate human capacities

Project VI.A.2 Community Organizing and Biodiversity Conservation Training for Local Stakeholders

- Need to develop appropriate human capacities

- Need to fully involve women and weaker segments of the population in conservation efforts

VI.B COMMUNITY-BASED BIODIVERSITY CONSERVATION EDUCATION AND RESEARCH PROGRAM

Project VI.B.1 Technical Competency Training on Biodiversity Research and Management Information System

- Need to develop appropriate human capacities at Government agencies, local educational institution, Panchayat levels

- Need to develop appropriate human capacities of local knowledgeable individuals such as medicine men, fisherfolk, forest produce collectors, stewards of sacred groves or ponds

Project VI.B.2 Establishment of a Pilot Village Biodiversity Research and Management for Biodiversity Information system

- Need to initiate activities on a pilot scale in a group of specially selected villages, e.g. those involved in good management of medicinal plant resources

Project VI.B.3 Community Based Development and Management for Biodiversity Education for local Communities

- Need to initiate activities on a pilot scale in a group of specially selected villages, e.g. those involved in good management of Devara Kadus of Kodagu

- Need to fully involve women and weaker segments of the population in such activities

VI.C VALUE ADDED PRODUCTS AND ALTERNATIVE SUSTAINABLE LIVELIHOOD DEVELOPMENT FOR BIORESOURCES DEPENDENT COMMUNITIES

Project VI.C.1 Local Capability Building for Development and Management of Biodiversity based Enterprises such as ecotourism

- Need to initiate activities on a pilot scale in a group of specially selected villages, e.g. those with high levels of potential for participation in ecotourism activities on the periphery of National Parks

Project VI.C.2 Local Capability Building for Development and Management of Biodiversity based Enterprises such as collection, cultivation and value addition to medicinal plants

- Need to initiate activities on a pilot scale in a group of villages specially selected for the ready availability of medicinal plant resources and potential for value addition

- Need to work with private sector to organize buy-back agreements and other biodiversity friendly measures

3.Methodology

I. Initiation of the process with a meeting in CES, IISc, Bangalore, on 12th October 2000 involving experts from various fields.

II. Press conference was held at CES, IISc, Bangalore, on 12th January 2001 to disseminate information relating to the KBSAP project.

III. Initiation of the school level activities with a pilot workshop at Nagavalli, district Tumkur, involving 50 school teachers from 17 districts of the state, experts from various fields of biodiversity, Govt. officials and the local knowledgeable individuals.

IV. Publishing articles on the six selected themes (Protected areas, Medicinal plants, Fresh water fishes, Wetlands, Traditional conservation practices and crop genetic diversity) both in Kannada and English news papers, between 14th January 2001 and 17th March 2001 to get responses from the readers. The responses received were analyzed and later on served as inputs for the development of the strategy and the action plan.

V. Dr. M. D. Subash Chandran has prepared the Strategy and Action Plan for Uttara Kannada District, Dr. Ranjit Daniels has prepared the Strategy and Action Plan for the Western Ghats Eco-region and Dr. M. N. Madhyastha has prepared the Strategy and Action Plan for Coastal ecosystem. These inputs have also fed i into the KBSAP report.

VI. A very well received programme – 'Dhareya Siri' on KBSAP was prepared by All India Radio, Bangalore along with CES and broad-cast simultaneously in Kannada from all 13 stations in the state between 6th June 2001 and 9th September 2001. The programme focussed on the six themes (Protected areas, Medicinal plants, Fresh water fishes, Wetlands, Traditional conservation practices and crop genetic diversity) in 14 episodes alternating with interaction episodes, involving

school teachers and students, experts, govt. officials and NGO's to get feed back from a broad cross section of the society. The AIR team visited several sites in Karnataka to interview people. AIR estimates that between six to seven lakh people listened to each of these episodes. 3,674 people registered as participants in the programme. Over 780 people wrote letters providing detailed comments and suggestions. About 600 people appeared for a written examination on the topic on 29th August 2001. The feed back received was analyzed and incorporated in developing the KBSAP.

VII. Fifty schools from 17 districts of the state undertook to develop School Biodiversity Registers (SBR) dealing with one or more of the following five themes: Medicinal plants, Fresh water fishes, Wetlands, Traditional conservation practices and crop genetic diversity. All schools also carried out a background study, which involves mapping exercise and documentation of flora and fauna of the study area. The methodology of the thematic studies involved field work and interviews in close collaboration with the local community. There were five training programmes and three review meetings with the teachers. The best 3 reports per theme were selected and prizes were awarded to the school teams. All the Strategy and Action Plans suggested in the SBR reports were analyzed and incorporated in the KBSAP.

VIII. Commissioned papers on the six themes were prepared by a panel of experts headed by:

1) Protected areas: S. G. Neginhal IFS (Retd.)
2) Medicinal plants: Dr. Amit Agarwal, Director, Natural Remedies
3) Wetlands: S. Sridhar, INCERT
4) Fresh water fishes: H. N. Chandrashekaraiah, Retd. Director, Fisheries Dept.
5) Traditional conservation practices: Dr. C. G. Kushalappa, Forestry College
6) Crop genetic diversity: Dr. T. S. Channesh, KSCST

IX. Four case studies were carried out by two NGOs:

1) Protected areas- Bhadra Tiger Reserve, Wildlife Aware Nature Club, Tumkur.
2) Wetlands- Amanikere, Wildlife Aware Nature Club, Tumkur
3) Conservation of Fishes: Hassan district - Society for Advancement of Aquaculture, Bangalore
4) Conservation of Fishes: Davanagere district. - Society for Advancement of Aquaculture, Bangalore

X. All the inputs received from these exercises were used to stimulate discussions at a series of six public meetings at Ponnampet, Shishila, Tumkur, Raichur, Davanagere and Bangalore on the six themes, Traditional conservation practices, Fresh water fishes, Medicinal plants, Crop genetic diversity, Wetlands and Protected areas respectively. These provided additional inputs for the preparation of the strategy and action plan.

XI. All these workshops were extensively covered by media like; E-TV, Udaya TV, and many Kannada and English newspapers.

XII. A final one-day state level meeting held on 11/11/01 debated and provided inputs for the draft of KBSAP.

XIII. The Karnataka State Government constituted a Project Steering committee under the chairmanship of the Chief Secretary, Govt. of Karnataka with 17 members from different fields. The committee met on 13th July 2001 and 26th December 2001 to guide the process and to finalize the KBSAP document.

XIV. A number of follow up actions is under progress: The final KBSAP report forwarded by the Government of Karnataka to the Government of India would be disseminated at a press conference.

XV. Thirteen schools selected on the basis of their performance in the School Biodiversity Register programme will take up more carefully designed year-round activities encompassing the entire Panchayat level with additional literature,

resource materials and training programmes. This would help develop a model to be disseminated more widely throughout the state.

XVI. We will identify with respect to the different elements of the KBSAP agencies that could play a constructive role in the follow up process. These would include government departments, private enterprises as well as civil society organizations. The relevant KBSAP elements would be communicated to them and attempts would be made to promote appropriate policy initiatives, as well as action programmes. Such action has already been initiated with respect to the Indo-Norwegian Environment Programme.

4. Process details:

The KBSAP process has occupied a total of fifteen months beginning October 2000, and leading to the finalization of the strategy by the end of December 2001. Table 1 summarizes the time course of these activities.

Acknowledgement

The Karnataka state Biodiversity Strategy and Action Plan (KBSAP) has been a cooperative endeavor involving a very large group of people who have provided valuable inputs in a variety of roles. A steering committee chaired by the Chief Secretary, GoK, guided this process. A number of experts helped us device the methodology, prepare expert papers, undertook special studies and helped draft the final document. A number of school teachers and students brought in important insights by working with local people in their own study areas. The All India Radio developed and broadcasted fourteen episodes, which brought in responses from a large number of listeners. Many journalists and newspapers helped by publishing articles, which lead to responses from large number of readers.

Many members if the Centre for Ecological Sciences put in tremendous effort in organizing the whole programme. Thus, an impressive number of Government officials both serving and retired, Scientists and other academics, teachers and students, persons from broadcast and print media, members of industry and environmental NGO's, dispensers of herbal medicine, fishermen and women, farmers and tribals contributed in many different ways to this effort. We also received considerable support from colleagues involved in the larger NBSAP process. I apologize that I am not able to name all of them personally here. However we have attempted to provide a comprehensive list of all those who have made this participatory effort possible in Annexure K and L.

Madhav Gadgil

Convenor

KBSAP

Annexure A: Correspondance

तार :
Telegram : PARYAVARAN.
NEW DELHI
दूरभाष :
Telephone :
टेलेक्स :
Telex : W-66185 DOE IN
FAX : 4360678, 4361704

Vinod Vaish
Special Secretary

सत्यमेव जयते

Email: vaish@envfor.delhi.nic.in

भारत सरकार
पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS
पर्यावरण भवन, सी. जी. ओ. कॉमप्लेक्स
PARYAVARAN BHAWAN, C.G.O. COMPLEX
लोदी रोड, नई दिल्ली-110003
LODI ROAD, NEW DELHI-110003

URGENT

D.O. No. J 22018/25/97-CSE(BC)

19 May, 2000

Dear Shri Bhattacharya,

The Ministry of Environment and Forests has prepared a National Policy and Macrolevel Action Strategy on Biodiversity through an extensive consultative process. A copy of this document is enclosed. This document is a macro level statement of policies, gaps and further actions needed for conservation and sustainable use of biological diversity. There is a need to prepare detailed microlevel action plans at state and regional levels based on this framework document. Towards this end, the Ministry has accessed funding from the Global Environment Facility (GEF) for preparing a detailed National Biodiversity Strategy and Action Plan (NBSAP).

The NBSAP project envisages assessment and stocktaking of biodiversity-related information at state level including distribution of endemic and endangered species and site specific threats and pressures. Key features of this project include an emphasis on decentralised state level planning, and the use of interdisciplinary working groups to involve all sectors concerned with biodiversity conservation. These detailed State level action plans will be consolidated and a national level action plan will be developed. Towards this end, it is envisaged that action plans will be prepared (i) for 14 themes relating to biodiversity at the national level, (ii) for all states and union territories, (iv)for 9 inter-state eco-regions, and (v) for 17 sub-state, local sites which have been identified as biodiversity rich niche areas.

The NBSAP project is for a duration of two years. MOEF is the executing agency for the project. To oversee the implementation of the NBSAP project, a Steering Committee has been constituted under my chairmanship with the Joint Secretary incharge as the Member Secretary and the National Project Director. Implementation of the BSAP Project would be done through a consortium arrangement between Biotech Consortium India Ltd. (BCIL) and Kalpavriksh (an NGO with wide experience in Biodiversity Conservation headed by Shri Ashish Kothari). While BCIL is the Coordinating Agency to deal with administrative financial and logistic arrangements, Kalpavriksh is the Coordinator of a Technical and Policy Core Group (TPCG) which will be responsible for technical execution of the project.

The NBSAP project was formally launched by the Minister for Environment and Forests on 11.4.2000. A Process Outline of NBSAP and a Call for Participation are enclosed.

For developing the State level plans, a nodal agency has to be identified to function as facilitator. This nodal agency will work under the guidance of a State Steering Committee to be appointed by the State Government with members from various concerned Departments and sectors. The Technical and Policy Core Group has identified Centre for Ecological Sciences, Indian Institute of Science, Bangalore as the nodal agency for your State. Some amount of financial assistance would be made available to the State nodal agency for this purpose. Kindly let us know immediately that this arrangement would be acceptable to your State Government.

In order to evolve a common methodology and understanding amongst all the executing and participating agencies/individuals, it is proposed to organise an Inaugural National Workshop of the NBSAP on 23 and 24 June, 2000 in New Delhi. This will be a two-day Inception-cum-Training Workshop for the key individuals who will be implementing the project relating to preparation of Action Plan at the State and regional levels. The workshop will facilitate the participants to understand the approach and methodology of the NBSAP process. The participants to the workshop will include representatives of State level nodal agencies, coordinators of the thematic working groups, TPCG members, Steering Committee members, representatives of other Central sectoral Ministries/Departments, Industry. The expected number of participants is about 120-150.

We shall appreciate it if you could kindly confirm acceptability of the identified nodal agency in your State or suggest an alternative and also facilitate participation of one or two key persons to represent the State Government in the National workshop on 23 and 24 June, 2000.

It is requested that the names and other details of the nodal agencies and the contact person may please be communicated to the Managing Director, Biotech Consortium India Ltd. (Kundan House, 4th Floor, 16 Nehru Place, New Delhi - 19, Tele: 6415314; 6415385) directly, to enable them to send further relevant information regarding the workshop.

Yours sincerely

(Vinod Vaish)

Shri B.K. Bhattacharya,
Chief Secretary,
Government of Karnataka,
Vidhana Soudha,
Bangalore-560001.

तार :
Telegram : PARYAVARAN,
NEW DELHI
दूरभाष :
Telephone:
E-Mail Address :

RECEIVED
16 SEP 2000

R.H.Khwaja
Joint Secretary

भारत सरकार
पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS
पर्यावरण भवन, सी. जी. ओ. कॉम्पलेक्स
PARYAVARAN BHAVAN, C.G.O. COMPLEX
लोदी रोड, नई दिल्ली-110003
LODHI ROAD, NEW DELHI-110003

D.O.No. J-22018/25/99-CSC(BC)

September 13, 2000

Dear Dr. Gadegkar,

This has reference to Karnataka Government's order no. FEE 194 ENV 2000, Bangalore dated 22.08.2000, designating CES as the nodal agency for **Karnataka** for National Biodiversity Strategy and Action Plan (NBSAP) project. A copy of this communication is enclosed. We are happy that you will be an important partner in this national endeavour.

You may note that for preparing the Strategy and action plan (SAP) for Karnataka, a sum of Rs. 5.0 lakhs (Rupees Five lakhs only) will be made available, of which fifty per cent will be released initially. Twenty-five per cent of funds will be released on submission of detailed interim report, within seven months of the release of the first instalment and remaining 25% after submission of the final report within ten months of the release of first instalment.

For ensuring smooth functioning of the project you will have to enter into a Memorandum of Understanding with the National Project Director. Two copies of the MoU are enclosed. You may kindly send both these copies back to us duly signed.

For preparing the SAP, you may seek the assistance and involvement of the relevant district and forest authorities, if needed,. In case you have any further clarifications, you may kindly get in touch with BCIL, Coordinator, Technical and Policy Core Group or the undersigned.

We are confident that with your valuable contribution, we shall accomplish the task of preparing NBSAP successfully.

Yours sincerely

With Kind Regards,

(R.H.Khwaja)

Dr. Raghvendra Gadegkar,
Director,
Centre for Ecological Sciences,
Indian Institute of Science,
Bangalore – 560 012
Karnataka

G.LATHA KRISHNA RAO, IAS

12/2/02.

FEE 194 ENV 2000

12-2-2002.

Dear Shri Varma,

Sub: Submission of Karnataka Bio-diversity Strategy & Action Plan.

Ref: Your D.O.letter to Shri Gokulram, Principal Secretary, Department of Forest, Ecology & Environment.

The Karnataka State Steering Committee under the Chairpersonship of Chief Secretary, Government of Karnataka reviewed on 26-12-2001 the National Bio-diversity Strategy & Action Plan (NBSAP) prepared by the Center for Ecological Sciences, Indian Institute of Science which is the nodal agency. The framework device covers the following six broad strategies.

a) Expanding & improving knowledge of the characteristics, uses and values of biological diversity.
b) Enhancing and integrating existing and planned in-situ and ex-situ Bio-diversity conservation efforts.
c) Promoting sustainable use of Bio-diversity resources
d) Formulating an integrated policy and legislative framework for the Conservation, sustainable use, and equitable use, and equitable sharing of benefits of biological diversity
e) Strengthening capacities for integrating and institutionalizing Bio-diversity Conservation and management.
f) Mobilising an integrated information, education and communication system for Bio-diversity conservation.

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As per the deliberations held during the meeting, the plan in corrected form was submitted to this department. A copy of the same is recommended and forwarded for consideration to integrate into National Bio-diversity Strategy and Action Plan.

With regards,

Yours sincerely,

(G.Latha Krishna Rao)

Shri Desh Deepak Varma,
Joint Secretary to
Government of India,
Ministry of Environment & Forests,
Paryavarana Bhavan, C.G.O. Complex,
Lodi Road, NEW DELHI- 110003.

Copy to

Professor Madhav Gadgil, Indian Institute of Science, Bangalore-560 002.

Secretary, Government of K
Strategy & Action Plan

Annexure B: Steering Committee:

Chairperson:

Ms. Theresa Bhattacharya, I.A.S.
Chief Secretary to Government,
Government of Karnataka,
Vidhana Soudha,
Bangalore

Members and special invitees:

1. Shri. N. Gokulram, I.A.S.
   Principal Secretary to Government,
   Forest, Ecology and Environment
   Department, M. S. Building,
   Bangalore

2. Ms. G. Latha Krishna Rao
   Secretary to Government,
   (Ecology & Environment)
   Forest, Ecology and Environment
   Department, M. S. Building,
   Bangalore

3. Ms. Anita Kaul
   Former Secretary to Government,
   (Ecology & Environment)
   Forest, Ecology and Environment
   Department, M. S. Building,
   Bangalore

4. Prof. Rajashekar Patil,
   Mangalore University,
   Konaje 575 199
   Mangalore

5. Prof. M. N. Madhyastha,
   Dept. of Bioscience,
   Mangalore University,
   Konaje 575 199
   Mangalore

6. Sri. S. K. Chakrabarthi,
   Principal Chief Conservator of Forests
   (Wild Life) Aranya Bhavan,
   Malleswaram, Bangalore 560 003

7. Dr. M. H. Swaminath,
   Conservator of Forests (Development)
   Aranya Bhavan, Malleswaram,

Bangalore 560 003

8. Shri. Darshan Shankar,
FRLHT, No. 50, MSH Layout,
Anand Nagar,
Bangalore 560 024

9. Dr. M. D. Subash Chandran
Dr. A. V. Baliga College,
Kumta
Uttara Kannada

10. Dr. Balakrishna Gowda,
Head, Dept. of Botany,
University of Agricultural Sciences,
Bangalore 560 065

11. Dr. S. B. Ganjigatti,
Member Secretary,
Karnataka State Pollution Control Board,
N. S. Bose Building
M. G. Road,
Bangalore 560 001

12. Dr. R. V. Hiremath,
Associate Director of Research,
University of Agricultural Sciences,
Dharwad

13. The Principal Chief Conservator of Forests,
Aranya Bhavan,
Malleswaram
Bangalore 560 003

14. Prof. Ravindra Paul,
Department of Zoology,
Gulbarga University,
Gulbarga

15. Dr. Srinath Rao,
Department of Botany,
Gulbarga University,
Gulbarga

16. Dr. R. J. Ranjit Daniels,
Care Earth
Shrinivas, 5 (Old no. 3)
21st Street, Thillaiganga Nagar
Chennai 600 001

17. Shri. R. K. Agarwal,
Principal Secretary to Government,
Department of Agriculture,
M. S. Building,
Bangalore

17. Dr. Thripati,
Member Secretary,
Karnataka State Pollution Control Board,
N. S. Bose Building
M. G. Road,
Bangalore 560 001

18. Prof. Madhav Gadgil
Centre for Ecological Sciences,
Indian Institute of Science,

Bangalore 560 012

19. Shri. Harish Bhat
    Centre for Ecological Sciences,
    Indian Institute of Science,
    Bangalore 560 012

20. Dr. M. H. Balakrishnaiah,
    Director (Technical Cell),
    Forest, Ecology and Environment
    Department, M. S. Building,
    Bangalore

Annexure C: Working group

Karnataka Forest Department

Dr. Swaminath, Conservator of Forests, Aranya Bhavan, Bangalore
Dr.Ravi Ralph, Conservator of Forests, Mysore Circle, Mysore
Dr. C. D. Dyavaiah, Conservator of Forests, Vana Vikas, Bangalore
Shri.G. N. Srikantaiah, Deputy Conservator of Forests, Tumkur
Shri. Jayaram, Deputy Conservator of Forests, Kolar

Wildlife Aware Nature Club

Shri. T. V. N. Murthy
Dr. Ameen Ahmed

Pharmaceutical industry
Dr. Amit Agarwal, Director, Natural Remedies, Bangalore
Shri. O. J. Colaso, Karnataka Ayurvedic Manufacture's Association, Bangalore

F. R. L. H. T.

Shri. Darshan Shankar, Director
Ms. Prathima

Govt. Ayurvedic College, Bangalore

Dr. Sathyanarayana Bhat

Two teachers from SBR group:

Shri. C. Yathiraju
Shri. B. V. Gundappa

Wildlife

Shri. Neginhal, IFS (Retd.)

Fisheries Department

Shri. H. N. Chandrashekaraiah, Former director of fisheries dept.
Dr. M. F. Rahaman, Scientist, Fisheries Department
Dr. Shyam Bhat, Fisheries Department

Wetlands

Shri. S. Sridhar, INCERT, Bangalore

Forestry College, Ponnampet

Dr. C. G. Kushalappa

KSCST

Dr. Chennesh

CES

Prof. Madhav Gadgil
Shri. Harish R. Bhat
Shri. Srinidhi S.

Annexure D: Minutes of Workshops

Six workshops on KBSAP from October 10th – November 1st 2001 held at Tumkur, Shishila, Davanagere, Kodagu, Raichur and Bangalore

I. Medicinal Plants Workshop held at Information Centre, Namadha Chilume, Devarayana Durga, Tumkur on 17th October, 2001

Number of participants: 60
Different organizations participated:
Tumkur Science Centre
Karnataka State Forest Department
F.R.L.H.T
Educational institutions:
1) Govt. High School, Mala
2) Nehru Memorial P. U. College, Sulia
3) S. V. S. High School, Agumbe
4) Visheveswaraya High School, Bhadrawathi
5) Veerabhadreshwara High School, Godachi
6) Berchman's High School, Chikmagalur
7) Govt. Jr. College, Malur
8) Govt. High School, Kustagi
9) Govt. P. U. College, Raichur
10) RVPPU College, Tumkur
11) Vidyabodhini High School, Sullia

Minutes:

A one day workshop on the theme ' Medicinal Plants' as a part of KBSAP – SBR was held at Namadha Chilume Information Centre, Devarayana Durga, Tumkur on 17th October, 2001. Teachers from six districts of the state had come to tumkur with one local knowledgeable individual and two students. There were many locals from all different sectors who participated actively in the discussion.

The participants included: Prof. Madhav Gadgil, Shri.G. N. Shrikantaiah, DCF, Tumkur, Shri. Darshan Shankar, FRLHT, Dr. Amit Agarwal, Natural Remedies, Dr. Sathyanarayana Bhat, Govt. Ayurvedic College, Bangalore, Shri. C. Yathiraju, Tumkur Science Centre, and Shri. O. J**.** Colaso , Karnataka Ayurvedic drug Manufactures Association, Bangalore.

Five vaidyas were also invited The participants endeavoured to share their views regarding the strategy and action plan drafted for medicinal plants conservation. Some of the highlighting points of the meeting were:

- Medicinal Plant must be properly documented along with their medicinal importance and priority

- Proper awareness need to be created among the public regarding the use and importance of the medicinal Plants

- 50% of the Known Medicinal plants available, represent 0.1% of the total Karnataka states forest cover

- A local management committee could be thought of with respect to medicinal plants

- Primary focus should be on conserving wild population and endemic medicinal plants

- Long term monitoring of population of the medicinal plants using the local knowledge individuals must be planned

- There needs to create an in-situ gene bank for the medicinal plants

- Proper Medical plant seed center needs to be thought of locally.

- Regulation of one plant has caused a lot of damage and infact has been determined in the disappearance of several medicinal plants

- Creation of MPCA's infact has lead to greater exploitation

- There are exploitation of Medicinal Plants by the contractors
- Some feel that MPCA concept has become useless as it does not actually regulate human activities and local people are not being involved fully.

- MPCA could be strengthened by creating awareness, locally.

- There needs a solution for conserving Medicinal Plants growing near bunds and hedges

- Kitchen herbal gardens, sacred groves managed by for MPCA,s could be thought of for conserving Medicinal Plants. This could also help in proper management of Medicinal Plants.

- Bare foot taxonomists in the grass root level must be encouraged

- There should be a Grama Aranya Mandali,s locally.

- Nati vaidya,s need not be taxed

- Commercial exploitation of Medicinal Plants from wild should be taxed severely, If there is a tax levied on the commercial exploitation of Medicinal Plants some amount must go to the panchayat
- Nati vaidyas should be permitted to collect medicinal plants every where
- License should be obtained from panchayat for collecting the Medicinal Plants
- If any medicinal plants are to be utilized, then a proper permission letter to be procured
- Tax on nati vaidyas is ridiculous as they serve the society freely
- Awareness regarding medicinal plants to be created through primary education.
- All nati vaidyas should be registered in the panchayat and the registered vaidyas should be permitted to collect Medicinal Plants freely.
- Nati vaidyas possessing the identity cards, should be permitted to collect any herbs
- Medicinal plants conservation and awareness must be a part of the syllabus
- Proper documentation of the medicinal plants is very crucial
- Panchayat libraries should be equipped with books relating to Medicinal materials for cultivating

- Medicinal Plants should be looked there should be a buy back guarantee between the farmers and the company before cultivating any medicinal plants commercially.
- Nati vaidyas need to be recognized and encouraged locally
- Statistics of raw products is required before talking about profits from cultivating Medicinal Plants.
- Cultivating medicinal plants without pesticides and with manners does not lose its medicines properties.

II. Fresh Water Fishes Workshop held at Shishileshwara Temple, Shishila on 12th October, 2001

Number of participants: 86
Different organizations participated:
Nagarika Seva Trust, Belthangadi
Mathsya Hitha Rakshna Vedike, Shishila
Shishileshvara temple trust, Shishila
Gram Panchayat, Shishila
Fisheries Department, Mangalore and Bangalore
College of Fisheries, Managlore
Karnataka Forest Department, Belthangadi.
Education institutions:
1)Govt. Jr. College, Srirangapatna
2) Rotary High School, Mandya
3) Govt. P.U. College, Pavagada
4) Govt. School, Brahmasandra, Tumkur
5) N.V.S. Girls High School, Tumkur
6) Sri. Maruthi High School, Korategere, Tumkur
7) Govt. P. U. College, Nagavalli, Tumkur
8) M. G. M. G. High School, Madhugiri
9) Hiryur High School, Hiryur, Shimoga
10) Seethamma P.U. College, Davanagere

Minutes:

The participants included: Prof. Madhav Gadgil, Shri. H.N.Chandrashekariah, Dr. Shyam Bhat, Dr. M. F. Raman , Shri. Shamappa Daithota, Ms. Vidya Nayak, Shri. Manjunath Shetty, Shri. Veerappa Gowda, Shri. K. Narayana & Dr. Bhat. Participants in the discussion included temple authorities, tribals, local knowledgeable individuals. Teachers from five districts of the state had participated along with the students and one knowledgeable individual from each institution. The outcome of the discussion were:

- There has to be strict been on poisoning and dynamiting considering the conservation of aquatic fauna and water quality.

- Fish migrating area and breeding areas has to be identifies and properly protected

- There should be more emphasis on local active groups to make them come forward for conservation

- Avenues for increasing protection and conserving fish has to be explored

- Seasonal Protection need to be given and identified Properly

- There should be ban on dynamiting and Poisoning strictly, and culprit has to be prosecuted immediately.

- Hence, the Possibility of getting dynamite has to be reduced drastically

- Rights of collecting fee for fishing has to be given to the local organization them the panchayat

- Fishing to be sustainably regulated

- Sand removal to be regulated to the limited quantity

- Ague culture in paddy fields could be promoted. Conserving paddy field is a must, as they provide good habitat for many species
- Regulate mesh size

- While giving contact, preference should be for local cooperative union and not Outsiders

- Owner ship of the tank needs to be considered

- Gram Panchayat can take responsibility of tank contract, regulation

- The rights over the tank should not only be with the panchayat, but also other local organizations.

- Certain financial support to be provided to the local conservation unit for tank and fish protection

- To get the proper fingerlings, fish culture centres should be established could access easily, instead of the travelling all the way to get fish fingerlings

- There should be more interaction between people, panchayat and departments

- Creating awareness and educating, before carrying out any conservation activities

- There should be regulation in excess feeding of the fishes by the public at religious rituals and festivals for which, the food offered by devotees has to be collected at one place and fed occasionally along with clearing the stagnant water during summer.

III. Wetland Workshop held at Bala Bhavana, Davanagere on 18th October, 2001

Number of participants: 45
Different organizations participated:
Bharathiya Gnyana Vignyana Samithi, Davanagere
Jeevana Shikshna Kednra, Davanagere

Tumkur Science Centre, Tumkur
Wildlife Aware Nature Club, Tumkur
Watershed management committee, Bangalore
Educational institutions:
1) St. Theresa High School, Belthangadi
2) K. S. P. M. Govt. High School, Karkala
3) Vidyodaya P. U. College, Yadahalli, Sirsi
4) Kalidasa Jr. College, Tumkur
5) Govt. Hr. Pr. High School, Tumkur
6) Govt. P. U. College, Yelaburga
7) Govt. High School, Yeramarus, Raichur
8) Anand High School, Raichur
9) Govt. P. U. College, Koratagere, Tumkur

Minutes:

The participants included: Prof. Madhav Gadgil, Dr. Madan Gopal, Shri. Shadaksharappa.

Dr. Madan Gopal presented his planned work in Karnataka state for the conservation and management of water bodies. The Annual mainfall in the state ranges from 466mm 4600 mm. About 54% (16% of india) area in Karnataka is declared as drought prone area (88 districts). Out of the desired 6,84,500 ha achkat areas, only 2,40,000 haare exisiting as of now Regulation and management of the tanks – 4 ha and lesser area – comes under Taluk panchayat 4-40 ha comes under ZP, and 40- 2000 ha comes under mainor irrigation dept. Management of tanks in this form is not functioning up to the mark.

Lateron, the discussion was elaborate with the following inputs and suggestions from the public:

- There is lack of integrated and participatory approach in management, regulation and conservation of the tanks.
- The destruction of water course origin must be prohibited
- Gokatte construction concept has aided in increasing water table
- Integrated tank management act which would cover all aspects like fisheries, irrigator etc, has to be looked at
- There has to be a proper under standing between the Govt., and the locals

- All the tanks should be handed over to the local organizations, which would be strengthened to protect, regulate and manage the tank. All the legal rights over the tanks must be given to the local organization.
- There needs to be more stress on the catchment area too, as they would also be very important in conservation of tank
- There should be brood programs of creating awareness among the public
- A portion of the profit gained by the fish contractor must go to the panchayat and local panchayat should levy cess on the contractors
- Local fisherman union or local tank development union could be empowered to collect the cess and only a portion must go to the panchayat. Rest of the money should be utilized for the conservation of the tank and welfare of the union.
- Dynamiting and poisoning must be banned completely throughout the state
- Contract must be given only to the locals and not to the private departments
- The changing of the water course must be stopped throughout the state
- Demarcation of the wetland to be taken up
- Community should be given the ownership of the tank so that they could be able to act on the encroachment
- There needs serious persuasion of the community against encroachment
- Pollution tax should be imposed heavily on the polluter
- Local communities to be involved during desalting programme
- Before desilting the tank, sufficient publicity should be given to local, so that formers would come forward to take the desilted soil.
- Water regulating guard, need to be appointed locally
- Panchayat or the local organization should be employed to take action

IV. Traditional conservational practices held at Kodagu on 10th October, 2001

Number of participants: 52

Different organizations participated:

Forestry College, Ponnampet

Karnataka Forest Department, Coorg

Devarakaadu Samithi

Centre for Environmental Education, Coorg Circle

Coorg Wildlife Society, Coorg

Tunkur Science Centre, Tumkur

Govt. Ayurvedic College, Bangalore

Educational institutions:

1) S. V. V. P. High School, Tumkur

2) Seethamma P. U. College, Davanegere

3) Govt. High School, Manvi

4) Govt. P. U. College, Korategere, Tumkur

5 Govt. High School, Koodabettu, Karkala

6) Kausalya High School, Mandya

Minutes:

The participants included: Shri. Anur Reddy, Conservator of Forests; Prof. Madhav Gadgil, Shri. Srivastava, Deputy Conservator of Forests; Shri Swamy Rao, Director of Forestry College; Shri. C.Yathiraju, Tumkr Science Centre, Dr Sathyanarayana Bhat, Govt. Ayurvedic College, Bangalore. Five of the temple committee members were awarded for their contribution towards conservation of Devarakadu. Few on the highlights from the discussion are:

Management of the sacred groves:

Taluk level Committee to be set up this was possible through the active members of these committee – forestry College. NGO's CEE along with Members from the local level committee's at the Village level. Forest department had co-operated actively in this activity.

Rights of this Committee: Felling of tree is restricted in this area. If a tree is felled, then 10% of the revenue would go to the devarakadu samithi. No cash crops are encouraged inside this devarakadu.

Responsibilities: Forest development must cooperate in the preparation of devarakadu working plan; Protection regulates – encroachment, fire and poaching activities.

Out of the Profit got from the devarakadu, 90% would go to the temple committee and 10% to the forest department. Out of 90%, 45%, as the devarakadu Samithi, remaining to temple/ village getting the trees, transporting them from the devarakadu and auctioning them is the responsibility of the forest dept.

Under each devarakadu temple committee, forest dept must come up with their respective management plan for the convenience of discussion the points were split as follows:

Sacred groves:

1. Area: Small; Large
2. Ownership: private; Govt
3. Protection / conservation: traditional, through system
4. Conservation of species
5. Seasonal Chanages
6. Ritual hunting practices
7. Gundu thopu concept
8. Gomala

- Gundu thopu Concept:

- Usually found near water bodies and comprising of various fruit yielding trees. These sere annual festival inside these groves where feast would also be arranged. Harvesting the resources from this Gundu thopu
- Was restricted to temple use only Possibility of recognizing Kans – kans were gives special status by the British.

- After independence, Kans were clear felled and Monocultures were raised. These are many rare Species in the Kans.
- All kinds of forests have equal rules and regulations. There is a need to document sacred groves in private holdings. Private land holding people must be given some incentives for conserving the sacred grove. There should be lot of encouragement for the Private land holders to conserve sacred groves. This compensation depends on the landscape elements. If the private holding sacred groves is taken over by the Gram panchayat, then the owner should be properly compensated. Awareness regarding the profit that would be gained should be created among the Villages. In an Instance near Pavagada 80 hectares of hillock is protected by the people of that village. They are planning to provide habitat and drinking water for peafowl and declare Navilu dhama . This require support firm Forest Department and Govt .
- Individual rights need to be considered.

- While looking at conservation, availability of the resources in the villages need to be addressed.
- Care should also be taken to think about in organic manure
- There must be a Programme for creating awareness ragarding the available law on protection and Conservation. School teachers need to be trained in the environmental education, by which the communication would be better and awareness Programme would be more fruitful

Ritual hunting:-

Educating the public is the only way where this problem could be partially solved.
NG0,s and concerned people could implement this activity . They hunting should be made symbolic and restrict to one animal only.
Fruit Yielding trees inside the sacred groves, should be considered as Gene bank. There should be awareness amongst public regarding Protection of water bodies in side the sacred groves.

V. Crop and Genetic diversity –Raichur 15th October, 2001

Number of participants: 103
Different organizations participated:
University of Agriculture Science, Raichur
Karnataka State Council for Science and Technology, Bangalore
Educational institutions:
1) Govt. High School, Belur
2) Chenamma PU. College, Kodagu
3) Govt. P. U. College, Raichur
4) Govt. High School, Raichur
5) Govt. P. U. College, C. N. Halli, Tumkur
6) Govt. High School, Godachi, Dharwad

Minutes:

Crop and Genetic diversity on 15/10/01 - Raichur

The participants included: Dr. S. A. Patil, Vice-Chancellor, Dharwad University, Dr. Lokesh, Scientist, UAS, Raichur, Dr. Chennesh, KSCST. Some of the highlighting points that had come in the discussions were:

- A Proper network of farmers could be thought of and a website would be considered for this purpose

- There are no centers for Crop and genetic diversity information. This kind of centre must be created.

- Local varieties of Crops are grown and maintained by farmers. They also market locally and distribute to the required. Some kind of incentives could be thought of, for maintaining such varieties

- There should be some Possibilities of creating markets for some varieties, locally, Hence there could be more additional to the market value which would in turn encourage farmers to grow more traditional varieties.

- Documentation and assessment of various Crop Varieties should be the top priority

- There should be some support price for the traditional variety by the Agriculture department

- The financial support which would be thought of to the farmers should be carefully examined and implemented, amidst of beurocracy.

- The financial assistance to the farmers would help a lot and encourage the farmers.

- The financial aid should directly come to the farmer and not through Panchayat

- Awareness should be created among the people and farmers regarding the traditional varieties.
- While using television or radio as the medium of educating and creating awareness, free timing of the farmers and common people must be considered.

- Encouragement to develop / activate these varieties as a hobby and make them aware of the market price would help the farmers to grow the traditional varieties.

- There must be a proper market window regarding these could be made in the local level and Panchayat level

VI. Workshop on Protected Areas held at CES, IISC, Bangalore on 1/11/01

Participants included Dr. M.H Swaminath (IFS), Prof. Madhav Gadgil, Shri. S. G. Naginhal (IFS, Retd.), Shri. T. V. N. Murthy (WANC), Shri. A. N. Yellappa Reddy, Shri. Suresh Heblikar, Shri. Manu, Shri. B. K. Parmeshwar Rao, Shri. Jogayya, Shri. T. N. A. Perumal, Shri. S. Sridhar.

Minutes:

- Notification and Denotification rights to be with loka sabha and not Parliament.
- There need to increase the Protected areas in the drier parts also (8- 9%) .
- Tribals should be appointed in the watcher level and guard level too there should be a dear cut plan for habitat development.
- The threats to biodiversity must be reduced and balanced developmental activities should be undertaken.
- Proper Compensation for Crop damage must given.
- Reduction in the use of pesticides should be carried out.
- Management policies must be properly made, suitable to the local conditions.

- Ecodevelopmental activities need to be strengthened Complete survey of flora and faunas in national parks, wildlife sanctuaries and other forested area should be carried out immediately suitable actions should be fit in the management plans.
- There should be a participatory approach involving local people and forest development, towards conservation enforce 25% of the land, with tree cover.
- Strengthen the existing acts.
- Recruitment of forest staffs must be done on quality basis.
- Weapons could be used for self-defense too.
- Biodiversity conservation should be at 2 levels - Landscape level 2) Habitat Level 3) species level
- Prevent fragmentation of the corridors.
- A comprehensive study should be carried out in this context create corridors by acquiring private land.
- Ecorestoration Programme should give scope for native species.

Compensation

- Revise compensation rates and reduce the elaborate procedures
- VFC,s could also help to access the loss and damage along with the department
- RFO,s to be trained to access crop damage
- If the Compensation is delayed unnecessarily then the interest of the compensation must be paid by the forest dept.
- Decentralize the rules to local level.
- Certifying authority should be given to local panchayat

Displacement

- Tribals should not be moved out as they are partly responsible for conserving biodiversity
- Tribals should be allowed to collect forest produce as they are very much department on those produce for lively hood
- Law should be Uniform to all citizens
- National park requires carefully examination

Mining / Infrastructure: -

- Holistic approach has to be taken and proper EIA to be prepared for which a committee involving all respective departments and local NGO,s
- EIA authority should be independent and should be decided by the state biodiversity board
- Non forest area should be considered for mining and must be at the fringe of the bufferzone outside PA,s about 5-10 km away
- Proliferation of road network must be restricted
- Disaster management plan should be linked with the EIA

Habitat and Corridors

- Broker approach to be solved with respect to corridors
- Few more areas need to be considered for protecting corridors
- Identify areas / habitats that could be notifies as sanctuaries

Notification / Boundaries / Policy

- District level Biodiversity Authority should decide for notification a PA
- Final notification must be done within a specified time bound period which is to be determined, that could be a maximum period of 2 years
- Boundaries to be much of demarcated areas along with proper survey members, for all NP and WS
- Computerize revenue and FD land records, super impose and compose with satellite Imagery for final correction
- In certain parts of the NP settlement could be permitted for which certain changes under the wildlife protection act 1972 has to be brought out People participation in PA;
- Like JFPM, people's participation in PA, to be encouraged and incorporated under management plans and system.
- Create the local panchayat in this context
- This also can help in regulating poaching ,fire and help towards conservation
- Considerable amount of grant should be provided to this committee.

- There should be a district biodiversity committee which must involve NGO's, experts and locals and help in educating and creating awareness among people
- At the village level JFPM and panchayat could gram this structure and at District level NGO's could take active part in it.
- There should be ecotourism cell in each PA, created by FD this cell should involve naturalist as a field guide and NGO's active participation during education and awareness Programme
- Educating the tourists by this joint venture could promote ecotourism through FD and organize ecotourism regularly
- Many nature camps created by FD is not popularized and seldom utilized by the interested people.
- Areas for ecotourism inside PA,s need to be properly defined with do's and do not's
- This could be carried out by NGO's if properly funded by FD
- Should level education regarding nature awareness should be improved
- Govt. and NGO's should join hands for such educative programmes
- Scrutiny of the dedicated NGO's performance must be done regularly
- Scientific documentation
- Documentation of all flora and fauna should be done systematically
- Information regarding the general flora fauna, endemic species, rare species to be given in the brochure from for the common
- DCF should get the flora and fauna documented in their respective regimes with the help of NGO, experts and naturalists
- School biodiversity register exercise should be initiated in this regards
- Surveys on biodiversity at NP,WS and RF to be carried out once a year
- Tribal knowledge must be respected and utilized for this purpose

Poaching

- Communication system should be properly established
- Trained staffs to be appointed at wildlife divisions
- Better arrangement should be provided to the forest staff
- Insuring all the forest staffs who are working in anti-poaching camp

Concluding workshop of Karnataka State Biodiversity Strategy and Action Plan

Time: 10.30 am – 4.30 pm
Venue: CSIC Auditorium, IISc, Bangalore
Date: November 11, 2001

As a part of the Karnataka State Biodiversity Strategy and Action Plan, the concluding workshop was held at CSIC Auditorium, IISc, Bangalore on November 11, 2001.

Experts, Teachers, Students, NGO's , Govt. officials, local resource persons and the public participated in this workshop. Shri. T. V. N. Murthy of Wildlife Aware Nature Club, Tumkur, compered the entire programme and Shri. B. V. Gundappa, teacher from Govt. P. U. College, Nagavalli, Tumkur welcomed the participants. Dr. Satish Chandra, Former Chief Secretary, Govt. of Karnataka chaired the session. Prof. Madhav Gadgil presented the prepared Biodiversity Strategy and Action Plan for Karnataka State. There were series of interactions with the audience and the experts on the dais (Shri. S. G. Neginhal & Shri. T. V. N. Murthy, Dr. Sathyanarayana Bhat, Shri. H. N. Chandrashekaraiah Shri. C. G. Kushalappa, , Shri. S. Sridhar and Dr. T. S. Channesh) of the respective six themes (Protected Areas, Medicinal Plants, Fresh Water Fishes, Traditional Conservation Practices, Wetlands and Crop & Genetic Diversity). This was followed by interactions with the local village level resource persons who had actively contributed in the School Biodiversity Register Programme. Prof. H. Y. Mohan Ram inaugurated an exhibition was organized at the venue which had displays of posters and collections from Schools which had prepared School Biodiversity Registers.

Post lunch session began with presentations by the school team from different region of the state. The prize winners of All India Radio programme also shared their experience during the programme and wished to participate more in such events. Shri. T. M. Vijay Bhaskar, Commissioner of Public Instruction chaired the afternoon session. Dr. H. R. Krishna Murthy, Director, All India Radio, Bangalore, Shri. Gunashekar, Deputy Director, AIR and Shri Chandramouli, from AIR were the guests. A small skit was enacted which was thus the smaller version of the AIR programme regarding KBSAP called 'Dhareya Siri'. Lateron, prizes were distributed to the prize winning schools and the AIR prizewinners. Shri. Vijay Bhaskar in his chairman's remark appreciated the work done by the teachers in the short span

and encouraged them for further more such activities. He also said that he would provide the required support from his department in this venture. The function thus concluded with vote of thanks by Ms Sumangala of AIR.

For all the above workshops the following had participated:

From CES: 1) Prof. Madhav Gadgil
2) Shri. Harish Bhat
3) Shri. Srinidhi S.
4) Shri. Yogesh Ghokle
5) Ms. Anuradha Bhat
6) Shri. Sivan V. V.

From BGVS: Shri. Basavaraju
Shri. Abdul Latif

Annexure E: School Biodiversity Register Program

Sl. No.	School Name	Locality	District	No. of themes
1	St. Theresa High School	Belthangadi	D.K.	4
2	Vidhyabodhini High School	Balila, Sullia	D.K.	3
3	Nehru Mem. P. U. College	Aranthodhu, Sullia	D.K.	3
4	Govt. High School	Karkala	Udupi	3
5	Govt. High School	Koodabettu	Udupi	3
6	Sub. Junior College	Bhaskeri,Honnavara	U.K.	2
7	Vidyodhaya P. U. College	Yadahalli	U.K.	4
8	Chennamma Jr. College	Somvarapet	Kodagu	3
9	Berchman's High School		Chikamagalur	4
10	Govt. High School	Belur	Hassan	4
11	Hebbalu Govt. High School	Hebbalu, Belur	Hassan	2
12	S. V. S. High School	Agumbe	Shimoga	2
13	Visheveswaraiya High School	Bhadravathi	Shimoga	2
14	Hirur High School	Hiriyur	Shimoga	5
15	Govt. Jr. College	Malur	Shimoga	3
16	Alagavadi High School	Navalgunda	Dharwad	2
17	Veerabhadreshwara High School	Godachi, Ramdurga	Belgaum	3
18	Govt. High School	Sujjalur, Malavalli	Mandya	2
19	Govt. Jr. College	Srirangapatna	Mandya	3
20	Rotary High School	Malavalli	Mandya	3
21	Govt. High School	Alakapura	Kolar	2
22	Kalidasa Jr. College	Kalidasa Nagar	Tumkur	4
23	Nehru. Jr. College	Mayasandra	Tumkur	2
24	Havanur Rural High School	Havanur	Tumkur	2
25	Govt. PU College	Venkatapura	Tumkur	3
26	NVS Girls High School	Mayasandra	Tumkur	3
27	NVSJCHS	Mayasandra	Tumkur	4
28	Govt. High School	Bramasandra	Tumkur	3

29	Govt. PU College	Chikanayakanahalli	Tumkur	3
30	Ranganatha High School	Kalapura	Tumkur	3
31	Govt. PU College	Pattanayakanahalli	Tumkur	3
32	Maruthi Rural High School	Koratagere	Tumkur	4
33	Govt. Hr. Pr. School	Amruthagiri	Tumkur	4
34	SVVP High School	Ponnasamudra	Tumkur	3
35	RVPPU College	Y. N. Hoskote	Tumkur	2
36	Govt. PU College	Nagavalli	Tumkur	4
37	MGMG High School	Madhugiri	Tumkur	6
38	Seethamma PU College	Davanagere	Davanagere	5
39	Kausalya High School	Malavalli	Mandya	2
40	Govt. PU College	Yelaburga	Koppal	3
41	Govt. High School	Kustagi	Koppal	3
42	Anand High School	Yeramarus	Raichur	3
43	Govt. High School	Yeramarus	Raichur	3
44	Govt. High School	Jalahalli	Raichur	3
45	Govt. Girls High School	Jalahalli	Raichur	3
46	Govt. PU College	Kavital	Raichur	2
47	Govt. High School	Manvi	Raichur	3
48	Siddanga PU College		Tumkur	3
49	Govt. PU College	Koratagere	Tumkur	4

Work Schedule:

December 2000: Launching the programme

February 2001: First training programme and finalizing the resource materials

March- April 2001: Training Programme

May – June 2001 Field work

June 2001: Review meeting and formats finalizing

July 2001: Report submission

August- October 2001**:** Report evaluation by the evaluation committee

October 2001: Thematic workshops for discussions

November 2001: Final exhibition and awarding prizes.

Training Programmes:

Field oriented training programmes on five themes along with the background study were organized in three different centres selected by the teachers. Teachers of the adjoining districts along with two of their students participated in the training programmes.

1) 10th and 11th of March, 2001 at Government High School, Koppal taluk of Raichur district.
2) 4th and 5th of April, 2001 at Nagarika Seva Trust, Belthangadi taluk of Dakshina Kannada district.
3) 21st and 22nd of April, 2001 at BAIF, Tiptur taluk of Tumkur district.

Resource materials were prepared for the following in Kannada:

- Medicinal plants
- Freshwater fishes
- Wetlands
- Sacred groves
- Crop diversity

SBR reports Evaluation Committee:

1) Dr. Sathyanarayana Bhat
2) Dr. C. G. Kushalappa
3) Shri. H. N. Chandrashekaraiah
4) Dr. T. V. Ramachandra
5) Dr. Channesh
6) Prof. B. M. Kumaraswamy
7) Dr. K. Prabhakar Achar
8) Dr. Jayakar Bhandari
9) Ms. Prathima
10) Prof. Madhav Gadgil
11) Shri. Harish Bhat

A sample of the data on 54 medicinal plants collected by two schools are shown here

(Totally 36 schools have collected data for 260 medicinal plants)

BOTANICAL NAME	HABIT	PART USED	KAN_NAME	Srimati D Chennamma Pre University College, MadaPura, Kodagu		Government High School, Brahmasandra, Shira, Tumkur	
				Presence	Status	Presence	Status
Abrus precatorius	Climber (W)	Roots	Gulagangi	+	very rare	+	rare
Abutilon indicum	Herb	Roots	Thutigida				
Acacia concinna	Liana	Fruits	Sigeballi	+	rare	+	common
Acacia nilotica ssp. Indica	Tree	Bark	Kari jali, Gobli			+	common
Achyranthes aspera var. rubro-rusca	Herb	Whole Plant	Utranigida	+	abundant		
Acorus calamus	Herb	Rhizomes	Baje	+	rare	+	rare
Adenia hondala	Climber	Tubers	Kembu chendu hannina balli	+	very rare		
Aegle marmelos	Tree	Roots,Unripe fruit	Bilva	+	very rare	+	common
Aerva lanata	Herb	Whole Plant	Bilee sooligida				
Ailanthus excelsa	Tree	Root,Root bark	Hemmara				
Alangium salvifolium	Tree	Roots	Ankola			+	abundant
Albizia lebbeck	Tree	Bark,Gum,Seed	Bage				
Albizia odoratissima	Tree	bark		+	very rare	+	rare
Aloe barbadensis	Shrub	Leaves		+	rare	+	rare
Alstonia scholaris	Tree	Bark	Janthalla	+	very rare	+	common
Alternanthera sessilis	Herb	Whole Plant		+	abundant	+	common
Amaranthus spinosus	Herb	Roots		+	rare	+	common
Ammannia baccifera	Herb	Whole Plant	Kallurive	+	very rare		
Ampelocissus arnottiana	Climber (W)	Roots	Sambara balli				
Andrographis paniculata	Herb	Whole Plant					
Anogeissus latifolia	Tree	Gum	Dindiga	+	rare	+	common
Anthocephalus chinensis	Tree	Roots	Kadwal	+	Rare		
Aphanamixis polystachya	Tree	Bark	Mullu muttaga				
Argyreia nervosa	Tree	Roots	Samudrasos	+	Very rare		
Aristolochia bracteolata	Herb	Whole Plant		+	Very rare	+	rare
Aristolochia indica	Climber(h)	Roots	Iswaraballi	+	Very rare	+	abundant
Aristolochia tagala	Climber(h)	Roots	Dodda Iswari balli	+	Very rare		
Artemisia indica	Shrub	Flowers					
Artocarpus hirsutus	Tree	Leaves	Hebbalasu	+	Rare	+	rare
Asparagus racemosus	Herb	Roots					
Azadirachta indica	Tree	Leaves		+	Rare		
Bacopa monnieri	Herb	Whole Plant		+	Abundant		
Balanites aegyptiaca	Tree	Bark	Ingalukke				
Baliospermum montanum	Shrub	Roots	Kadu haralu,Nagadanti				
Bambusa arundinacea	Shrub	Resin	Bidiru	+	Rare	+	rare
Barleria cristata	Shrub	Whole Plant	Jhinte	+	Rare		
Barringtonia acutangula	Tree	Fruits	Holekauva				
Basella alba	Climber(h)	Whole Plant		+	Rare		
Bauhinia purpurea	Tree	Stem, Bark	Kempumandara	+	Very rare	+	rare
Bauhinia tomentosa	Shrub	Roots	Karanasupu	+	Rare		
Biophytum sensitivum	Herb	Whole Plant		+	Rare		
Boerhavia diffusa	Herb	Whole Plant					
Bombax ceiba	Tree	Bark, gum		+	Rare		
Borassus flabellifer	Tree	Fruit					
Boswellia serrata	Tree	Gum					
Breynia retusa	Shrub	Whole Plant		+	Rare		

Two sample School Biodiversity Registers , translated from Kannada to English by the teachers

1. SBR on Wetlands - Karkala Sundara Puranik High School
2. SBR on Sacred Gorves - Government High School – Kudabettu, Mala.

SCHOOL BIODIVERSITY REGISTER

WETLANDS (PONDS)

Smt. K. Harshini

&

Student participants

Karkala Sundara Puranik High School

Karkala 574104

(Udupi District)

2001

GUIDANCE

Centre for Ecological Sciences

Indian Institute of Science

BANGALORE - 560012

SCHOOL BIODIVERSITY REGISTER

WETLANDS (PONDS)

CONTENTS

GENERAL INFORMATION

VILLAGE PROFILE

Village	:	Karkala Kasba
Taluk	:	Karkala
District	:	Udupi
Latitutde	:	13(deg)N
Longitude	:	75(deg)E
Altitude	:	35M
Topography	:	Irregular
Landscape element Type	:	Woodlands, Scrub land, Rocky outerops, Hillocks, Orchards, Paddy fields etc.
Annual Rainfall	:	4000 to 5000 mm
Main Crops	:	Coconut, Arecanut, Paddy
Main domestic animals	:	Cattle Fowl, Dog, Cat
Population (2001 Census)	:	25,118

COMPOSITION OF STUDY TEAM

Name of the School	:	Karkala Sundara Puranik Memorial High School, Pervaje KARKALA - 574 104
Name of the Teacher	:	Smt. K. Harshini
Student Participants	:	Hariprasad Shridev Krishna Prasad Shilpa Keerthi

LOCAL KNOWLEDGEABLE INDIVIDUALS

Sl.No.	NAME	AGE	SEX	OCCUPATION	SPECIAL KNOWLEDGE
1	Dr. K. Prabhakar Achar	58	M	Professor	Biodiversity
2	Dr. Bharathesh A	45	M	Ayurvedic Doctor	Medicinal Plants
3	Doddalinge Gowda	45	M	Fishery Official	Fish breeding
4	Nagaraja	50	M	Attender	-----
5	Vardamana	54	M	Agriculturist	-----

REFERENCE:

1. POLI - A commemorative volume for camara 2000 published by : Deputy Commissioner, District Administration, Dakshina Kannada District, MANGALORE - 575001.

2. A field guide to te BIRDS OF DAKSHINA KANNADA by K. Prabhakar Achar and K. Geetha Nayak published by : Bhuvanendra Nature Club India. (Sri Bhuvanendra College, KARKALA - 574 104)

NUMBER OF VISITS TO THE LOCALITY AND DATE

Sl.No.	Date
1	14 April 2001
2	25 April 2001
3	03 May 2001
4	23 May 2001
5	05 June 2001

WETLANDS (PONDS)

INTRODUCTION

The life on earth's surface is inconceivable without water. In fact, the life originated in water Wetlands may be considered as a special kind of ecosystem where the soil is saturated with water for most part of the year. The wetlands include a variety of habitats such as shallow water bodies ponds, lakes, reservoirs and coastal areas. Wetlands support human life and provide a variety of resources including food, fodder, fibre and fuel. Agriculture had its beginning in the flood plains and one of the wetland plants, rice, accounts for more than half of the world's human population. The life of wetlands emprises of plants such as reeds, lotus and lilies and among animals include waders like ducks and teals. In recent years, the large areas of wetlands have been inpacted by human activities and either modified or destroyed. For the protection of wetlands around the world an international convention was adopted at the city of Ramsar on the shores of the Caspian Sea in Iran, in February 1971, which came into force in December 1973. Since then, wetland conservation has gained greater momentum.

WETLANDS OF KARKALA

The wetlands of Karkala in general constitute a treasure of economic reserves and provide the right kind of habitats for breeding, nesting and wintering of local and migratory birds. Besides their aesthetic value, such sites also provide fodder and forage for many animals, including birds of Karkala, which lies at the foothills of the Western Ghats, in well known for its scenic wetlands, that include Aanekere, Sigadikere, Ramasamudra, Tavarekere, Nagarabhavi, Matadakere and Shivatikere

1. Current Status :

Aanekere: Aanekere is a man-made wetland, built in 1262, by the then ruler of Karkala, Pandyadeva, belonging to Bhairavarasu dynasty. It has area of about 25 acres surrounded by lush vegetation, consisting mainly of paddy fields and orchards of coconut and arecanut. This scenic pond was once the most productive system, which has lost its past glory and

become one of the highly threatened wetland habitat of Karkala, mainly due to siltation and weed infestation, especially the world's most dreaded aquatic weed, Salvinia molesta.

Bhuvanendra Nature Club (WWF-India) has been monitoring the avifauna of Aanekere and its environs since 1991. The water and wader birds of Aanekere include dabchick, little cormorant, pond heron, grey heron, nightheron, little, median and teal, common teal, blue winged teal, coot, white breasted waterhen, purple mooren, bronze winged and pheasant-tailed jacana etc. Common sandpipers, wood sandpipers and little ringed plovers and the migratory birds, which arrive during winter. Small gree, pied and white-breated kingfishers are the divers of Aanekere.

Sigadikere:

Sigadikere lies to the south of Aanekere and is separated by an intervening road. Its total area is about 10 Acres and serves a recharging pond. It is also highly threatened due to Siltation and aquatic weeds. This seasonal pond dries up in the summer months and eventually converted into a grazing ground for the local cattle. The birdlife is relatively less and mainly inhabited by egrets, whistling ducks and teals.

Ramasamudra :

Ramasamudra is the largest wetland of Karkala and is spread over 60 acres. It is a perennial pond and its water is being lifted for agricultural and horticultural purpose by the surrounding household. Earlier, Karkala town used to get the drinking water supply from the pond. The Horticulture department is lifting water from this pond for its farms and nurseries. On its western end, the fisheries department run by the state government, created nursery and rearing ponds for culturing exotic fishes such as rohu, catla and mrigals. The edge of the pond is bordered by pandanus groves. Within the pond itself there is a mine island, containing pandanus vegetation, which serves as an ideal breeding and roosting ground for egrets. There are two main bathing ghats, which contribute considerable polluting agents. The pond has less of weed infestation and siltation when compared to Aanekere.

Tavarekere:

Tavarekere is located very close to the Ramasamudra, on the western end. On the northern end of this pond is large rocky outerop, at the summit of which lies the famous Jain Temple, `Chaturmukha Basadi'. This pond is being used for pisciculture by the state fisheries department. While lilies adore this pond seasonally. This reedy pond provide excellens habitat for egrets, waterhens and jacanas. The pond in about 10 acres. The dreaded Salvinia molesta also invaded this pond.

Nagarabhavi:

It is the smallest of the wetlands and may be considered as a sacred pond. It is found to occupy 1/2 an acre. On one side of the pond there is a `Nagabana'. This pond is infested with another common weed, Eichornia (Water hyminth). Due to siltation, the pond dries up in the summer. Egrets and ducks inhabit this pond.

Matadakere:

Matadakere is about 10 acres and lies on one side of the Karkala - Padibidri Road. The water of this pond is relatively clean and there is less of weed infestation. At the centre of the pond, there is a mini island, which provide secure place for the aquatic birds. On the eastern side of the pond there is a sacred grove, with evergreen species.

Shivatikere:

Shivatikere is also an ancient sacred pond lying at the close quarters of `Shiva Temple' near Hiriyangadi. It is about 15 an acre and dries up on summer months. Water lilies are not found in this pond and the birdlife is also very poor.

All the wetlands of Karkala mentioned above are located within a radius of 2 kms. Fed mainly by inflow from rain-fed streams and general drainage system, the wetland system prevailing in Karkala is complementing to one another in sharing the flora and fauna.

Aanekere may will be considered as a repository or gene bank for many unique species of aquatic flora and fauna of Karkala.

In recent years, the changes in the surrounding environment, urbanisation and heavy infestaton of weeds and siltation contributed to gradual degeneration of once productive wetland system of Karkala. Current agricultural practices upstream have contributed to pesticide pollution; besides sewage and garlbage from the surrounding human habitation also adds to the pollution of these wetlands.

2. Ecological History:

In the best of times, the Aanekere tank used to have the finest examples of aquatic flora and fauna and a rick biodiversity value. Some useful fish species of food value such as murrel and fresh water eels were abundant in Aanekere. Not long ago, large number of fresh water eels migrating downstream into the Swarna River, and then into the sea, to breed at the onset of the monsoon and swim upstream into the tank at the opportune period. This tank used to be one of the best eel-rearing areas in the district. Ever since the construction of the barrage across the outlet, a generation ago, the migratory phenomenon of those fascinating fishes seems to have complete disappeared.

The crucial factor responsible for the gradual decrease of biodiversity of this once highly productive wetland within a span of one generation seems to be the situation which has drastically reduced the water retention capacity of the tank causing significant changes to the ecological characters of the wetland. Weed infestation, especially the world's most dreaded Salvinia molesta, has severely affected the plant diversity of the wetland.

Apart from the excellent possibility of being an important bird refuge. Aanekere also performs many other functions. Perpectual presence of water in the tank has ensured that water for paddy cultivation as well as recharging well water for domestic use in available throughout the year. This has been the blessing for the town ever since the tank was built. Perhaps, the main objectives of then rulers to whom the Aanekere belonged were to provide water to the surrounding agricultural land.

3. Utilization patterns:

The Department of fisheries has an inland fisheries station in Karkala, operating in the Ramasamudra area. The department maintains the culture ponds. Carps and cutfishes are cultured. Carps mainly include rohu, catla and mrigala. Saccobranchus (Heteropreustes) in the main catfish. These fishes are kept in the rearing ponds and stocking ponds. The fisheries department does not sell the fishes directly to the consumers; instead, after harvesting, the department will auction the fishes depending upon the demand. The fish contractor sells the fishes at the rate of Rs. 40 to 40 per kg. In the peak season, about 400 to 500 kgs of fishes are being marketed locally.

Although fishing is prohibited in Aanekere, Sigadikere and Matadakere, illegal fishing is going on in small quantities.

Illegal hunting of waterfowls in the vicinity of Aanekere and Tavarekere is not uncommon. These birds are also secretely old to the local consumers.

Ramasamudra used to provide drinking water for the Karkala town. Since the operationlization of Mundli water supply scheme across Tellar rivulet of Swarna River, water from Ramasamudra is drawn only for agricultural and horticultural purposes.

4. Forces driving ecological change

The impact of the human activities in and around wetlands seems to be the main driving force for the ecological change. The Ramasamudra is relatively free from major disturbances. Nevertheless, the introduction of exotic fishes such as carps has resulted in the decline of local species of fishes such as eels and channa. The siltation and weed infestation have also changed the ecological character of the wetlands. The kingfishers are less frequent now, probably due to the non-availability of fishes. The pesticides drained from the agricultural fields have also contributed to the decline of the fish population. The scenic water lilies which once used to adore the wetlands, particularly Aanekere, Sigadikere have become a very rare phenomena. The bird population, teals and ducks in particular, have declined over the years. The illegal hunting of waterfowls has contributed to their decline in recent years.

5. Knowledge and Beliefs:

It seems, Pandyadeva, belonging to the Bhairavarasu dynasty, built the tank Aanekere for bathing elephants of his palace. The term `Aanekere' literally means a tank meant for elephants. Similarly, the adjacent `Sigadikere' seems to be meant for culturing `Prawns' (shrimps). `Sigadi' literally means prawn. Now, neither elephants bathe in the `Aanekere' nor there is prawn cuture in Sigadikere.

At close quarters of Tavarekere, there is a small jain temple, `Padmavati Basadi', at the foothill of the Gomateshwara statue. There was a belief that the beautiful while coloured water lilies grow luxuriously in Tavarekere. If regular `puja' is held in Padmavati Basadi. It seems once the theieves entered in Padmavati Basadi and `pooja' rituals were not held for quite sometimes and during that period the `while lilies' did not grow in the Tavarekere. The beautiful pink coloured water lilies of Aanekere and Sigadikere were used extensively during `Tulasi Pooja'. Almost at the centre of the Aanekere, there is small jain temple called `Kere Basadi', where regular worship of the Jain `Theerthankaras' is taking place. The name `Shivatikere' is believed to have come to the tank because of the Shiva temple.

The beautifully coloured and while water lilies are used for decoration in the nearly temples. The birds inhabiting the ponds provide aesthetic value to the area.

6. Gainers and Losers:

The fishing people seem to be the main gainers from the wetlands. Some people catch fishes for their domestic use, while others sell these fishes to the neighbouring households traditional methods such as hook-and-line, scoopnet, Gillnet etc. are used for catching fishes. Siltation and weed infestation have drastically affected the fish population and hence the fishermen are the losers. the families living around the Ramasamudra are the gainers as far as water harvesting for agricultural activities is concerned. The water from Aanekere is also used to paddy cultivation and the downstream farmers are gainers.

7. Values:

The wetlands play a major role in providing fish and wildlife habitat and general biodiversity of both plant and animal species. The habitat values of wetlands take on more its real value results from several functions, such as ground water relations, productivity habitat. Biomass production values of wetlands need to be emphasized. Reeds and grasses are not only used for thatching, but also as cattle fodder. The seeds, petioles, rhizomes, tubers, fruits, leaves of many wetland plants are important basic food items, valuable delicacies or medicines. Wetlands are important grazing lands during the dry season.

8. Scenarios

The monitoring of wetlands of Karkala since 1991 by Bhuvanendra Nature Club, Karkala (WWF-India) has detected the ongoing changes in the physical, chemical and biological characteristics. The local people visualize that if the current trend of siltation, weed infestation, decline of aquatic life and biodiversity continues, the wetlands of Karkala, particularly Aanekere and Sigadikere, might be converted one day into grazing land. The surrounding agricultural land and paddy fields might be transformed into follow lands. The loss of birdlife will result in the disappearance of the aesthetic value. While another group of local people feel that past glory of these wetlands might be restored. The government local bodies and NGOs might collectively undertake the restoration work, such as desilting and deweeding etc. and transform these wetlands more productive and sustainable.

9. Aspirations:

The recent establishment of a minipark on the bank of Aanekere and a children's park on the rocky out crops of Ramasamudra has revived the hope of developing the ecology of Aanekere and Ramasamudra. Bhuvanendra Nature Club - India has been in the forefront to preserve the ecoogy and avifauna of Aanekere. Memoranda and meetings with the then chief Minister of Karnataka, Deputy Commissioner of Dakshina Kannada District, the former Chief Wildlife Warden and CCF of Karnataka, special secretary to Karnataka government on forest, environment and ecology, Deputy Conservator of Kudremukh Wildlife Division, Karkala, and a score of administrative authorities and local leaders of Karkala to impress the need for declaring Aanekere as a `Bird sanctuary' have not yet yielded any results. Realising

the apathy of the government bodies and officials, a well known local doctor and a dedicated environmentalist, Rtn. PHF. Dr. Bharthesh A, took the lead and began the `Save Aanekere' movement and the Rotary club of Karkala, along with other collaborating agencies, drawn a `pilot project' for manually eradicating the world's worst weed - Salvinia molesta. Though late, the citizens of Karkala have realised their responsibility of preserving the natural heritage and culture. Sustainable use of natural resources which brings long term benefits to all concerned and a participatory approach to problem solving appears to be the motto of citizens of Karkala.

The main aspirations of the people of the locality may be listed as follows:

- Desiltation and creation of two artificial islands in Aanekere
- Declaration of Aanekere as a bird sanctuary
- Planting oranamental and fruit yielding trees in the Aanekere environs to attract birds and also to provide suitable roosting sites.
- Painting the avifauna of Aanekere on a sign board
- Desiltation of Sigadikere and providing boating facilities for recreation
- Providing boating facilities in Ramasamudra
- Development of Ramasamudra environment into an eco-tourism centre.

10. Strategies:

In order to maintain the biodiversity and productivity of the wetland ecosystem and the wise use of their resources problems confronting the wetlands must be taken up on priority basis for conservation. Strategies for achieving the objectives may include the following.

- Integrating activities pertaining to protection, restoration, monitoring, public awareness and education and socio-economic aspects for conservation of wetlands.

11. Action plans:

Action plans should involve detailed work plan for a specified period to achieve the

conservation objectives A list of action plans is as follows:

- Removal of encroachments and fencing of wetlands by any area development authority
- Fisheries development activities by the inland fisheries department for enhancing fisheries resources
- Restoration of biological diversity of wetlands by desiltation, deweeding and rehabilitation of threatened species through governmental and local agencies.
- Setting up of watch towers and padrolling by traditional boats for observation and monitoring of wetland biological diversity.
- Organising training programmes to school and college students by teachers and local experts.
- Production of short videotapes in local languages on wetland biodiversity and conservation by government departments and NGOs.
- Ecodevelopment planning around wetlands and publication of brochure/posters in local languages.

CONCLUSION

At the dawn of civilization, man settled in the neighbourhood of wetlands, such rivers, streams and ponds, understood the multiple uses of water and gradually become totally dependent upon it. In course of time, by creating his own artificial environment, he started taking control of his surroundings to his gains. Unlike other animals, man is endowed with intelligence and reasoning, which he used in selfish way, for his own welfare, without caring for the well being of his environment which sustains him. Gradually, this has led to the imbalance of Nature, causing water, land and air pollution. This is turn has resulted in health hazards. It is high time now that he should awake and arise, before too late, begin to care for the health of his environment.

Now, we realise from the ancient civilizations of egypt and mesopotamia, as also from our own, that why our amesstors worshiped water, air and earth. The humankind must understand, at least now, that the eart does not belongs to him alone, but also to millions of

other creatures and future generations. Man must now learn to conserve the natural resources and also use them in a sustainable manner.

ACKNOWLEDGEMENTS

We are very much grateful to Dr. K. Prabhakar Achar, Centre for Ecological Sciences, Indian Institute of Science, Field Station, Karkala, for his guidance, and in fact, this work is largely an outcome of his endeavours.

We are extremely thankful to Prof. Madhav Gadgil, Centre for Ecological Sciences, Indian Institute of Science, Bangalore, and his research team for their support and encouragement.

We must thank, in particular to our beloved Headmaster and the faculty for their kind cooperation.

Our thanks are also due to all knowledgeable persons who have provided valuable informations and inputs.

ANNEXURE

A checklist of the Biodiversity of Aanekere wetland and its Environs

A PLANT DIVERSITY

I. AQUATIC PLANTS (HYDROPHYTES)

1. Nymphaea nouchali
2. Nymphaea stellata
3. Jussea repens
4. Limnophylla sp.
5. Hydrilla sp.
6. Vallisnaria sp.
7. Utricularis sp.
8. Sagittarius sp.
9. Cynodra dactylodon
10. Chara sp.
11. Lemna sp.
12. Marselia sp.
13. Eicchornis sp.
14. Salvinia molesta
15. Pandanus sp.

II. EMERGENT AND TERRESTRIAL PLANTS

1. Solanum xanthocarpum
2. Solanum nigram
3. Solanum torvum
4. Clerodendron sp.
5. Passiflora sp.
6. Zizyphus oenoplea
7. Oldenlandia corymbosa
8. Cassia tora
9. Cassia occidentalis
10. Leucas linifolia
11. Seoparia dulce
12. Ludwigia linifolia
13. Blumea sp.
14. Physalis minima
15. Amaranthus spinosus
16. Heliotropium sp.
17. Minosa pudica
18. Alternenthera sessilis
19. Eclipto alba
20. Illyanthus sp.
21. Centella asiatica
22. Fimbristylis sp.
23. Kyllinga monocephala
24. Portulaca oleoracea
25. Rungia parviflora
26. Urina lobata
27. Datura fastosa
28. Colocasia sp.
29. Calotropis gigantea
30. Pteris sp.

B. ANIMAL DIVERSITY

I. FRESH WATER FISHES

(a) Carps

1. Labeo rohita (Rohu)
2. Catla catla (Katla)
3. Cirrhina mrigala (Mrigal)
4. Cyprinus carpio

(b) Catfishes

1. Saccobranchus (or Heteropneustes)
2. Clarius magur
3. Arius macronotacanthus

(c) Eee

1. Anguilla bengalensis

(d) Murrel

1. Ophiocephalus punctatus
2. Ophiocephalus micropeltus
3. Channa orientalis

(e) Other fishes

1. Etroplus canarensis
2. Osphromenus olfax
3. Gobius striatus
4. Barbus pinnauratus
5. Macrones arnatus
6. Callichrorous malabaricus
7. Peristolepis malabaricus

II. WETLAND BIRDS

1. Little Grebe or Debehick
2. Little Cormorant
3. Grey Heron
4. Large egret
5. Median egret
6. Little egret
7. Cattle egret
8. Pond Heron
9. Lesser whistling Teal
10. Common Teal
11. Gargancy Teal
12. Cotton Teal
13. Whitebreasted waterhen
14. Purple moorhen
15. Coot
16. Pheasant tailed jacana
17. Bronzewinged jacana
18. Little Green Heron
19. Night Heron
20. Little Ringed Plover
21. Spotted sendpiper
22. Common Sandpiper
23. Marsa sandpiper
24. Redwattled Lapwing

SCHOOL BIODIVERSITY REGISTER

SACRED GROVE

Smt. Jayanthi Shetty

&

Student Participants

Government High School

Kudabettu - Mala 574 123

Karkala Taluk

2001

GUIDANCE

Centre for Ecological Sciences

Indian Insitute of Science

BANGALORE - 560012

SCHOOL BIODIVERSITY REGISTER

CULTURAL TRADITIONS

SACRED GROVES

CONTENTS

SCHOOL BIODIVERSITY REGISTER

CULTURAL TRADITIONS

SACRED GROVES

GENERAL INFORMATION

VILLAGE PROFILE

Village	:	Mala
Taluk	:	Karkala
District	:	Udupi
Latitude	:	13(11'N to 13(15'N
Longitude	:	75(05'E to 75(10'E
Altitude : 100m		
Topography	:	Undulating
LSE Types	:	Evergreen forests, Scrub, Grassland, Hopea plantation, Casuarine plantations, Arecanut plantation, Coconut plantation Cashew plantion, Rubber plantation.
Annual rainfall	:	5000 to 6000 mm
Main crops	:	Arecanut, Coconut, Paddy, Pepper, Rubber, Coffee
Main domesticated animals:		Cattle, Dog, Cat
Population	:	(As per 2001 census) : 5,566

COMPOSITION OF STUDY TEAM

Name of the School	:	Government of High School Koodabettu - MALA - 574123
Name of the Teacher	:	Smt. Jayanthi Shetty
Name of the Students	:	Ravindra Shetty Mahesh Dongre Krishna Kumar Ramesh S Surendra

SACRED GROVES

INTRODUCTION

The sacred groves have been considered as a kind of `traditional reserve forests', which range from small patches with a few trees as in `Nagabanas' to `Bhoothastanas', consisting of undisturbed forested areas covering several hectares, with all types of vegetation including trees, climbers, shrubs and medicinal herbs. The faunal component primarily consists of serpents (cobras), birds and primates (monkeys). The sacred groves preserve key species that influence the biodiversity of the area. In certain cases, they may preserve species that have become rare and extinct.

The sacred groves are also intimately associated with the cultural history of the locality `Bhootharadhana' (or Devil worship) is quite fascinating from the biodiverstiy point of view, due to its close relationship with plants and animals. The most popular animal boothas include `Panjurli' or `Varaha' (Pig), `Pilibhutha' or `Pilichamundi' (tiger) and `Mysandaya' or `Guliga' (or Ox).

Owing to many anthropogenic and ecologic factors, the sacred groves are on the decline in many areas, although the sacred groves located on the remote and inaccessible areas still remain infact. Peoples perceptions about sacred groves indicate that the cultural change has affected the tradition; but the sacred sites have been revived in areas where religious beliefs are still very strong. Sacred groves have been protected by traditional practices of conservation rather than modern conservation approcahes, which o a large extent ignores the role of local communities. Therefore, it is quite appropriate and essential to halt the ongoing degradation of sacred groves inorder to preserve the country's heritage of living diversity.

SACRED GROVES OF MALA VILLAGE

1. CURRENT STATUS

There are over 200 sacred groves in our study sites of these, particulars of 15 sacred groves are given in the Table-1. `Sri Brahmanatha' sacred grove seems to be one of the oldest ones.

Sri Brahmanatha: This sacred groves is found on the bank of the Mullur stream, at Mullur (Mala). Sri Brahmanatha is believed to be Brahmalingeshwara (Brahma + Shiva). This sacred grove has a well protected evergreen forest patch, some of the trees appear to be as old as 300-400 years, thereby suggesting that this grove must have been in existence since then. The stone idols situated amidst the grove bear the resemblance of ancient "Bhottada Kallu" giving some evidence that it must have been installed in this place by the Malekudiyas, as the `Bhoothastana'. probably centuries ago. After the arrival and settlement of Chitpavan Brahmins in the Mullur area, they too must have began worshiping this `Bootha', and subsequentely, they must have renamed it as "Sri Brahmanatha". Now, each year, on `Charitrashudda Bidige' (i.e. on the day of Yugadi Padya), all communities from the neighbouring settlements congregate in the grove for an annual fair, perform `Rudra-abhisheka' to invoke the rain God, `Varuna', and also worship `Nagaraja'. The annual festival culminates with `Vanabhojana' (the community meal at forest), in which people of all communities participate.

- Particulars of sacred plants are given in Table - 2
- Particulars of sacred animals are given in Table –3
- Particulars of sacred birds are given in Table – 4
- Sacred fish Masher is found in the sacred pond of Yedupadi Parashurama Temple.

2. ECOLOGICAL HISTORY

Our study team interviewed a number of knowledgeable individuals of the study locality to find out the ecological history pertaining to the changes occurred during the last ten years regarding the quantity of sacred plant and animal species.

- Majority of the knowledgeable individuals are of the opinion that there has been no changes in the quantity of the listed species. Since the religious faith has not changed during the last ten years among these people, the sacred species have also not undergone any noticeable change according to them.

- While others feel that the quantity of the sacred species has declined over the last ten years. In the name of rennovation, people have started building concrete structures inside the sacred groves. This has led to the shrinkage of their natural habitats.

- The majority of the knowledgeable individuals have considered that the following species have decreased considerately: *Rouwolfia serpentina, Andrographis paniculata, Coleus aromaticus, Aegle marmelos, Minusops elengi* etc.

- According to some people, mindless human activities have led to the disappearance of a few species.

- Changes have taken place in the habitat of a number of sacred species. As a result, those species, which were acclimatized to a particular set of conditions, failed to adopt to the changed habitats.

- People also believe that the decrease in the religious faith and beliefs also contributed to the destruction of sacred species.

In conclusion, the local knowledgeable individuals have expressed mixed opinion regarding the ecological history of sacred species.

3. UTILIZATION PATTERNS

The knowledgeable individuals of our study area expressed a wide ranging opinions about the utilization pattern of sacred species.

- Sacred species totally protected include *Ficus religiosa*. *Ocimum sanctum* and *Naja naja* (indicum cobra)

- Some sacred species were destroyed mainly because they do not know the real values of the speices.
- Butea monosperma, Cynodon dactylon, `Dharbe' etc are extensively used in the religious ceremonies.
- Some people sell the sacred species, but they do not get the proper value
- Some people utilize the sacred species to derive economic benefits.
- Some people collect the sacred species which are on the verge of extinction and very rare for their economic gains without realising their significance.
- Some animals like wildboar, Monkey, Peacock and Parakeets are being attacked and killed since they are proved to be destructive to the crops.
- Among the animals, cobra enjoys the greatest religious value and it is being conserved `Nagabanas', the habitat of the cobra, enjoy natural protection, unless cleared for the purpose of rennovation and building concrete structures.

4. FORCES DRIVING ECOLOGICAL CHANGE

The reasons responsible for the changes in the available sacred groves and sacred species (quantitative changes) may be considered under forces driving ecological change.

Most of the knowledgeable individuals interviewed by our study team opine that the numbers of certain sacred species have come down in recent years. According to them, the excessive human activities are responsible for the change.

Ongoing destruction of forests appears to be key driving force for the ecological change. Just for the sake of economic benefits, these people set aside all values and fell trees and make profit.

In recent years, there has been gradual erosion of religious and cultural beliefs, which in turn contributed to the shrinkage of sacred groves and loss of sacred species.

The recent culture of concretization of sacred groves, especially the Nagabanas, is causing

tremendous damage to sacred tree species including *Ficus religiosa* and *Ficus glomerata* with the loss of natural habitat, certain sacred species also have disappeared. Rennovation of `Nagabanas' has become symbol of social status among certain neo-rich people, especially the business category.

On the whole, the destruction of forests, erosion of religious and cultural faiths, the absence of concerns and values among the people regarding sacred species, destructive activities such as hunting etc. appear to be the major driving forces responsible for the disappearance of most fo the sacred species, according to the opinion expressed by great many knowledgeable individuals.

5. KNOWLEDGE AND BELIEFS

Most of the knowledgeable individuals have shown keen interest regarding the utility of sacred elements. Also, people have their own knowledge and beliefs about a few sacred animals and plants.

- Ocimum sanctum: This medicinal plant has great cultural and religious significance. This plant is cultivated around the houses and also kept in the `Vrindavana' (Tulusi katte) and worship by Hindus. On the 12th Day (Dwadashi) of Deepavali Amavasya, annually special Tulsi pooja in performed. Besides medicinal values, `Tulsi' in an excellent insecticide. It is believed to produce more oxygen and purify the atmosphere.

- Ficus religiosa: It is another sacred plant which increased the quantity of oxygen in the atmosphere. There is a belief that by moving around this tree in the early morning (Brahmi muhurt), the child bearing capacity of the woven increases in those with low feenndity and reproductive defects.

- Naja naja (Cobra): For Hindus, cobra is the symbol of sanctity and they worship keeping `stone nagas' in `Nagabanas'. Nagapanchami in celebrated as an annual religious function by all Hindus. To get rid of certain social problems, the priests ask the devotess to perform special offerings to Nagaraja' such as `Naga Prathiste', `Ashlisha Bali', `Naga Mandala' etc. Because of these religious faith, the cobra is well protected by the society.

- Froof: People believe that croaking noise of the frogs is an indication of monsoon setting. Frogs are the natural predators of the crop destroying insects.

- Kite: This raptor is considered as `Garuda' the vehicle of work `Vishnu'. This bird is conserved for its good omen.

- Masheer: This is sacred fish which is conserved by the people.

6. Gainers and losers

The knowledgeable individuals interviewed by our study, team are of the opinion that the changes that have occurred in the sacred groves and sacred elements had greater impact of the local people than outsiders.

- The reduction in the sacred plants such as *Ocimum sanctum* and *Ficus religiosa* has affected the health of the people.

- The raiding of crop plants by wild boars, monkeys, elephants (occasionally), Peacocks, parakeets etc. causing great economic loss to the farmers.

- The destruction of forests has led to the disappearance certain sacred plants such as Butea monosperma,

- Gmelina arborea, `Dharbe' grass etc, which in turn severely affected the conduct of `Pujas' and religious rituals.

- The transformation of certain sacred groves into concrete groves has also resulted in the scareity of fodder to the cattle.

- The ancient sacred groves had very thick tree cover, which used to provide a kind of air-conditioning to the people of the locality. Felling of the trees of these pristine groves, opened the canopy, as a result these have been changed into barren lands.

- Some people hold a contrary view that the nuisance species such as wildboar, monkeys, peacocks and parakeets etc., which used to destroy the crops, have reduced in their number, as a result the farmers are benefited due to decrease in the damage of their crops.

On the whole, Losers out number the gainers due to the on going transformation in the existence of sacred species.

7. Values

The majority of the knowledgeable individuals with whom we have interviewed assigned high value to sacred groves and sacred species.

- The value attributed to the sacred elements primarily based on the economic considerations. Those species which have greater value have been considered to be more valuable.

- Some people assign greater value to those species which are of religious importance such as *Ficus religiosa, Ficus glomerata, Butea monosperma, Gmelina arborea, Prosopis spicigera, Cypodon dactylon,* `Dharbe' grass etc, which are extensively used in religious rituals.

- Some other people value sacred species from the point of view of conservation of biodiversity as a whole so that these species are available for the next generation.

- Still others value those species which contribute for the improvement of their living status.

- Species which have been assigned sacred value include *Ficus religiosa, Butea monosperma, Cynodon dactylon, Ocimum sanctum*, `Dharbe' grass, cobra, *Elephas maximus, Pathera tigris* etc.

On the whole, it appears from our interactions with knowledgeable individuals that those species which are useful economically and religiously are valued by the people.

8. Scenarios

When our study team interviewed the knowledgeable individuals to elicite their opinion regarding the prospectus of the sacred groves and sacred species during the next ten years they came out with mixed expressions.

Some knowledgeable individuals are very critical about their opinion and they expressed apprehension about the existence of sacred groves and sacred species during the next years.

The ongoing concretization of sacred groves has resulted in the shrinkage of natural habitats
of sacred species. If this tread continues, certain sacred species are bound to totally disappear from the scene.

In today's social setup, the religious and the cultural values are outweighed by the personal prestige, and hence, the fate of sacred groves and species are in pathetic condition and also in distress and further likely to deteriorate in the future.

If irrational hunting and felling trees are continued at the same pace, a section of the society feels that there can be hardly any species left to be seen by the next generation.

However, some people are still optimistic and they feel that the sacred groves and sacred
species will continue to exist in the future and some local organizations will awake and arise and uphold these values. By these, they expect greater benefits from the sacred elements.

On the whole, the majority of the knowledgeable individuals expect the conservation of sacred groves and sacred species in a sustainable manner.

9. Aspirations

Most of the knowledge individuals expect the conservation of sacred groves and sacred species. Our study team could list the following aspirations.

- The conservation of sacred species is essential for the maintenance of delicate balances of nature.

- The conservation of sacred species is essential for the survival of the biodiversity.

- Species with economic and religious values most be conserved.

- If the number of crop raiding/destroying species such as monkeys, wild boar, peacock parakeets etc comes down, it is better, some people feel.

- Some people value `Nagabana', Brahmastana' only as places of worship, nothing more than that. Neither they have understanding nor concern regarding the existence and survival of sacred plant and animal species. They donot have any expectation regarding their conservation. Just to show off their status and position in the society, they construct concrete structures in the sacred groves.

- Some people conserve the sacred species for the sake of the management of their economic activities. Against their developmental aspirations, conservation aspirations of sacred species are being neglected.

- It appears as though some people have no much concern regarding the conservation of sacred species. They feel that these species might have contributed for improving their living standard, to certain extent.

10. Strategy

The knowledgeable individuals interviewed by our study team expressed following opinions:

- The sacred groves and species must be conserved in a proper method. Some kind of regulation should be imposed on their utilization.

- The sacred species have great value and hence it is our duty to see that they must be grown, cultivated and conserved for the future generations.

- Religious centres such as temples must create awareness among the people and see that the sacred groves are not converted into concrete jungles.

- The forest department and the joint forest management committees must take strict legal measures for the conservating sacred groves and species. All kinds of hunting and felling trees must be regulated. Forest Act, Wildlife Act etc must be properly implemented.

- The Grama Panchayats must promote conservation awareness among the people. The temple managements or the owners of the sacred grove must be accorded recognition and honoured for the conservation of sacred groves and species.

- The Local Voluntary organizations such as the Youth Clubs, Jayees, Rotaract clubs must take up the responsibilities of conservation of sacred species.

- Awareness must also be created among the students at the school level. The students must be made to realize the significance of sacred groves and sacred species. Various competitions must be conducted to the students, for which the forest department and the agricultural departments must provide prizes and certificates.

- According to some, the temple authorities, Grama Panchayat, Taluk and Zilla Panchayats cannot regulate the private sacred groves; they can conserve only those groves present in the government land.

11. Action Plans

The knowledgeable individuals interviewed by our study team have suggested the following action plans:

- If the people stop cutting the trees for their personal gains and economic profits, the sacred groves can be conserved.

- It must be seen that sacred groves are not converted into concrete jungles.

- Even though the economic gain is reduced by the sustainable use of sacred species, this will create awareness among the people for conserving the sacred species for the next generation.

- The Temple trustee must induce religious awareness among the people once by doing this the conservation of sacred groves can be achieved.

- The forest department must take strict legal measures for the conservation of sacred species. The strict legal actions must be taken against those hunting sacred animals.

- At the village level, the Panchayat Raj Insitutions must oversee the conservation of sacred groves.

- Individuals and organizations must be identified and encouraged for promoting the conservation of sacred species.

- For the promotion of conservation of sacred groves, the forest department must provide the financial assistance. This arrangement must be implemented.

- Some people feel that the conservation of sacred groves will adversely affect their economic gains and this in turn might lead to the collapse of their standard of living. Therefore, the limited use of such resources is not practicable according to them.

- The topics addressing the values of sacred groves and sacred species must be incorporated in the educational curriculum.

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TABLE - 1

Particulars of important sacred groves of the study area

Sl.No.	Place	Name of the Sacred grove	Area(inha)	Name of the Owner
(1)	(2)	(3)	(4)	(5)
1	Peradka	Brahmasthana	0.125ha	Vishwanatha Poojari
2	Peradka	Nagabana	0.05ha	Dayananda Shetty
3	Angadibettu	Nagabana	0.05ha	Kali Heggadthi
4	Hekkunje	Nagabana	0.01ha	Vasanth Chiplunkar
5	Kalleri	Nagabana	0.05ha	Raju Shetty
6	Mullur	Brahmasthana	0.05ha	Village Panchayat
7	Mullur	Nagabana	0.05ha	Sadashiva Joshi
8	Heranje	Nagabana	0.05ha	Shankar Joshi
9	Heranje	Nagabana	0.05ha	Nagabhushana Joshi
10	Devaragundi	Nagabana	0.05ha	Venkatesh Ranade
11	Mala chowki	Brahmasthana	0.05ha	Malinpeshwara Temple
12	Kotemane	Nagabana	0.05ha	Kalu Hegde
13	Kesinbail	Nagabana	0.05ha	Vishnumurthi Temple
14	Peradka	Nagabana	0.05ha	Babanna Nayak
15	Peradka	Brahmasthana	0.05ha	Naranga Madivala

TABLE - 2

Particulars of Sacred Plants of the study Area

Sl.No.	Name of Plant	Life form	Availability
1	Ficus bengalensis	Tree	Common
2	Ficus racemosa (=glomerata)	Tree	Common
3	Ficus religiosa	Tree	Rare
4	Saraca asoea	Tree	Rare
5	Tamarindus indica	Tree	Common
6	Ficus infectoria	Tree	Rare
7	Aegle marmelos	Tree	Rare
8	Ixora coccinia	Shrub	Common
9	Acacia ferrugnea	Tree	Rare
10	Mimnsops elengi	Tree	Rare
11	Centella alba	Runner	Common
12	Calotropis procera	Herb	Common
13	Prosopis spicigera	Tree	Rare
14	Azadirachta indica	Tree	Rare
15	Cynodon dactylon	Grass	Common
16	Butea parviflora	Tree	Rare
17	Emblica officinalis	Tree	Common
18	Gmelina arbora	Tree	Rare
19	Michelia champuca	Tree	Rare
20	Ocimum sanctum	Herb	Common
21	Calotropis gigantia	Herb	Common

TABLE - 3
Particulars of Sacred Animals of the Study Area

Sl.No.	Name	Availability
1	Bonnet Monkey	Common
2	Common Langur	Rare
3	Lion Tailed Macaque	Rare
4	Elephant	Rare
5	Deer	Rare
6	Sambar	Rare
7	Hare	Common
8	Gaur	Rare
9	Loris	Rare
10	Porcupine	Rare
11	Ant. eater (Pangolin)	Rare
12	Palm squirrel	Common
13	King cobra	Rare
14	Cobra	Common
15	Tortoise	Common
16	Frog	Common

TABLE – 4

Particulars of Sacred Birds of the study Area

Sl.No.	Name	Availability
1	Blackwinged Kite	Rare
2	Brahminy kite	Rare
3	Indian Peafowl	Common
4	Blue Rock Pigeon	Common
5	Roseringed parakeet	Common
6	Bluewinged parakeet	Common
7	Crow-pheasant or coucal	Common
8	Common Nightjar	Rare
9	Common Kingfisher	Common
10	Whitebreasted kingfisher	Rare
11	Common Grey Hornibill	Common
12	Malabar Pied Hornibill	Rare
13	Indian Goldenbacked woodpecker	Common
14	Crimsonbreasted Barbet	Common
15	Common myna	Common
16	House sparrow	Common
17	Baya weaver Bird	Rare
18	Common Iora	Common
19	Paradise Flycatcher	Rare
20	Koel	Common

3. Annexure F: Newspaper articles

Deccan Herald:

1) Ensuring bio-diversity: wildlife & plants - January 14th, 2001

2) Preservation of Biodiversity -Wetlands and fish – January 29th, 2001

Prajavani:

1) Vanyadhamagalu yara asthi ? - February 10th, 2001

2) Moolikegalu kayuthive kayakalpakke !- February 17th, 2001

3) Karnatakadha jaugu bhoomigalu – February 24th, 2001

4) Sihi neerina meenugalige sankata samaya – March 3rd, 2001

5) Namma sampradhayagalindha jeevavaividhya rakshane sadhyave? – March 10th, 2001

6) Mathe kangolisabekagidha bele vaividhya – March 17th, 2001

BIODIVERSITY: POINTS TO PONDER

Wildlife Sanctuaries and National Parks

Karnataka Government is developing a strategy and an action plan to conserve, sustainably use and equitably share the benefits of use of its rich heritage of diversity of life.

Wildlife sanctuaries and national parks, bird sanctuaries and tiger reserves such protected areas are the cornerstone of modern day nature conservation effort. They carry on India's rich heritage of traditions of nature conservation. Thus the heronary at Ranganathittu Bird Sanctuary on river Kaveri has been protected, perhaps for centuries by people out of reverence for nature; the Bandipur Tiger Reserve was a hunting preserve of Maharaja of

Mysore, who incidentally was the first Chairman of the Indian Board for Wildlife. India's coverage of such protected areas is amongst the most extensive and effective in the developing world. It has helped prove wrong Jim Corbett's prediction that tiger would disappear from India by 1960.

Yet as always, there is space to do better and debate ranges on a wide front of issues involving protected areas. Our current network is obviously not representative of the full range of state's ecosystems. It concentrates on deciduous forest in hilly tracts and has little representation of coastal evergreen or Deccan plateau thorn forest. It might then be desirable to further extend the network, especially to bring under protection the full range of our state's ecosystems. There are many wildlife enthusiasts who would like to see such an extended, strictly protected network put in place. They believe that four or five per cent of our land must be totally dedicated to saving the natural world. People should completely withdraw from these strictly protected areas; not even tribals should step in to collect fuelwood, wild fruit or honey. Because once people come in, there will be an avalanche of disturbances, such as fire to facilitate collection of fallen fruit and temptation to steal the meat of deer killed by panthers. In the end, nature will not stand a chance unless at least these four or five percent of wild lands are declared out of bound for all human activities.

Such full protection needs enforcement. Forest Department in charge of reserved forests and wildlife sanctuaries are the natural choice as the enforcement agency. It has a special Wildlife Wing to look after Sanctuaries and Parks. But this machinery is understaffed and under equipped. A single Forest Guard has to patrol thousands of hectares and deal with poachers equipped with rifles. jeeps and mobile phones. The long standing failure of the official machinery to nab the bandit Veerappan, responsible for massacring hundreds of tuskers and killing several Forest Department officials is a testimony to the handicap under which Foresters operate. It has been persuasively argued that resources for biodiversity management should be channeled to strengthening the hands of the Foresters to undertake their duties.

This is a simple, straightforward solution to a complex problem. Perhaps, as the American writer H.L.Mencken has warned, simple solutions to complex problems are invariably wrong. It has been argued that Forest Departments have been and remain commercially oriented with responsibilities in the Wildlife Wing viewed as punishment postings. It has therefore been suggested that a separate Nature Conservation Service should be organized with its own dedicated, scientifically trained cadre. Others have pointed out that a dedicated Pollution

Control machinery has not been particularly effective, so there is little reason to believe that a separate Nature Conservation Service would be the answer.

Tribal rights activists have disputed this whole line of reliance on a technocracy. They have pointed out that if troupes of Langurs and Macaques roam the length and breadth of India, this is due to strong cultural traditions of the people. At the other extreme, sandal with the highest level of governmental control and protection of any plant or animal has been greatly depleted from much of the state. These activists argue that wildlife once thrived in tribal strongholds and will do so again if only tribals are once again given full control over their territories.

Some would dispute this solution of empowering tribals as being as simplistic as giving full powers and all funding to Foresters. They advocate the middle path of joint responsibility modeled after the success of Joint Forest Management Committees to take care of degraded forests near villages. The Joint Protected Areas Committees thus envisaged would empower local communities to help the official machinery effectively protect, while ensuring that the latter acts in an accountable and transparent fashion, thereby checking corrupt practices such as the off-alleged involvement of some officials and politicians with Veerappan and other poachers.

There are then a number of diverse lines of thinking on how to enhance the coverage and efficacy of our Protected Areas. All citizens of Karnataka are invited to contribute their perspectives, their ideas and suggestions for practical action.

Medicinal plants

Karnataka Government is preparing a strategy and an action plan to conserve, sustainably use and equitably share the benefits of use of its rich diversity of living resources such as medicinal plants.

"No sound lacks mantric powers; no root is devoid of medicinal properties" says a Sanskrit verse. Indeed herbal medicine is an ancient and effective system of India, a system that helped Buddhist monks being welcomed in China and European traders being drawn to the West coast. Even today, despite the ascendancy of Allopathy, some 300 species of plants are commercially used for manufacture of medicinals in Karnataka, another 2000 may be being used locally by Naati Vaidyas. Much of this resource is obtained through harvests from natural populations; of the 770 odd commercially used species in India, only about 10% derive from cultivated sources. Even these tend to be brought under cultivation as a last resort, when cheaper supplies are no longer readily available from the wild. So cultivation of

a species means that while being supplied to the organized sector, it is no longer accessible to the large number of rural users who cannot afford to buy their drugs on market.

Unfortunately supplies of a substantial number of medicinal plant species are indeed on serious decline, so much so that some 50 of them were banned three years ago from use in exported products. But when the drug manufacturers questioned the rationale behind the identification of these 50 banned species, Central Government authorities could not adduce convincing evidence to justify the action and the ban had to be lifted. Thus, while the steeply rising prices and reports from many localities such as the famous Siddhar Betta of Tumkur district suggest that there is serious erosion of India's and of Karnataka's medicinal plant resources, we have little detailed understanding of what is happening. Indeed in Karnataka an inquiry showed that while there was some limited information on the status of 10 out of 300 commercially used species with the Forest Department, there was no specific information about populations of the other 290.

This lack of information on the status of natural populations of medicinal plants mirrors our poor state of organization of information on their uses. Botanical identity of many species mentioned in Ayurvedic texts is in doubt and there is no standardisation of the constitution of many herbal medicines. There is as yet no reliable electronic data base of this information exposing us to biopiracy as in the recent case of use of turmeric as a lotion for treating wounds. So benefit sharing based on tribal knowledge is a very tricky proposition indeed, although a significant precedent has been set in Kerala with a Kani tribal community organization being paid a sum of Rs. 5 lakh in recognition of the information they contributed on properties of the herb *Trichopus zeylanicus*.

Medicinal plants are of course protected, along with other living reosurces in the Wild Life Sanctuaries and National Parks. But in Reserved Forests and everywhere else most of them are collected as if from no-man's-land, with no individual or agency having a stake in their long term persistence and sustainable use. Tribals and other forest produce collectors who supply the agents of herbal manufacturers only receive equivalent of daily wages for their labour, and believe that if particular species are exhausted, they will find some other ways of eking out their living. The agents and industry are merely concerned with acquiring their raw material as cheaply as possible for the moment. The Panchayats or Forest Authorities have no information and no regulation in place for most species and lose nothing by their on-going decimation.

There have of course, been several concrete responses to these challenges. A series of Medicinal Plant Conservation Areas have been identified in the state and protected with the

involvement of local communities. Simultaneously Dhanavantari Vanas have been organized to encourage medicinal plant cultivation. The Forest Department could take steps to bring the full set of 300 - odd commercially used medicinal plants under its regulatory regime. Additionally, the P.R. Nayak Committee on Panchayat Raj legislation has suggested that Panchayats should have the responsibility of documenting and monitoring local biodiversity resources including medicinal plants in association with local educational institutions. P.R.Nayak committee has also recommended that Panchayats should be authorized to regulate harvests of medicinal plants and be allowed to levy collection charges to motivate them to promote sustainable use. The Biological Diversity Act 2000 recently tabled before the Parliament has similar provisions. This act also visualises very comprehensive regulation of all utilization of biological diversity resources through State and Central level authorities; provisions which have been dubbed Draconian by Ayurvedic manufactures.

Much obviously needs to be done, to conserve our medicinal plant resources, to use them wisely, to tap our classical and folk knowledge towards this wise use and to justly reward holders of such knowledge. All readers are invited to contribute their perspectives, ideas, and suggestion for practical actions to this end.

Wetlands

Karnataka Government is elaborating a strategy and an action plan to conserve, sustainably use and equitably share the benefits of use of its rich resources of diversity of life. Wetlands are amongst the worst affected of ecological habitats of Karnataka.

Life originated in water; on land it thrives where water abounds. Wetlands are therefore important to Karnataka's biodiversity. Defined as shallow bodies of standing water of a hectare or more in extent, Karnataka has over 44,000 man-made wetlands constructed over centuries beginning with the Vijayanagara dynasty. Once critical resources for supporting paddy and other irrigated crops, especially in the Maidan areas, these wetlands have fallen on unhappy times with the coming in of large scale irrigation projects over the last century. Traditionally community based organizations took care of the protection of the catchments, and of regular maintenance including desilting of these tanks. With lower population densities and little industry, pollution was not a threat, nor had many exotic weeds been introduced.

The community based organizations were however dependent on a highly inequitable society with concentration of wealth, land ownership and political clout in hands of a small

minority. Following independence came democratic governance and land reform, leading to collapse of traditional community based institutions. The community woodlots and grazing lands in the catchment have been largely distributed to landless for cultivation. Other pressures on land have led to encroachment on tank beds. For example, the famous Dharmambudhi tank of Bangalore has been drained to make way for the Majestic Bus Stand. The magnificent Amanikere of Tumkur is also under similar threat. The tanks have become sinks for sewage and industrial wastes. Exotic weeds like water hyacinth have come to thrive in the organically enriched waters promoting drying up of the tanks. This process of degradation of wetlands has affected many elements of biodiversity as well: water-lilies, fish, frogs, turtles, birds, a variety of lesser known organisms.

Borewells chasing the ever-plunging underground aquifier have replaced small tanks as sources of irrigation, at least for the bigger landholders in many parts of Karnataka. This has been promoted by subsidized pumps and electric power. But as these subsidies appear likely to end there is growing concern for good management of the wetlands. An important initiative in this context is creation of water user sanghas reestablishing community based management, but now in the modern context of a democratic society striving towards equity. There have been other governmental initiatives as well, such as that of Bangalore Urban Forestry Division to take care of the city tanks.

While water will naturally be the central concern in all the efforts at better management of wetlands, their living resources should also be protected. The measures should include control of encroachment, pollutants and invasive species such as weeds like water hyacinth and fish like Tilapia, maintenance of indigenous biota through some limitation of its replacement by cultured fish like carps, and regulation of fishing and hunting. These measures would need actions by state agencies such as minor irrigation, fisheries and forest departments as well as Pollution Control Board. It might be worthwhile to bring in local initiatives as well. This could involve NGOs such as Wildlife Aware Nature Club of Tumkur that has spearheaded the campaign to save Tumkur's laargest wetland, Amanikere, water user sanghas, Fishermen's Co-operatives, municipalities and Panchayat Raj institutions. All readers are invited to contribute their perspectives, ideas and suggestions for concrete, practical actions to this end.

Freshwater Fishes

Karnataka Government is working on a strategy and action plan to conserve, sustainably use and equitably share the benefits of the use of its rich diversity of living resources such as freshwater fish.

Fish are amongst the most nutritious of foods, easily digestible sources of proteins and rich in a number of vitamins, minerals and essential fatty acids. Given the rapidly declining per capita availability of pulses, the main source of proteins for the bulk of Indian people, fishes are a vital dietary supplement. Subsistence fishing in streams and rivers, wells and tanks of Karnataka has therefore been important for the poorest of our people. It is also one of the most neglected of aspects of the quality of their lives. For development of freshwater fisheries has completely ignored enhancing the availability of a variety of fish for rural poor, focussing instead on culturing a small variety of fishes such as carps largely for the urban market. Such aquaculture calls for elimination of all native fishes, greatly affecting fish diversity. In the process it has also destroyed many traditional practices of protection of fish diversity, such as in temple tanks. Just to cite one example, Devikere was one such a sacred pond in Sirsi town, with full protection to all aquatic life. Such refugia have served as important sources for replenishment of diversity exploited elsewhere. In such protected habitats, as well as in other ponds where there was regular fishing completely free of charge by mostly poor local people, just a few species are now being cultured with the catch auctioned off to outside contractors.

There is no doubt that culture of carps has been a successful venture greatly enchancing production of fish in particular habitats, though at the cost of diversity of aquatic life and access of poor to fish. Elsewhere the productivity as well diversity of fish has been on drastic decline due to a variety of reasons. Fish undertake seasonal movements, often upstream to breed during the monsoon months. Traditionally people often abstained from killing them while on the spawning run. Such movements have been adversely affected by the series of larger reservoirs constructed in recent years with no provisions for fish ladders. Fish habitats have been drastically affected by siltation and shallowing of many rivers and streams and their drying up in the summer months.

Freshwaters have also been polluted by sewage, industrial effluents, chemical fertilizers and pesticides. Many of these toxins accumulate in bodies of animals high up in the food web like some predatory fish, and of course, humans. The consequent health hazards for humans are slowly being uncovered, as many take years to have an effect. The famous Minamata disaster in Japan when many defective infants were born to mothers consuming fish that had

accumulated heavy metals in their bodies is more than 30 years old; it is only recently that consumption of fish from Great Lakes in the U.S. with accumulations of organic chemicals has been shown to lead to disturbances in human reproductive hormones. Apart from human health hazards pollution surely results in considerable loss of biodiversity, though little is understood of the detailed consequences, for instance, for fish diversity.

Numbers and diversity of fish has also been affected by indiscriminate fishing, often with destructive methods. Many fisherfolk in Karnataka report that the spurt in road construction activities over the last three decades has led to ready availability of dynamite to all and sundry. As a result, outsiders, often from cities, can now go to streams in the countryside, kill all fish by use of dynamite, collect the booty and ride away on a motorbike. Such people have no stake in the long term health of the streams they may so visit and do not care if their methods wipe out many fish populations. These people also violate taboos as on fishing from sacred stretches of rivers such as Tunga at Sringeri, or Kapila near Shishila in Dakshina Kannada. In recent years they have poisoned such sacred waters: the locals are helpless in preventing them.

The reason locals are helpless is because the existing legislative framework for wild life conservation has a narrow focus on charismatic species like tiger, chital and colourful butterflies with no mention of fish in schedules of protected species. So fish habitats outside of wildlife sanctuaries and national parks, which encompass most of bigger streams and rivers and the 44000 irrigation tanks receive no protection at all.

A number of elements may therefore be included with profit in the proposed strategy and action plan for conserving Karnataka's fish diversity. Amongst others these may include : (a) Systematic review of the schedules of wild life act to include significant fish species; (b) Extending legal protection to traditional fish sanctuaries such as temple tanks and sacred river stretches; (c) Complete ban on destructive methods of fishing such as dynamiting; (d) Empowering Panchayat Raj institutions to regulate fishing and to maintain traditional methods of sustainable fishing and rewarding them for maintenance of diversity of indigenous fishes through special grants (e) setting up of Joint Protected Areas Management Committees to oversee conservation of aquatic habitats along with terrestrial ones, (f) Encouraging Fisheries and Irrigation Departments to promote indigenous fish diversity in selected habitats instead of going in for aquaculture everywhere: (g) Development of fish ladders and fish weirs to permit movements of fish across bunds and dams; (h) Strict enforcement of polluter pays principle to restore the health of Karnataka fresh waters.

There are just a few possibilities. All readers are invited to contribute their perspectives, ideas and suggestions for concrete practical actions to further these objectives.

Cultural Traditions

Karnataka Government is working on a strategy and an action plan to conserve, sustainably use and equitably share the benefits of the use of its rich heritage of living diversity. Of considerable significance in this respect are cultural traditions such as protection to peepal and banyan trees, hanuman langurs, sacred groves and temple tanks.

Banyan (Aala) or Peepal (Arali) almost always constitute the biggest trees in any village, town or city of Karnataka. Botanically they belong to genus Ficus which ecologists now recognize as a keystone resource, responsible for supporting a whole spectrum of biodiversity by producing fleshy fruit at times when such fruit is scarce. Atthi, Basari and several other Ficus species are also protected as sacred trees all over Karnataka. The genus Dipterocarpus is the flagship genus of tropical rain forest. The northernmost population of Dipterocarpus on the Western Ghats occurs in a sacred grove, Karikanamman Mane in Uttara Kannada district of Karnataka. The most abundant of large wild mammals of Karnataka is bonnet macaque protected because of association with Rama. The most magnificent freshwater fish of Karnataka's rivers, Mahaseers, reach their largest size in sacred stretches of rivers such as Tunga near Sringeri. The spectacular breeding colony of Painted Storks and Grey Pelicans at Kokre Bellur has been traditionally protected by the villagers.

There is no dispute that Karnataka has a rich tradition of conservation of nature. Equally certain is the fact that its efficacy has been severely eroded. Historical evidence suggests that some 10% of our land may once have been covered by sacred groves; today this is down to less than 0.1%. At the same time our Wildlife Sanctuaries and National Parks now cover over 4%. The fast declining old traditions may then be of no relevance in the modern day context. Moreover, this protection is not rational; it is based on fear of primitive deities, often residing in trees or stones. Some votaries of scientific temperament therefore advocate that it is better to wipe out such superstitions, to cut down our last banyan tree and shoot our last monkey if we want to enter the new millenium as a fully rational society.

Even the priests are willing to discard these traditions. Many have been happy enough to perform rites to propitiate the deities, to obtain divine consent to cut down the giant trees in the sacred groves, invest part of the money timber merchants are willing to pay to construct a

temple over the gods who are mostly in the open, and use the balance for other purposes. The Government too has extended little recognition and legal protection for these traditions. Thus when a sacred stretch of Kapila river near Shishila in Dakshina Kannada was poisoned killing tonnes of magnificent fish, the locals were helpless in getting any legal help to protect their heritage.

The question before us then is whether we should write off these traditions as irrelevant in modern day context, or build upon them, modifying them suitably to suit present day conditions. Obviously religious beliefs, especially those rooted in powers of nature spirits are on the wane. For instance as money and market gains ascendance peepal trees which would not have been felled earlier are given the axe to fire brick kilns or monkeys shot at when they damage coconuts or mangoes. So if the living diversity protected by these traditions is to be conserved in days to come, then new ways will have to be devised to motivate people.

People may be compelled to protect through fear of punishment, or through positive motivation of monetary rewards or social recognition. The fear of divine punishment may then be replaced by that of Government through handing over the control of sacred trees or groves, of fish or ponds to the Forest Department. The control could also be modeled on Joint Forest Management Committees, with local people drawn into enforcement. However, as in this case there may be no material rewards such as access to non-timber forest produce, some other rewards, such as special grants to the community may have to be introduced. Since a variety of different kinds of protection are offered through cultural traditions, these cannot be captured easily through legislative provisions or Government orders. It may then be desirable to authorize Gram or Taluk Panchayats to declare particular trees or stretches of rivers as protected. We might also wish to ensure that such traditions are taken into account in course of Environmental Impact Assessments.

From their own experience, readers may have other perspectives, ideas, and suggestions for practical actions. All of these would be most welcome.

Crop Varieties

Karnataka Government is working out a strategy and an action plan to conserve, sustainably use and equitably share the benefits arising from use of our rich resources of

living diversity, such as the crop varieties evolved by farmers through selection over generations. All citizens of Karnataka are invited to contribute to this exercise.

The bright red Byadgi chillies, the deliciously sour Appimidi mangoes, the salt resistant Kagga strains of paddy and myriads of other varieties of field and tree crops are a part of the rich heritage of living diversity of Karnataka. This variety has evolved over generations of low input cultivation through selection by women and men to adapt the crop to the local soil, moisture, pest and disease environment. Modern agricultural practices have changed all this. For one, they have homogenized the environment through inputs of water, chemical fertilizer and pesticides. A small number of high yielding varieties have then been introduced to take advantage of the higher inputs; eroding diversity while substantially enhancing productivity.

Plant breeders have, ofcourse, been conscious of the great value of genetic diversity embodied in traditional land races or varieties. So as HYVs have rapidly replaced these, the genetic material has been systematically collected and maintained in collections with the Indian Council of Agricultural Research, or institutions such as the International Rice Research Institute, as well as with seed companies like Monsanto. It was one such cultivar from Pattambi in Kerala that provided the gene for resistance against the insect pest, Brown Plant Hopper that threatened to wipe out Southeast Asia's paddy crop some years ago. At that time, prior to the Convention on Biological Diversity formulated at the Earth Summit in 1992, such genetic resources were considered a common heritage of mankind. Now they are treated as a sovereign property of the country of origin. Under the present regime, India would have claims on part of economic gain resulting from use of the pest resistant genes from the Pattambi cultivar. CBD also recognizes the contributions of farmers to the evolution of these cultivars. The Government of India would then have the responsibility of sharing part of the benefits with farmers of Pattambi. The new Protection of Plant Varieties and Farmers' Rights Bill of the Government of India proposes setting up a National Gene Fund for the purpose channelising such benefits to the farmers.

Recent years have also witnessed another development - the fatigue of green revolution. The rates of increase in farm productivity have now fallen off, even as the Government is finding it difficult to sustain subsidies to fertilizers, pesticides and electricity for pump sets. This means that farmers may no longer find the HYVs as profitable over the traditional varieties as in earlier years. Indeed, they may now be better placed in going back

to some of the old cultivars. This might for instance, be the case with pepper where the breeders have been unable to evolve resistant varieties fast enough to keep pace with emergence of new disease strains. Some of the older varieties, although less productive, are disease resistant, and might offer a solution for the farmers. Since retrieving older strains from the ICAR collections may not be easy, farmers may be better off maintaining some of these under limited cultivation on their own fields. An important added advantage to on farm maintenance of crop genetic diversity is that the cultivars would then continue to evolve properties such as resistance to newer strains of diseases.

For a variety of reasons then it might be worthwhile encouraging farmers to maintain some crop genetic diversity on farm. It would be essential to develop a good system of documentation of the identity and properties of such cultivars to facilitate the farmer community taking advantage of these genetic resources through exchanges amongst themselves, as well as to sustain claims for payments from the National Gene Fund. Such documentation poses complex scientific challenges since the cultivars do not constitute distinct, stable, uniform varieties, nor do they have standardized names.

Much thought then needs to be devoted to decide on how to motivate farmers to maintain traditional varieties on the farm, reversing the whole thrust of Government propaganda of last 30 years to replace these by HYVs. This may need a system of incentives, the converse of subsidies that promoted replacement of these cultivars. Just as farmers are awarded titles like Krishi Pandit for demonstrating high crop productivities, they may also be given recognition for maintaining high levels of crop genetic diversity. Such systems of incentives would also need good systems of documentation. A variety of different institutions, Agriculture Department, Panchayat Raj Institutions, Co-operative Societies, local High Schools and Colleges, Agricultural University, National Bureau of Plant Genetic Resources, private seed companies, NGOs like Navadhanya may play a role in such an endeavour. Readers are warmly invited to share their own perspectives, ideas and suggestions for practical action to help the state develop a strategy and an action plan to address these challenges.

Annexure G: All India Radio Programme:

Participatory 13 episode programmes on the six commissioned papers is in the process of preparation for broadcasting through 13 stations of Karnataka simultaneously beginning from 6th of June, 2001. Each topic would be followed by the feedback from the audience. The last episode would be a phone in programme, where the public would participate. Experts, NGO's, School teachers and students will be participating in this programme.

On the spot recording programme for respective topics:

	Topic	Place	On the Spot Recording
1	Biodiversity Introduction	Belthangadi:	Ms. Vidya Nayak
2	Wildlife Sanctuaries & National Parks	Bhadra Tiger Reserve:	Dr. Ameen Ahmed
3	Medicinal plants	Tumkur:	Shrikantaiah
4	Wetlands	Pavgada:	Sheshagiri Rao
5	Fresh Water Fishes	Shishila:	Anuradha Bhat
6	Cultural tradition	Kodagu:	Kushalappa
7	Crop varieties	Ranebennur:	Channesh T.S.

Resources persons interviewed for the following:

Topic	Resource persons
1. Biodiversity Introduction	Prof. B.M.Kumaraswamy; Harish Bhat, Nagesh Hegde,
2. Protected Areas	Neginhal; WANC members, Ullhas Karanth
3. Medicinal plants	Dr. Satyanarayan Bhat, C.J. Colaso, G.N. Shrikantaiah, D.C.F. Tumkur

4. Wetlands	Jayaram, D.C.F. Kolar, Yathiraju, Somashekar Reddy, Indian Institute of Management, Bangalore
5. Fresh water fishes	Prof. Chandrashekaraiah, Anuradha Bhat, Shyam Bhat
6. Sacred Groves	Prof. C.G. Kushalappa , Yellappa Reddy, Jayakar Bhandary
7.Agro biodiversity	Dr. Channesh, Prof. Seetharam, Vanaja

DETAILS OF THE PROGRAMMES BROADCAST ON ALL INDIA RADIO AS A PART OF THE OF KARNATAKA STATE BIODIVERSITY STRATEGY AND ACTION PLAN PROJECT

Sl. No.	**TOPIC**	**Date and time of Broadcast**	**Recording spot**	**Resource person**
01	Biodiversity	06-06-01 7 pm to 7.32 pm		Prof. B. M. Kumaraswamy, Harish Bhat, Nagesh Hegde
02	National Parks and Sanctuaries	13-06-01 7 pm to 7.32 pm		S. G. Neginhal (Retd. IFS), WANC members, Ullhas Karanth
03	Interactive programme on Biodiversity	20-06-01 7 pm to 7.32 pm	Belthangadi	
04	Medicinal plants	27-06-01 7 pm to 7.32 pm		Dr. Sathyanarayana Bhat, C. J. Colaso, G. N. Shrikantaiah
05	Interactive programme on National parks and sanctuaries	04-07-01 7 pm to 7.32 pm	Bhadra Tiger reserve	

06	Wetlands	11-07-01 7 pm to 7.32 pm		Jayaram (IFS), C. Yathiraju, Somashekar Reddy
07	Interactive programme on Medicinal plants	18-07-01 7 pm to 7.32 pm	Tumkur	
08	Fresh water fishes	25-07-01 7 pm to 7.32 pm		Prof. H. N. Chandrashekaraiah, Anuradha Bhat, Shyam Bhat
09	Interactive programme on wetlands	01-08-01 7 pm to 7.32 pm	Pavagada	
10	Traditional conservation practices	08-08-01 7 pm to 7.32 pm		Prof. C. G. Kushalappa, Jayakumar Bhandary, A. N. Yellappa Reddy
11	Interactive programme on Fresh water fishes	15-08-01 7 pm to 7.32 pm	Shishila	
12	Crop and genetic diversity	22-08-01 7 pm to 7.32 pm		Dr. T. S. Chennesh
13	Interactive programme on Traditional conservation practices	29 –08-01 7 pm to 7.32 pm	Kodagu	
14	Interactive programme on Crop and genetic diversity	05-09-01 7 pm to 7.32 pm	Ranebennor	

Annexure H: All India Radio Programme Listernship survey summary

प्रसार भारती
(भारतीय प्रसारण निगम)

आकाशवाणी
पी. बी. स. 5096,
बेंगलूर - 560 001.
टेलेक्स 2473, तार : ''आकाशवाणी''
दूरभाष : 2259292, 2268151

PRASAR BHARATI
(Broadcasting Corporating of India)

All India Radio
P.B. No. 5096,
Bangalore - 560 001.
Telex : 2473, Telegram : "AKASHAVANI"
Phone : 2259292, 2268151 (PABX)

संख्या : D. O. No.
5(3) 2000 - AR

दिनांक / Date :
22.10.2001.

A.S.CHANDRA MOULI
DEPUTY DIRECTOR (AUDIENCE RESEARCH).

Respeqted Prof.Gadgil,

It gives me great pleasure to inform you that the Radio Serial 'Dhareya Siri' that went on air has been very well received by the listeners.

During our Radio Programme Listenership Survey we discovered that the said radio serial had 16 percent listening to urban, 12 percent in rural and 14 percent for rural - urban combine. This is a good record considering the fact that Radio has been competing with as many as sixty television channels. Since the programme went on state hook-up meaning all AIR stations broadcasting the programme simultaneously, one percent listening implies 6.7 lakhs listeners. In otherwords, the programme has been listened by 93.8 lakhs which is about 9.4 million listeners.

We are delighted by these statistics as a theme like Bio-diversity has interested so many millions of listeners. Generally for Science programmes, the clientele expected is small as illiterates do not evince much interest in science programmes. Nevertheless, this has truly been an unique experience for us as well as all age and category of listeners have enjoyed listening to the series. Infact, this comes as a good testimony to vouch for AIR' commitment to the public service broadcasting.

We are indeed grateful to your centre for having made such a serial possible.

With warm regards.

Yours sincerely,

(A.S.CHANDRA MOULI)

PROF.MADHAV GADGIL
CENTRE FOR ECOLOGICAL SCIENCES
INDIAN INSTITUTE OF SCIENCE
BANGALORE - 34

Annexure I: Commissioned Papers

1. **Crop and Genetic Diversity**
2. **Freshwater fishes**
3. **Medicinal Plants**
4. **Protected Areas**
5. **Traditional Conservation polices**
6. **Wetlands**

Towards conserving the Crop Genetic diversity in Karnataka.

By

Dr. T.S. Channesh

Karnataka State Council for Science & Technology

Indian Institute of Science, Bangalore –560 012

Table of Contents

1. Background

Both natural processes and human management have generated and sustained a vast array of genetic, species and ecological diversity. Within agricultural systems this agricultural Biodiversity performs many closely interrelated socio-economic and environmental functions, including promoting food and livelihood security; maintaining productive and environmental sustainability; and contributing to resilient rural economies. But this agrobiodiversity is being lost at an alarming rate. ***Agricultural bio-diversity is the diversity of genetic resources (varieties, breeds, species; cultivated, reared or wild) used directly or indirectly for food and agriculture; the diversity of species that support production (soil biodata, pollinators, predators, etc.) and those in the wider environment that support agroecosystems (agricultural, pastoral, forest and aquatic), as well as the diversity of the agro-ecosystems themselves.*** High agricultural Biodiversity helps sustain many production functions such as soil organic matter decomposition, pollination and pest control. Farmers may manage cover primarily to save soil and water in intensive orchard production systems. However, the species chosen will usually perform other functions in the agroecosystem such as enhancing soil structure, improving soil fertility and nutrient cycling as well as playing a role in pest management by providing habitat heterogeneity and preserving a favorable balance between pests and predators.

Crop Genetic Diversity : Crop genetic diversity is a part of agro-biodiversity and essentially a most important constituent of agrobiodiversity. Domestication is the foundation stone of the biodiversity of crop species. It is form this foundations that the landraces (crop varieties of farmers stock) emerged and diversified, and they in turn were the foundation stock for the modern cultivars developed in the last hundred years. Over the period of time there will be a gradual genetic change within the species depending upon the area of cultivation climate soil, etc have led to diversification and in to landraces to cultivars and varieties. Hence the genetics, geography, domestication are the prime cause of diversity in crop plants. There is high intra-specific genetic variation in the crops grown by the people specially in highly cross pollinated crops. They have been maintained by the farmers for various reasons such as palatability, taste, resistance to pests and diseases etc. The ***insitu*** conservation of different crop diversities in farmers have very high values and can be better than a decentralized

germplasm collection or cold stored seed lots. It is very much essential for understanding these strengths and develop methodologies for conserving them.

Agricultural Biodiversity also influences landscape structure by providing environmental services and functions and human activity can transform whole landscapes over large areas. For example, many rural communities enrich their agricultural plots and forests, fallows with valued perennial plants. Through such enrichment practices, successional vegetation can become a site for economic production as well as for ecological rehabilitation.

The knowledge potential of rural people to manage and enhance agrobiodiversity is substantial. These systems became tuned to local needs over centuries and detailed knowledge allowed people to social and ecological change. However, many modernising interventions and colonial administrations have ignored the importance of local knowledge and skills, resulting in an erosion of knowledge and an undermining of formal and informal institutions that were central for the sustainable management of agricultural biodiversity. These institutions include rules about use of biological resources and distribution of benefits, tenure, conflict resolution mechanisms and methods of enforcing rules, cultural sanctions and beliefs.

In the present context in Karnataka, which has housed a variety of crops, virtually covering all major tropical cultivated types opts a definite plan of action towards the conservation of these traditions and rich heritage of crop diversity. ***The cereals, pluses, oil seeds, fibers, vegetables, fruits, spices, fodder crops, crops that support industries***, etc., have been in cultivation over centuries. Native fruits such as mango, Jack have tremendous diversification. Post Columbus introduction of crops also have sufficiently filled our stomach and led to diversified cultivars within them also. Further in crop like chilly for example the famous widely grown **Byadagi variety** is a farmers pride. This was because of intensive cultivation of the introduced ones at least after the acceptance of the same. This has happened in crop like chilly, which was literally replaced pepper in Indian foods, then it is really remarkable in some other crops which have accepted in more interest and love. This was due to our farmers domestication trend of crop plants and the support of soil strength.

2. Why Conservation? Vis-a-vis Role Crop genetic diversity's role in the agroecosystem

Conservation has always drawn the attention and interest of variety of publics, institutions with, set objectives. Considering the contributions of crop genetic diversity which are as follows has led to conservation interest and drawing the attention of farmers and institution and their by policies.

Decomposition and nutrient cycling. Decomposition communities are highly diverse and are central to nutrient cycling, organic matter dynamics and other ecosystem functions. Although detailed knowledge of the extent and functions of this diversity is limited, it can easily be demonstrated with crop diversity that has tremendous potential in drawing such potentials.

Biomass production and yield efficiency: Diverse agroecosystems (fish polycultures, Mixed crops, varieties of crop cultivars, mixed herds, intercorps, integrated agro-sylvo-pastrol) are generally highly productive in terms of their use of energy and unit land area (or unit water volume). This efficiency is largely a product of the systems' biological and structural complexity, increasing the variety of functional linkages and synergies between different components. Many cultivars identified or unidentified serving the requirements of feed and fodder, in feeding the food needs.

Soil and water conservation.: Soil, water and nutrient conservation have been improved with the use of windbreaks, contour farming with appropriate broader crops and cover crops in a wide range of agroecosystems. Specific varieties have always been supportive in designing the function specified.

Pest Control: Predators, parasitic wasps and microorganisms play a key role in controlling agricultural pests and diseases. For example, more than 90% of potential crop insect pests are controlled by natural enemies living in natural and semi-natural areas, adjacent to farmlands. The substitution of pesticides for natural pest control services is estimated to cost $54 billion per year. Many methods of pest control, bothTraditional and modern, rely on

Biodiversity. Also some cultivars evolved to resists the attack of pests, and also the reserve of our pest control possibilities.

Biodiversity conservation. There is no strict divide between 'wild' and 'domesticated' species important for food and livelihoods. Which are in regular cultivation are domesticated or otherwise, but for the functions they can serve the purpose. Whilst not necessarily the subject of conscious management by herders or farmers, many wild plant and animal species thrive in, or are dependent on, agroecosystems, especially structurally and biologically complex agroecosystems. The cultivation practices have managed and conserve the diversity over several years, further require the possibilities to continue.

3. Options for sustaining and conserving crop genetic diversity: An Action

3.1 Expand Knowledge on the dynamics of crop genetic diversity

Much is uncertain and unknown about the structure and multiple functions of crop genetic diversity. Knowledge about the functions of bio-diversity, synergies and complimentary ties, interactions within agro-ecosystems, ecological processes within soils and interactions with the atmosphere and water, is rudimentary.

Actions: Supportive studies on dynamics of crop genetic resources of the state are to be initiated. The extent of landraces, farmers stock have to be documented. The pattern of distribution of landraces in agroecosystems needs to be understood. Sufficient budget to be allocated towards such studies that evolve information and knowledge towards genetic diversity and its conservation. Advanced techniques such as GIS. Computer based formats should be adopted in generation and management of such information and knowledge.

3.2 Increase effective use of crop genetic diversity in food production

Crop genetic diversity performs vital functions in agriculture, land and water use. The diversity of plants, animals and microorganisms is essential for maintaining the productivity and sustainability of farm crops and animals managed forests and rangelands, aquaculture and fisheries. Future global food security is dependent on harnessing and sustaining crop

genetic diversity and its many functions, from the farm plot to the landscape level. The current overemphasis on genetic engineering must be balanced by higher level approaches that build on agroecology, landscape ecology as well as social and biological diversity. National sovereignty and food security ultimately depend on a wide choice of agricultural technologies and development options.

Actions: 1. Establish the policy frameworks that ensure political commitment, incentives, educational and institutional capacities to support crop genetic diversity in food production, such as multiple crop production, traditional varieties. Recognition to indigenous cultivars, farmers stocks etc.,

2. Encourage producers and consumers network approaches for indigenous stocks.

3. Promote local adaptive management of crop genetic diversity.

Variation within and among agro-ecosystems is enormous. Daily, seasonal and longer-term changes in the spatial structure of crop genetic diversity are apparent at the broad landscape level right down to small plots of cultivated land. These spatio-temporal dynamics have major implications for the way agro bio diversity is managed, how, by whom and for what purpose. It calls for flexible responses, mobility and local level adaptive resource management in which local users of crop genetic diversity. This suggests new practical avenues for technical support in which land users' own priorities, knowledge, perspectives, institutions, practices and indicators gain validity

Actions: 1. Identification of crop genetic reserves and help to maintain insitu as crop clusters, such as Ragi ecosystem, Sorghum ecosystem etc.

2. Ensure the farmers and local institutions to maintain the stock that is in practice and the environment that support the practice.
3. Encourage for mass reservoirs of crops, of varied cultivars that will evolve as well manage the resources for the future need.

3.4. Support local participation in planning and management

Decisions about what agricultural bio-diversity is to be conserved, how it should be managed and for whom should be based on an understanding of local livelihoods and peoples own definitions of well being. Most professionals have tended to project their own categories and priorities onto local people and landscape management. In particular, their views of the realities of the poor, and what should be done, have generally been constructed from a distance and mainly for professional convenience. This implies the adoption of a learning process approach in the management of agricultural bio diversity and its functions.

3.5. Strengthen local rights and security of tenure

The legitimacy of rural peoples' claims to tenure and rights to crop genetic diversity are made more apparent as landscapes are re-interpreted as the product of social and ecological histories. These findings support a rights based approach to the participatory management of bio-diversity important for food, agriculture and they also have major implications for national policies on the sharing of benefits derived from the use of landscapes, agricultural bio-diversity and its end products. Guaranteeing the right of farmers to save and re-use seeds and livestock progeny is crucial in this connection. Failure to enshrine these rights in national legislation and policy practice may lead to inequitable benefit sharing schemes and conflicts that could undermine the sustainable management of agricultural bio-diversity and food security.

Actions: 1. Documentatuon and maintainance of village agro-bioprofile, to honour local rights (Box-1).

2. Initiation and managing village level germ plasms or identifyoing some of the village clusters which have govrned the genetic resources, and declaring as isitu village collections. Ensuring the maintenance of resources insitu.
3. Managing local level mass reservoirs and genetic reservoirs.

3.6. Reform trade policies, markets and economic incentives

Economic instruments are key to sustaining agricultural bio-diversity and its multiple functions. Trade policies, markets, subsidies and economic incentives must reinforce the

objectives of the International Convention on Biological Diversity rather than contradict or actively undermine them. A multilevel and systemic approach to economic transformation will often be needed to reform trade, taxation and public spending aimed at sustaining crop genetic diversity.

Actions:
1. Encouraging and ensuring the local markets for the diversity managed.
2. Access and manage the resources at local and decentralized way by farm societies, and agricultural department.
3. Arrenging incentives for farmers both at community level and individusl level for managing the crop genetic diversity.

Box -1

Village Agro-Bioprofile

This document will represent the entire agro-bioprofile of the village and presents a methodology to conduct such exercises for any farming village of the state.

Task that it will address

- **The crop diversity in the village.**
- **The dynamics of the biopotentials for the crop diversity**
- **Documentation of the status of the over all diversity and specific diversity.**

4. Proposal for future work

The various actions need a definite support of Knowledge base, Information base, Institutional support, Individuals who can organize and manage the efforts. A set of activities at pilot scale and then on mission mode could be initiated to take up the issues one by one to execute.

Initially generation of knowledge base could be initiated by starting some of the studies on distribution of crop genetic resources, their by identifying the clusters that are to be targeted. Mapping of cultivars distribution may be undertaken. The diversity strength of crops within the farm ecosystems or agro-ecosystems can be understood by lysozyme studies, such studies can be initiated in a large scale involving local colleges. The study may also evolve aspects of patterns of such distribution and their management practices across the agro-ecosystems.

5. Conclusions

These high lights identifies the aspects of crop genetic diversity conservation requirements of the state of Karnataka. However specific action may require a detail analysis and initiation then evaluation for large scale application. Further identified land mark classics of working process should be taken in a mission mode with the help of village panchayath, Agricultural department, Local farmers, and farm societies.

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A sample of Agro-biodiversity of Uttara Kannada

Crops	Varieties
a) Annuals	
1. Paddy/Rice	Jaya, Gowri, Mandya vijaya, Vani, Inton, Rangoon, Falguna, Kumbara Jaddu, Buttala, Hasirupatta(Dasirupatta) Local-1-10 (Different Reasons) Kagga, etc.
2) Groundnut	Local Cultivars
3) Black gram	Local Cultivars
4) Cowpea	Local Cultivars
5) Sugarcane	CO series & Local
6) Jowar	Fodder varieties
b) Perennials/Plantations	
1) Arecanut	Local, Mangala
2) Coconut	Local Cultivars
3) Bitelvine	Local Cultivars
4) Banana	Karibale, Putta bale, Robasta, local Boodh bale
5) Pepper	Local Cultivars
6) Cocoa	Local Cultivars
7) Cashew	Local Cultivars
8) Jaikai	Local
II. Domestic Animals	
1) Cows	Malanadu Gidda, Hallikar-Cross, Cross breeds
2) Oxen	Hallikar –cross,
3) Buffalo	Local, Surti, Nagpuri, cross breeds
4) Poultry	Local

Consolidated Information form both coastal and hilly areas.

BIO-DIVERSITY STRATEGY AND ACTION PLAN FOR PRESERVATION OF FRESHWATER FISHES IN KARNATAKA

H.N. Chandrasekhariah, S.L. Raghavan and M.F.Rahman

CONTENTS

BIO-DIVERSITY STRATEGY AND ACTION PLAN FOR PRESERVATION OF FRESHWATER FISHES IN KARNATAKA

By

H.N. Chandrasekhariah, S.L. Raghavan and M.F.Rahman

I. INTRODUCTION

Bio-diversity or biological diversity refers to the abundance and variety of flora, fauna and micro-organisms inclusive of the ecosystems and ecological processes to which they belong. Bio-diversity could be categorised at three levels - (i) the diversity of genes, (ii) of species and (iii) of eco-systems. Genetic diversity is the total genetic information contained in the genes of individual organisms, species diversity refers to the variety of living organisms and eco-system diversity deals with the diversity of habitats, biological communities inclusive of ecological processes within ecosystems.

Bio-diversity provides specific economic benefits in the form of food, medicines and industrial raw materials. Genes from the wild are vital for developing new agricultural and medicinal products. The other benefits provide ecosystem services like maintenance of soil fertility, regulation of water-cycles, purification of waters, moderation of climate, degrading and recycling waste materials, etc. Which are of vital important to human survival and development. From ethical considerations, it is recognised that biodiversity bears intrinsic values independent usage to humanity. Yet, in the present day, materialistic world, the primary focus and concern is on the direct economic value of biodiversity. Biodiversity conservation could provide a safe platform for human survival by allowing the options of future access to species and related ecosystems necessary for sustaining life. Conservation of biodiversity goes beyond the goals of traditional nature of conservation. It not only encompasses protection of nature from the adverse impacts of human activities, but also envisages meeting the people's needs from the planned and sustainable utilization.

The concept of biodiversity conservation appears simplistic, but conservation measures calls for certain creative approaches. The conservation programmes deserves the

participation of Government, the Planners, Scientists, Technocrats, Administrators and the Public. The entire process of conservation planning depends on the investigated scientific data which needs updating. Rich biodiversity is an indicator of the health of the particular habitat and its potential to sustain life. In view of the National Programme for the improvement and expansion of inland and marine fisheries sector of the Country, augmenting aquaculture production alone is not sufficient and conservation of diversified fish germplasm is a necessary prerequisite.

More than seventy percent of earth's surface is covered by water. The waters - be they are oceans, rivers, lakes, tanks, etc., are inhabited by an unique variety of animals remarkably adapted to leading an aquatic life. During the process of evolution, they have been successful in colonizing the earth and there are more types of fishes (about 25,000) than all the other backboned animals put together. There are fishes in all sizes ranging from the tiniest - 10 mm in length and 1.5 g in weight to gigantic 20 m in length and weighing 4000 kg. In the 450 millions years since fishes evolved, they have spread out even in certain inhospitable places such as at the sea bottoms, torrential currents, ice-cold waters and in the underground caves.

Fisheries had provided livelihood to scores of fishermen offering employment in ancillary industries like net making plants, ice factories, freezing plants, canning, marketing, boat-building, etc. Fish, thus provide man with food, medicines and other ingrediants. Yet, human greed threatens todestroy the harmony between man and nature.

II. FISHERIES RESOURCES

Karnataka is endowed with vast natural and man-made resources for the sustainance and development of fisheries. The State's resources are bestowed with rich aquatic biodiversity comprising of 5813 km of rivers, 73 reservoirs formed across various rivers commanding a total waterspread area of 2,25,000 ha and about 9,000 km of irrigational canals. In addition, the State has seasonal, long-seasonal and perennial tanks numbering

around 40,000 with waterspread area of 2,93,000 ha. The State has a coastline of 300 km having 27,000 sq.km. of continental shelf and 87,000 sq.km. of exclusive Economic Zone (EEZ). There are 26 estuaries whose waterspread area is around 7,214 ha and of brackishwater is 8,000 ha.

DRAINAGE OF KARNATAKA

The drainage picture of the State presents the following conspicuous elements. With the western ghats (Sahyadri) forming a major water-divide, there are short and swift flowing rivers in the west draining into the Arabian Sea. Notable among these are Sharavati, Kali, Bedthi/Gangavalli, Aghanashini/Tadri and Chakra. Some of them raise over the western ghats, flow due east or north-east initially, then take a sudden turn to the west, flow down the steep western slopes of the ghats and, after meandering through short plateau in the coast, joins the sea passing through the coastal plains. A number of them appear as drowned valleys where they join the sea. Practically, save estuaries, there are no deltas.

To the east of the major divide, flow the rivers Krishna and Cauvery. A major part of the upstream of Krishna and its tributaries - Bhima, Ghattaprabha, Malaprabha and Tungabhadra, flow through northern Karnataka, some due north-east to pass through Andhra Pradesh before joining the Bay of Bengal. Only a tributory of river Godavari - Manjira/Karanja is there within the State's boundary.

The river Cauvery in the south raising over Kodagu, flows down the eastern slopes of the ghats, meanders gently over the Mysore plateau, crosses it over a couple of walls, passes through Tamil Nadu upland before joining the Bay of Bengal.

A few rivers on the Mysore plateau in the southern part of Karnataka - Uttara Pinakini, Dakshina Pinakini and Palar, flow north or south because of an east-west water divide across the plateau and, turning east, pass through Andhra Pradesh or Tamil Nadu to join the sea.

Data provided in Table-1 on the river drainages of the State, point to the fact that more water flows through the short west-flowing rivers than all the rivers flowing eastwards.

Table - 1

Data on River Basins

No.	Name of basin	Length in kms in the State	Catchment area in sq.km.	Percentage of the total area	Estimated average flow in M.Cum.
1.	Krishna	483	1,13,271	59.06	27,500
2.	Cauvery	553	47,883	24.96	11,900
3.	Godavari	155	4,405	2.30	1,400
4.	West-flowing	1170	26,214	13,68	57,000

Source: Karnataka State Gazeteer, Part-1, 1982, p: 38.

RESERVOIRS

Multipurpose utility reservoirs numbering 73 built across the rivers of Krishna, Cauvery, Godavari and west-flowing river basins within the State. These impoundments have a total waterspread area of 2,25,000 ha. The construction of dams has affected the fish fauna of the respective rivers to a considerable extent, especially, the migratory fish species.The list of reservoirs along with their waterspread area is presented in Annexure - 1.

TANKS

These are enclosed waterbodies and, generally, are man-made built for irrigation and drinking water needs. There is, however, no clear cut definition for tanks and ponds but, waterbodies above 1 ha can be called tanks and less than 1 ha, are termed ponds. Most of the tanks and ponds are rainfed.

There are about 6015 major - and about 25,000 minor tanks commanding a total waterspread area of 2,93,000 ha. which includes perennial, long-seasonal and seasonal tanks.

III. STATUS OF FRESHWATER FISH FAUNA

Fishes, depending on their ecology, are variously adapted to environmental conditions in the aquatic eco-system. Some of them have excellent hydro-dynamic characteristics enabling them to swim at high speed while others lead a relatively immobile mode of life undergoing number of adaptations in the course of evolution that are unrelated to hydrodynamics but that ensures normal development and survival of the species. The differences in the drainage or sub-drainage on river across which the impoundments are situated, zoo-geographically, determine the fish species available in each. Rivers, reservoirs and perennial tanks are the resources of varieties of indigenous fishes. Due to multiple factors, the indigenous fish fauna is greatly affected.

No systematic survey on the fish fauna of the State has been carried out covering all the freshwater resources in the recent past. However, certain selected riverine stretches and reservoirs were surveyed the `status of fish fauna available in each drainage', efforts to conserve and re-establish the species under threat have to be evolved. This calls for undertaking a detailed fish faunistic survey in freshwater resources of the State at the earliest. From the records available and also from the limited investigations carried out by the authors, over 200 fish species from various freshwater resources of the State have been listed.

RIVERS

In Krishna river, 106 fish species belonging to 5 orders and 19 Families are recorded which includes the introduced Indian gangetic carps and the exotic fishes (Catla, Rohu & Mrigal and Common carp, Silver carp & Grass carp respectively). Majority of the fish species are endemic to this river system. Out of this, about 13 species are under the `threatened' category. The species are *Hypselobarbus pulchellus*, *H.kelus*, *Labeo calbasu*, *L.fimbriatus, L.bata*, *L.potail*, *Puntius saran sarana*, *Schismatorhynchus nukta*, *Thynnichthya sandkhol*, *Mystus krishnensis*, *Rita pavimentata*, *Channa marulius*, *C.stratus* and *Mastacembelus armatus*, *Neotropius khavalchor*, *Bagarius yarrelli*, *Proeutropiichthys taakree taakree* and *Silonia childreni* are almost extinct.

Cauvery river basin has recorded 106 fish species under 8 orders and 23 Families which includes the stocked Indian major carp-Catla, Rohu and Mrigal and the exotic carp - Common carp, Silver carp and Grass carp. *Puntius carnaticus, Hypselobarbus dubius* and the non-predatory catfish -*Pangasius pangasius* available earlier, are now almost extinct from the riverine/reservoir zones of the State. In addition, following 14 fish species are under `threat' and these are - *Cirrhinus cirrhosa, Hypselobarbus micropogen, Labeo calbasu, L.fimbriatus, L.kontius, Neolissochilus hexagonolepis, Puntius carnaticus, P.narayani, Mystus punctatus, Silonia childreni, Bagarius varrelli, Channa marulius, C.striatus* and *Mastacembelus armatus*.

Godavari basin has 64 fish species belonging to 4 Orders and 13 Families which also includes the introduced Indian gangetic carp - Catla, Rohu and Mrigal and the exotic carp - Common carp, Silver carp and Grass carp. Of these, Thynnichthys sandkhol has been observed to be almost `extinct'. Nine more fish species are under `threat' and these are - *Hypselobarbus kolus, Labes bata, L.potail, Osteobrama cotio cunma, O.vigorsii, Silonia childreni, Proeutropiichthys taakree taakree, Channa marulius* and *Mastacembolus armatus*.

West-flowing rivers basins record 105 fish species belonging to 7 Order and 19 Families which also includes the introduced gangetic major carp - Catla, Rohu and Mrigal and the exotic carp - Common carp, Silver carp and Grass carp. *Hypselobarbus thomassi, Labeo calbasu, L.nigrescens* and *Clarius dussumieri* are almost extinct', while 8 more fish species are under threatened category. The species are - *Hypselobarbus curmuca, Cirrhinus reba, Puntius sahyadriensis, Ompok malabaricus, P.pabo, Channa marulius, S.striatus* and *Mastacembelus armatus*.

The fish fauna of the reservoirs and tanks are greatly influenced by the river drainages and also due to the introduction of fast-growing Indian major carp and the exotic carp.

RESERVOIRS

These are expansive perennial freshwater resources of the State and the fish species present in these mainly consists of indigenous to the system such as - Cirrhinus reba,

Hypselobarbus kolus, H.micropogon, H.pulchellus, Labeo bata, L.calbasu, L.fimbriatus, Puntius sarana sarana, Tor khudree, Schismatorhychus nukta, Aorichthys aor, A.seenghala, Mystus cavasius, M.krishnensis, Rita pavimentata, Wallago attu, Ompok bimaculatus, Glossogobius giuris, Channa marulius, S.striatus and Mastacembelus armatus. In addition to these, the introduced gangetic major carp, exotic carp which includes Oreochromis mossambica forms the major fishery in most of the reservoirs.

TANKS

Majority of the tanks in the State are seasonal, long-seasonal and quite a few are perennial in nature. The tank fishery is comprised of Murrels - Channa marulius, C.striatus, C.orientalis, C.punctatus, Catfish - Mystus vittatus, Clarius batrachus, Heteropneustes fossilis, minnow carp and weed fishes like Puntius dorsalis, P.sophore, P.ticto, P.chola, Esomus danricus, Parluciosoma daniconius, Amblypharyngodon mola, Chela cachius, Danio aequipinnatus etc. and Spiny Eels - Mastacembelus armatus. Majority of the tank fishery is diminishing fast on account of ecological
degradation of their habitats.

IV. MANAGEMENT OF FISHERIES IN KARNATAKA

The management of fisheries in the various waterbodies of the State is vested with the Department of Fisheries, Government of Karnataka. Main activities of the Department consists of :

i) Development and conservation of inland fisheries.

ii) Imparting requisite training to the fishermen.

iii) Providing infrastructure facilities such as fishseed production and rearing, ice plants, cold storages, approach roads, construction of market yards, etc. and

iv) Implementation of various schemes for the welfare of the fishermen.

There are eleven Fish Farmers' Development Agencies in the inland sector functioning in the districts of Bangalore Urban & Rural, Kolar, Mandya, Mysore, Tumkur, Hassan, Chikkamagalur, Shimoga, Dharwar, Raichur and Bidar. These Institutions are registered under the Societies Act and they are autonomous having their own governing bodies constituted for the individually oriented development of small watersheets.

Karnataka Co-operative Inland Fisheries Federation has been functioning to implement the tank fisheries development schemes under NCDC assistance in Mysore, Mandya and Hassan districts.

The Department of Fisheries has organised four training centres to impart desired experience to fishermen and private fish farmers in fish culture practices at Krishnaraja Sagar, Kabbini, Bhadra and Bethamangala. The centre at Kabbini is conducting training courses exclusively to tribals under the Tribal Sub-Plan Scheme.

A Reservoir Development Unit is functioning to develop fisheries in Linganmakki reservoir.

The Department, Zilla Parishad, Karnataka Co-operative Fisheries Federation and Fish Farmers' Development Agencies are maintaining 83 Fish farms for the production and rearing of quality fishseed of major carp, having a gross land area of 291 ha with an effective waterspread area of 64.15 ha with 2,416 ponds. Out of the 83 fish farms, 25 are seed production farms and the rest are rearing farms. Annually, about 25 crores of fishseed (fry) are produced in these farms and 16 crores of fingerlings are stocked in the various freshwater resources of the State. Certain quantity of fingerlings of quality fish are also procured from Andhra Pradesh for stocking.

FISHERY RIGHTS OF RESOURCES

Fishery rights of the inland water resources under Government control rests with the Department of Fisheries. However, the minor tanks with waterspread area of 10 ha and below are transferred to Village Panchayats/FFDAs. The tanks, above 10 to 25 ha waterspread area, are under the control of Zilla Parishads which, therefore, are responsible for the development of fisheries in them as also to dispose of the fishery rights subject to the conditions contained in the Government Orders issued from time to time in this regard.

Disposal of fishery rights is done by (a) Licensing, (b) Auctioning, (c) Leasing and (d) Leasing on tender-cum-auction basis. Fishing licenses, however, are issued to fishermen mainlyto conduct fishing in rivers and reservoirs. Long-term leasing policy for a period of 5 years giving preference to certain Institutions to enable them to take-up fish culture on commercial scale and to improve the socio-economic conditions of the fishermen, particularly to offer employment opportunities to SCs and STs and also to un-employed Fisheries Graduates isformulated.

The tanks under the control of FFDAs (less than 10 ha) in 11 districts of the State are leased to individual un-employed persons after providing necessary training and related assistance like supply of fishseed, purchase of fishing equipment, fish feed, etc. for a period of 7 years to produce fish and toimprove his economic conditions.

Government has decided to lease tanks on `tender-cum-auction' basis to private parties/enterpreneures for a period of 5 years in order to achieve increased fish production adopting the technical know-how available.

There are legal bindings on the lessee on the operation of nets of suitable mesh sizes and in the use of basket/traps and to abstain from resorting to destructive type of fishing like dynamiting, poisoning and not to damage/destroy any civil installations, etc.

V. FISH PRODUCTION

To augment fish production, the Department of Fisheries initiated stocking of fast-growing Indian major carp - Catla, Rohu and Mrigal during early sixties and gradually increased the density of stocking year after year. Though the carps introduced, does grow fast, but are not breeding in the freshwater resources of the State. Hence, initially, the stocking material was procured from Kolkata maintaining the desired trend of introducing the species every year. Later, after adopting hypophysation technique, the above fish species were induced to breed in some fish farms and the produce was stocked in majority of the freshwater inland areas. Subsequently, the exotic Common carp (in 1953), Silver carp, Grass carp (in 1965) and Big Head (in Eighties) were introduced in selected tanks only. This endevour resulted in boosting the fish production to considerable extent
(1,18,420 M.tonnes) in 1997-`98.

Though the Department of Fisheries owns 82 fish seed production and rearing farms, the emphasis of mainly on the production of seed of Catla, Rohu and Mrigal by adopting hypophysation technique besides Common carp. There are also 73 privately owned fishseed production and rearing farms who also following the same pattern of seed production as there is great demand.

Annually about 1554 lakh of fish seed are stocked in the freshwater resources and harvest 1,18,420 M.tonnes of fish which includes the cultured (1,02,323 M.tonnes) and the indigenous (16,097 M.tonnes) fishes. The above figures indicate that the contribution of the indigenous fish is about 16% projecting the gradual declining trend.

About 25,000 M.tonnes of fish were harvested during early sixties and the catch composition mainly was of indigenous fishes like Labeo fimbriatus, L.calbasu, Puntius sarana sarana, P.carnaticus, Tor khudree, Neolissochilus hexagonolepis, Hypselobarbus dubius, H.pulchellus, H.kolus, Wallago attu, Aorichthys aor, A.seenghala, Silonia childreni, Mystus cavasius, Mystus krishnensis, Bagarius yarrelli, Ompek bimaculatus, Channa marulius, C.striatus, C.orientalis, Clarias batrachus, Heteropneustes fossilis, Notopterus notopterus, Mastacemeblus armatus, medium and minnow carps and also prawns.

Though there are 155 fish seed production and rearing farms owned by Government as well as by private entrepreneurs, majority of the fish seed required for stocking is being procured from Andhra Pradesh as the cost of fish seed is cheaper. However, in the recent past, results of fish culture have revealed that the fishes so procured from Andhra Pradesh are not attaining the size normally expected in natural waters besides are pruned to certain diseases.

Though the Department of Fisheries did not officially is responsible to introduce the exotic Tilapia - Oreochromis mossambica in the various waterbodies of the State, it was a case of purely accidenal entry along with gangetic carp seed brought from Kolkata and the species is very well established in majority of the Inland waterbodies.

In the recent past, fish culturists in and around Bangalore have evinced interest to take-up the culture of African catfish - *Clarias garriepinnis*. The fish is highly predatory and is being fed with poultry waste to boost its growth.

Even though the fish production has gone up on account of stocking of gangetic carp as also the exotic fish species, the indigenous fish fauna has been subjected to great stress and is affected in growth and population too. Deforestation, erosion, siltation, aquatic weed infestation, pollution, introduction of non-compatible exotic fish species, indiscriminate fishing, dynamiting, poisoning, etc. are the reasons that could be assigned to this alarming situation.

VI. FISHERMEN

There are about 5,65,000 fishermen in the inland areas of the State. Of which, only 1,20,000 are actively engaged in fishing profession. There are 286 Inland Fishermen Co-operative Societies with a membership of 98,000 whose main objectives is to attend to fish production, marketing and for the purchase of fishing implements, boats and to effect their supply to the members. Preference is given to the Fishermen Co-operative Societies while leasing reservoirs. These Societies are expected to develop fishery in the tanks, its harvest and marketing through their members and also to arrange facility for credit purchase of fishery requisites by the members. Depending upon the resources, the fishermen population are found concentrated. Tribal nomadic fishermen - Burude-besthas are habituated to move from place to place to conduct fishing in tanks, reservoirs, rivers, canals, etc. Fishermen forms a part of the fishing unit in some reservoirs and tanks and are engaged in fish marketing also.

VII. FISHING METHODS

The fishing gears used by the fishermen for commercial exploitation of various types of inland waterbodies are varied. There is no standardisation with regard to length and breadth of the nets or the code number of nylon twine used for webbing and the mesh sizes. Though mesh sizes varied depending upon the fish to be caught from 30 to 150 m, fishermen mostly employ 30 to 60 mm mesh bar nets irrespective of any limits to mesh sizes or number of nets as their prime objective is to catch as much as fish possible without any consideration towards conservation of breeders of commercially important fish species as also the ones indigenous to the biotopes. The different types of gears used by fishermen in the State are as follows :

a) **Castnet**:

Beese-balae is the local name of this net. The circular bottom of the net is provided with lead sinkers. It is fabricated out of nylon twine and the code number of the thread, depending upon the mesh size, varies. This type of net is extensively used in tanks, canals, rivers and marginal areas of the reservoirs.

b) **Dragnet**:

Dragnet is fabricated out of cotton thread and measures about 50 M (length) X 2 m (Height) and the mesh size is between 1 to 2 inches. This net, normally, is operated in the tanks in the low water level conditions. 3 to 4 persons are required in its operation.

c) **Nylong gillnets**:

These nets are generally employed for sub-surface fishing. While in tanks, these nets will have mesh sizes between 30 and 75 mm, in reservoirs, larger meshed nets of 90 to 150 mm bar, commonly called `Catla' nets are being operated. These will be around 80 to 100 M in length and 3 to 7 M in height.

d) **Uduvala**:

These are bottom set gill-cum-wall nets with mesh sizes ranging between 35 and 80 mm bar with length of 60 to 90 M and width of 0.50 to 0.75 M. The head and bottom ropes pass through each mesh and clove-hitched by reed floats to every third mesh in the head rope with stringing of burnt clay oval shaped sinkers to each mesh in the bottom rope. This attachment of mest directly with head and bottom ropes gives a firm wall-like tension to the net when in operation. These nets are efficient and are generally operated in creeks and bays of reservoirs and also in larger tanks. These are normally operated in the shore areas of the tanks and reservoirs parallel or diagonal to the shore, being laid in the evening and hauled-up in the morning.

e) **Pedda Uduvala**:

This is a modified bottom gillnet possessing advantages of both the Nylon - and Uduvala gillnets. The nets are wider - 1.5 to 1.75 M, which increases the surface area. These are operated in deep areas of the reservoirs. Construction details are similar to Uduvala.

f) **Alivi**:

The `alivi' net is 75 to 100 M in length, width ranging from 3 M (at the outer edges) to 6 M (in the middle). It is made of cotton twine and tanned in vegetable colours. The tapering edges acts as wings, the meshes gradually decreasing in size from 25 mm (bar) to 20 and 12 mm on both sides, but, as little as 7 mm in the middle for a length of about 45 M. Hence, the middle portion acts as an effective seive net. Coir ropes are tied as head and foot ropes and continued on the outer side as a single rope for 100 M on both sides. A bamboo is tied on the two outer edges for rigidity. The head rope is provided with 70 to 75 wooden floats of indigenous material and at intervals of 0.75 to 1.75 M. The alivi is usually operated in the sluggish river, streams, but, now, is adopted to exploit the inundated areas of reservoirs and also large tanks. Two coracles and eight men are required to operate one alivi net. The net, though operated for a duration of 8 hours, the entire operation consists of circling, soaring fish partially by outer ropes to the middle and effective seining. No fish can escape the net part ones it encircles an area of a reservoir or a tank.

g) **Kontevala**:

This is an almost miniature alivi net in shape and its length is 20 to 25 M, width from 2.5 to 3.0 M in the centre, tapering on to two edges to 1 to 1.5 M. Cotton twine is used as in alivi and meshes are uniformly 10 mm (bar) throughout. Bamboo sticks of 0.75 M are tied at intervals making several pouches in the net during operation. The net is usually dragged by 3 men in littoral areas and the catch comprises of young fish and prawn, mainly used as bait for long lines.

h) **Long-lines**:

The long-lines consisted of a single line having vertical lines (snoods) with barbed hooks of preferably small sizes (Nos. 10 & 12). The snoods are so fixed that they could not be entangled with one another. The length of snoods are of uniform size. The lines with small baits (earthworms, young fish, insects, etc.) could be operated on surface in column and bottom as required.

i) **Rod and Line**:

Indeigenously rigged rod and line with baited hooks are found all over the inland waters of the State with throw lines, *i.e.* baited hooks weighed with sinkers to be thrown some distance in large tanks. Murrels - *Channa marulius*, *S.striatus*, *Wallage attu*, *Ompok bimaculatus*, *Mastacembelus armatus*, etc. and, on certain occasions, even Common carp are captured.

j) **Prawn net**:

Scoop-net, also known as `prawn net' with triangularly tied lengths of sticks, are used all over the State along the margins of the tanks for collecting small fish and prawns in particular. These nets are common in southern and central districts. Very little commercial fishing, however, is possible by this net.

k) **Trape**:

Both `filter traps and sub-conical plunge-baskets' are found.Plung baskets are used to capture murrels, magur, singhi, etc. Filter traps are used in the inlet and outlet channels from tanks and surplus drains, especially in rainy seasons in relation to inflow and outflow of water and migration of fishes. Round baskets with or without aprons are found in maidan areas and in parts of malnad and coastal districts, square or rectangular types are observed. During roiling of a tank by community wading and de-watering, traps and plunge baskets are extensively employed.

VIII. MARKETING AND DISTRIBUTION

Fishermen sell their catch to fish merchants and a portion is kept for consumers at landing centres. Fish merchants collect the harvested fish who in turn bring the pooled catch to towns and cities and sell them to retailers/consumers. Fish is normally transported in fresh condition, with ot without ice-packing by cycles, autoriksha, tempo, buses and trains. The marketing channel follows from production to consumers and to middle-men at landing centres. Middle-men himself acts as a retailer and sell fish to consumers by providing facilities for better preservation and speedier transport.

The prices for the fishes are steadily rising. Presently, depending on the size and quality, carp is sold at Rs. 20/- to 25/- per kg in rural and semi-urban areas of the State and at Rs. 30/- to 50/- per kg in the districts, cities, etc. Indigenous fishes like Murrels - *Channa marulius, C.striatus*, Magur - *Clarias batrachus*, Singhi - *Heteropneustes fossilis*, Spiny eel - *Mastacembelus armatus*, Butter-fish - *Ompok bimaculatus* are, normally, sold at higher rates while minnows and medium carp species, at a cheaper price. The demand for fish is growing rapidly at the rate of 10% every year. There is a wide gap between the demand and supply.

Indian major carp - Catla, Rohu and Mrigal catch pooled from different sources in the State is sent to Kolkata fish market where it fetches better price. During 1999 - 2000, Karnataka Co-operative Fisheries Federation, Mysore exported 50 tonnes of Catla and Rohu to middle-east countries. Apart from this, there are certain private enterpreneures who are also engaged in exporting freshwater fishes - especially the catfishes to middle-east countries.

IX. FISHERIES CONSERVATION AND REGULATION

The Indian Fisheries Act of 1897 of Government of India empowers the State Government to make rules for the introduction of `conservancy measures and licensing systems'. Mysore Game and Fish Preservation Regulation Act of 1901 empowers the State Government to :

i) frame rules for regulation and central of fishing and amend or cancel any rule/s so made.

ii) declare closed-season.

iii) prohibit harvesting of fish in any area for a period of 5 years.

iv) prohibit poisoning or use of explosives in any stream, river or lake.

v) regulate by notification, sale of fish within any specified local area.

vi) make provisions to impose penalty to persons who contravenes conditions laid-down in licences granted.

vii) empower Court of Magistrate to confiscate implements used for capture of fish and licences granted.

viii) empower officials delegated with powers to arrest without warrant any person who commits offence punishable under this regulation.

With the re-organisation of the State, the areas which have merged from adjoining States, are still governed by the rules of the respective parental States. In view of this, a common Karnataka Inland Fisheries (Conservation, Development and Regulation) Bill is prepared in 1996 and placed before the Legislative Assembly for enactment. But certain observation have been raised by the Assembly; hence its compliance and enactment is pending. The Act II of 1901, passed by the State Government and the proposed Bill are enclosed.

X. CONSERVATION

Sanctuary is an abode of fish fauna of the river system in which it forms a part and they have to be protected. As an attempt to conserve the fisheries, certain fish congregations areas in river stretches have been declared as `sanctuaries' by the Department of Fisheries, Government of Karnataka.

DECLARED FISH SANCTUARIES

No.	Sanctuary	River	Taluk	District
1.	Ranganathittu (Bird Sanctuary)	Cauvery	Srirangapatna	Mandya
2.	Ramanathapura (Vanhi Pushkarni near Rameshwara temple)	Cauvery	Arkalgud	Hassan
3.	Shishila (Near Shishileswara temple)	Kumaradhara	Belthangadi	Dakshina Kannada

There are some more riverine stretches in the State where fish congregations have been observed and, to certain extent, is being taken-care-of by the Religious Institutions. These are :

No.	Sanctuary	River	Taluk	District
1.	Sringeri	Tunga	Sringeri	Chikmagalur

2.	Jammatgi	Tunga	Koppa	Chikmagalur
3.	Cippalgudda	Tunga	Thirthahalli	Shimoga
4.	Bachanayakanahalli	Kumaradhara	Sulya	Dakshina Kannada
5.	Todikana	Chandragiri	Sulya	Dakshina Kannada
6.	Thingala	Seethanadi	Karkala	Dakshina Kannada
7.	Part of Payaswini	Payaswini	Mangalore	Dakshina Kannada

There is one fish congregation area from Muthatti to Sangam in river Cauvery. This comes under the jurisdiction of National Parks and Sanctuaries. But this area reported to have been leased to M/s. Jungle Lodges and Resorts for management.

A new sanctuary in river Cauvery at Nisargadhama near Kushalnagar in Coorg district has come into being recently at the premises of Nisargadhama which is under the control of Forest Department.

These sanctuaries are harbouring the famous gamefish of India - Mahseer - *Tor khudree*, as also *Neolissochilus hexagonolepis*, *Hypselobarbus pulchellus*, *Puntius carnaticus*, etc. and not all the fish species endemic to the respective rivers.

Inspite of declaring officially Shishila as a Fish Sanctuary, about 5 years back, the area holding this valuable gamefish of India - *Tor khudree* was poisoned and truck-loads of dead fish were removed. Oflate, efforts are being made by local Organisations at Shishila to revive this sanctuary.

Also, Bachanayakanahalli near Enokal in Dakshina Kannada district encountered mass mortality of *Tor khudree* during April, 2001.

Few Non-Government Organisations (NGOs) like Wildlife Association of South India (WASI) and Coorg Wildlife Association who had taken same stretches of river Cauvery,

initiated measures to protect Mahseer fishery by preventing fishing and allowing only `sport fishing with the condition to release the prize catch in live condition' back in the riverine stretch. They also undertook ranching of the river stretches of *Tor khudree* fingerlings getting them from Lonavla, Maharashtra State.

MAHSEER HATCHERY

Under Westernghat Development Scheme of Government of India to conserve the famous gamefish of India - Mahseer - *Tor khudree*, a hatchery at Harangi near Kushalnagar in Coorg district at a total cost of Rs. 2.00 Crores was established. Efforts are being made to produce young ones of the species in captivity.

Except for the aforesaid programmes, no other conservation measures have been strictly enforced the important indigenous fish fauna of the State.

XI. FACTORS RESPONSIBLE FOR THE DECLINE IN INDIGENOUS FISH FAUNA

There has been a decline the indigenous freshwater fish fauna to a great extent in the State. The decline may be attributed to several factors like the deforestation, mining, construction of dams and barrages, land-use practices, shirnkage, aquatic weed infestation, pollution, indiscriminate fishing, introduction of exotic fish species, etc.

a) **Deforestation** :

Mountain eco-system helps in the maintenance of related habitats right upto the sea coast. The origins of streams and rivers from forested mountains is a fact admitting. The forest streams constitute an important habitat for fish and its food organisms. Undisturbed forest, normally provides quality water. Deforestation exposes the soil to petting rain and erosion, the adverse result of which will be felt right upto the estuary. Rain forest in the tropics are indiscriminately destroyed for various purposes. Non-selective cutting of forest wealth near the river or stream banks has caused erosion, siltation and blocking the flow in the riverine stretch.

b) **Mining** :

Mining and related activities result in the disposal of sediments, sludge, slime, tailings and other solid and liquid wastes which ultimately find their way into the lotic and lentic water resources affecting the aquatic life in general.

c) **Construction of dams** :

Impoundments are created to regulate flow, control floods, irrigation and for hydro-power generation. Reservoirs acts as silt nutrient traps, as a result of which, eutrophication occurs and fish production increases. Changes in physics-chemical features may occur and stagnation of water may result in de-oxygenation and in the production of Hydrogen sulphide. Changes in fish fauna invariably occurs as also incidence of certain water-borne diseases. Construction of dams, anicuts, barrages, etc. not only inundates the natural breeding grounds of fishes present earlier in the riverine course, but also have prevented the migration of fishes from both up - and downstreams affecting their breeding to a great extent. Water abstraction and channelisation is crucial for fish life downstream and also for water quality in the impoundment. Over irrigation or over use of water leads to water-logging and salinity intrusion.

d) **Land-use practices** :

Poor agricultural practices and wasteful irrigation increases erosion, siltation, reduces stream flow, cause loss of nutrients or increase in salinity and some related problems. The result may be choking of river beds, reduction and elimination of bottom and drift organisms, smothering of breeding grounds of fish, reduction of fish stock in streams and its ever-all poor quality. Use of pesticides and other chemicals used in agricultural practices which finds entry into the aquatic systems, affects food chain and the fish ultimately.

e) **Shrinkage** :

Erosion and siltation has resulted in the disappearance of large number of wetlands as also rivers and reservoirs. Encroachment of the tank-beds by agriculturists and builders resulted in the reduction of waterspread area.

f) **Weed infestation** :

The various species of emergent, floating, submerged and marginal aquatic weeds are found in majority of the inland water areas where they have been a cause of choking the tanks completely. The entry of domestic wastes and industrial effluents congenial for the growth of these weeds has resulted in making the tanks useless. This has resulted in the health hazards to the humans and domestic animals as well.

g) **Pollution** :

Migration of population from rural to urban areas has increased the problem of waste disposal. Anthropogenic pollution threatens to upset the aquatic eco-system. Human wastes, which used to be a good source of manure in the rural areas, are a source of pollution in towns and cities. This has resulted in the depletion of fishery areas around cities in particular. For example, tanks in and around Bangalore City are affected very badly; to name a few - Bellandur, Varthur, Ulsoor, Byramangala, Madivala, Agara, Nagawara are the ones, from wherein, even the hardy fish species like Murrels, Clarias, Singhi, etc. have completely disappeared.

Discharge of harmful untreated domestic sewage and industrial effluents from Tanning, Textile, Chemicals, Sugar, Pulp and Paper, Pharmaceuticals, etc. in to the inland waterbodies has adversely affected the aquatic life, particularly the fish. It may be mentioned that mass mortality of fish is a regular phenomena in watersheets which are subjected to receive untreated concentrated domestic and industrial wastes. Release of untreated effluents from certain industries located on the river banks has not only eliminated the valuable fish stock, but also has created severe health problems to the public and the live-stock as well. Besides, certain toxins also accumulates in fish body and and it effects when such fish are consumed.

h) **Indiscriminate fishing** :

i) Fish have a biological instinct to ascend rivers during the initial monsoon floods for the purpose of breeding. This opportunity is availed by the fishermen in indiscriminate fishing by using different gears. This results in harvesting of spawners affecting the fish population in general.

ii) During the overflow of waterbodies, the fishes from downstream, while ascending, gets trapped in large scale near the dams. The fish so congregated in such locations, being vulnerable, are easily exploited affecting fish population to a very large extent.

iii) When the flow regime is maintained in the irrigational canals from the reservoirs, fishes also enters along with the water. On the closure of flow of water in the canals, the fish gets trapped near the gates and is captured which too results in the depletion of fish stock.

iv) Operation of nets of small mesh sizes all through the year in majority of impoundments results in the elimination of quality as also indigenous fish populations. The alivi net when in operation in perennial waterbodies, scoops out almost the entire fish stock affecting their population. Even juveniles of quality fish are being fished by the unrestricted use of small-meshed nets.

v) There are a number of water-falls in the east- and west-flowing rivers. The fishes while migrating upstream for food, shelter and for breeding, gets trapped at the foot of these falls. In addition, there are a number of pools in the riverine stretches where fish normally take shelter during the lean seasons. These areas are easy targets for dynamiting, poisoning, etc. damaging the fish population completely.

vi) Dynamiting and poisoning is resorted to during the lean season in pools along the river courses which holds considerable quantity of fish. Such a destructive process leads in the mass elimination of important fish components. Plant derivatives as that of unriped fruits of *Randia dumetorum*, bark, seed and root of *Barringtonia acutangula* and latex from Euphoria thirukalli are being extensively used to collect fish in such pools and congregated locations.

vii) Indiscriminate exploitation of certain ornamental fish species which have export potential and endemic to certain rivers, is in vogue. For example, the Loaches of river Tunga near Gajanur in Shimoga. This will result in the depletion and even disappearance of all the indigenous fish species in the long run.

i) **Introduction of Exotic Fishes** :

Common carp (*Cyprinus carpio*) :

In order to boost fish production, especially from the larger perennial waterbodies, introduction of fast-growing gangetic and exotic carps is effected. Exotic Grass carp - *Ctenopharyngodon idella*, Silver carp - *Hypophthalmichthys molitrix* and Common carp - *Cyprinus carpio* have been extensively stocked in almost all the inland water areas of the State. Unlike the Grass carp and the Silver carp which happens to be herbivores and planktivorous, the Common carp - an omnivore, utilises different food niches of an aquatic eco-system depriving the endemic fish species of their food. The species has a habit of browsing for food in the shallower areas of the impoundments which also are the sites of breeding and recruitment to the scores of indigenous fishes. On account of its omniverous feeding habits, it devours the eggs, fry, etc. of the indigenous fishes reducing their population to a great extent. The fish also attains early maturity, in just about 3 months, and with a prolonged breeding season, increases its population with retarded growth on account of over-population and to compete for food and shelter with the fishes endemic to the system. This biological process of the species has directly affected the very existence of indigenous fish fauna in majority of the waters (e.g., Krishnaraja Sagar reservoir) in the State.

Tilapia (*Oreochromis mossambica*)

Accidental introduction of Tilaphia has created a sort of total destructive scene in alll the tanks, rivers and reservoirs in the State. The important point to be taken note of in this species is its prolific breeding habit resulting in over-crowding affecting the grwoth and population of fish indigenous to the biotope. It is an example of `population explosion', the result being almost the total destruction of fish species indigenous to the waterbodies.

African catfish (*Clarias garriepinnis*) :

It is observed that, un-authorisdly African catfish - a highly carnivorous fish is cultured in some ponds and tanks around Bangalore. If this find entry into larger perennial tanks, it may result in devastating effect on the indigenous fish fauna.

j) **Spread of Epizootic Ulcerative Syndrome Disease** :

Out-break of Epizootic Ulcerative Syndrome Disease which affected the inland fishery resulting in mass mortality of the species such as *Wallago attu, Channa marulius, C.straitus, C.orientalis, Clarias batrachus, Mastacembelus armatus* has also a cause of depletion of fish fauna indigenous to the inland waterbodies of the State.

XII) BIO-DIVERSITY STRATEGY AND ACTION PLAN FOR THE CONSERVATION OF FRESHWATER FISHES

To conserve the freshwater fish bio-diversity of the State, following `measures' may be considered.

1(a) : **Survey of Fish Fauna**:

Detailed fish faunistic survey of the State covering all the inland waterbodies is required to be carried-out to record their present `status'. List out the existing fish species available including `rare, threatened and endangered' fish species.

2(b) : **Sanctuaries** :

Identify fish congregation places including the existing ones and officially declare them as `Sanctuaries'. To protect the fish fauna of the concerned river/s, the endemic fish species, not found in the sanctuary, should be collected and pooled in the area so as to preserve them *insitu*.

Organise Non-Governmental Organisation (NGOs) to protect these `sanctuaries' by providing :

- adequate funds for feeding the fishes.

- to fix suitable `name-boards' with description to indicate prominantly that `FISHING IS PROHIBITED' and also guidelines on `dos' and `donts' to protect the fishery.

- to maintain the sanctuary pools with appropriate flow of water and to guarantee adequate depth for the fish to take shelter.

- during religious congregations, care should be taken to avoid over-feeding which, unfortunately, may result in the depletion of Oxygen leading to mass mortality of fish. If possible, aerators may be used in such extreme conditions to over-come the depletion of oxygen.

(c) Appropriate action to collect `rare, threatened and endangered' fish species from natural sources, organise their rearing, breed them in captivity and replenish the stock in suitable areas. Some of the fish farma located near certain reservoirs can be utilised for this purpose.

(d) The riverine stretch - about 2 to 3 km above the reservoirs and a km in the lower reaches of the dam are the sensitive areas where fish migrates during monsoon for breeding. These areas should be identified inrespect of each reservoir in each river system and declare them as `TOTALLY PROHIBITED' areas for fishing. This facilitates prevention of capture of spawners and provide scope for their propogation.

(e) The disposal of fishing rights of irrigation canals by licencing or by public auction may be suspended and when the canal gates are closed, the fish congregated at the sluice gates, may be collected alive and released them in the reservoir to protect the fish fauna.

2. **Closed-Season** :

During monsoon, majority of fishes breed and the fishermen harvest large quantities of fish at the time. To facilitate successful breeding and recruitment of fish indigenous to the system, `CLOSED SEASON' for fishing should be declared in the reservoirs, rivers and even in perennial tanks. People depending on fishing during monsoon are to be identified and be paid monetary relief as is being done in coastal areas.

3. **Mesh Regulation** :

To avoid harvesting of juveniles fishes and to facilitate their growth upto the breeding size, operation of small-meshed nets should be regulated.

4. **Flow of Water** :

It may be considered to maintain minimum flow of water in river stretches during summer below the dams to protect the fishes sheltering in pools.

5. **Dynamiting and Poisoning** :

Use of dynamiting and poisoning to capture fish, not only kills all the available fish fauna, but also makes it unfit for human consumption. Capture of fish by these methods should be strictly
prohibited.

6. **Gene Banks** :

Strategy for the conservation of `rare. threatened and endangered' fish through setting-up of `gene banks' resources centres should be planned. It will help in conserving the valuable fish genetic resources of the State.

7. **Introduction of Exotic Fish Species** :

i) Legal action should be taken on these who have already initiated culture of exotic fish species banned by the Central/State Governments (Like the African Catfish - *C.garriepinnis*)

ii) Introduction of any exotic fish species in the State should be forbidden unless proved beneficial in maintaining the bio-diversity and cleared by the Government.

8. **Prevention of Pollution** :

Legal action should be taken to prevent entry/release of domestic and industrial effluents into the tanks, streams, rivers and reservoirs. Such of those industries which affect the bio-diversity of an aquatic eco-system, should be held responsible to compensate for the loss and damage.

9. **Encourage bio-pesticides in agricultural practices** :

To prevent the `lethal' effect on the fish life in a biotope on account of use of pesticieds in agricultural practices, action should be taken to encourage the agriculturists to use `bio-pesticides'. If required, guidance and desired subsidy may be provided.

10. **Mining** :

Mining adjacent to river/reservoir banks and stacking of earth in close proximity to these waterbodies should be totally avoided to prevent siltation and also to avoid stress on aquatic life.

11. **Siltation** :

Afforestation of the catchment areas of the water resources should be undertaken to minimise erosion and siltation. Silt traps can also be established wherever possible/feasible to avoid siltation. Efforts should be made to desilt the tanks/reservoirs affected with the problem.

12. **Aquatic Vegetation** :

Water hyacinth, Impomoea, Typha, Cyperus, etc. are commonly found in majority of the tanks and rivers. Spreading of these noxious weeds should be controlled mannually, mechanically or biologically. The operation should be repeated quite often to eliminate these from the waterbodies.

13. **Insitu preservation of fish** :

In certain selected reservoirs and in perennial tanks, the endemic fish species should be pooled and all `conservation' practices be followed to act as model centres for `insite' conservation.

14. **Public awareness** :

Suitable literature on the importance of bio-diversity conservation of freshwater fishes should be prepared in local/vernacular languages and distributed. Educational films on the subject may be prepared/procured and be screened in strategic places to create `awareness' on the theme. Schools and College level curriculum may be prescribed to educate the students on the importance of `bio-diversity'.

15. **Organising Non-Governmental Organisations (NGOs)** :

It may not be possible for the Department of Fisheries in the State alone to undertake the `conservation' and protection of valuable freshwater fish fauna of the State'. It is, hence, necessary to organise NGOs in selected places to take care of these resources. Suitable training may be provided to the members of the said Organisations.

16. **Fishermen Co-operative Societies** :

There are 286 Inland Fishermen Co-operative Societies with a membership strength of 98,000. These Institutions are actively engaged in fishing and other ancillary activities. The members are to be educated on the importance of `conservation of fish genetic resources of the State' and to maintain the `bio-diversity' of this valuable aquatic life. Their active and

constructive role will go a long way in the conservation and development of fish bio-diversity of the State.

17. **Cooperation and Coordination amongst concerned Departments** :

To conserve the fish bio-diversity in the State, the co-operation and coordination of all the Departments concerned is very essential. Therefore, a State Level and District Level Committees be constituted to oversee the programme and its implementation on the `conservation and review of action plan' periodically.

The Committee/s may be represented by :

1. Department of Ecology and Environment
2. Department of Fisheries
3. Department of Water Resources
4. Public Works Department
5. Department of Forest
6. Department of Revenue
7. Pollution Control Board
8. Zilla Parishads
9. Research Institutes and
10. Non-Governmental organisations.

ANNEXURE

LIST OF FISHES RECORDED FROM THE FRESHWATER RESOURCES OF KARNATAKA

1 *Notopterus notopterus*+*
2 *Anguilla bengalensis bengalensis*
3 *Angilla bicolor bicolor+*
4 *Hilsa (Ilisha) kelee*
5 *Hilsa (Tenualosa) ilisha6Hilsa (Tenualosa) toli*
7 *Catla catla **
8 *Cirrhinus cirrhosa *+*
9 *Cirrhinus fulungee+*
10 *Cirrhinus mrigala**
11 *Cirrhinus reba**
12 *Ctenopharyngodon idella*
13 *Cyprinus carpio var communis**
14 *Hypselobarbus curmuca*+*
15 *Hypselobarbus dubius*+*
16 *Hypselobarbus kolus*
17 *Hypselobarbus micropogon+*
18 *Hypselobarbus pulchellus*+*
19 *Hypselobarbus thomassi*+*
20 *Labeo ariza*
21 *Labeo bata*+*
22 *Labeo boga+*
23 *Labeo boggut+*
24 *Labeo calbasu*+*
25 *Labeo dussumieri*
26 *Labeo fimbriatus*+*
27 *Labeo kontius+*
28 *Labeo nigrescens+*

29 *Labeo pangusia*

30 *Labeo porcellus*+*

31 *Labeo potail*+*

32 *Labeo rohita**

33 *Neolissochilus hexagonolepis*+*

34 *Oraichthys cosuatis*

35 *Osteobrama bakeri*

36 *Osteobrama belangiri*

37 *Osteobrama cotio cunma*

38 *Osteobrama cotio peninsularis*

39 *Osteobrama dayi*

40 *Osteobrama neilli*

41 *Osteobrama vigrosii*

42 *Osteobrama (Kantaka) brevidorsalis*

43 *Osteochilus (Osteochilichthys) godavariensis*

44 *Osteochilus (Osteochilichthys) nashi*

45 *Osteochilus (Osteochilichthys) thomassi*

46 *Puntius amphibius*

47 *Puntius arulius**

48 *Puntius bovanicus*

49 *Puntius carnaticus*+*

50 *Puntius cauveriensis*

51 *Puntius chola*

52 *Puntius conchonius*

53 *Puntius denisoni*

54 *Puntius dorsalis*+*

55 *Puntius fasciatus*

56 *Puntius filamentosus**

57 *Puntius guganio*

58 *Puntius malabaricus*

59 *Puntius melanostigma*

60 *Puntius narayani*+*

61 *Puntius nigrofasciatus*

62 *Puntius parrah*

63 *Puntius pinnauratus*

64 *Puntius puckelli*+*

65 *Puntius sahyadriensis*

66 *Puntius sarana sarana**

67 *Puntius sophore**

68 *Puntius ticto**

69 *Puntius vittatus*

70 *Rohtee ogilbii*

71 *Schismatorhynchus nukta*

72 *Thynnichthys sandkhol*+

73 *Tor khudree**+

74 *Tor mussulah*

75 *Tor neilli*

76 *Chela cachius*

77 *Chela fasciata*

78 *Chela laubuca*

79 *Salmostoma acinaces**

80 *Salmostoma boopis*

81 *Salmostoma clupeoides**

82 *Salmostoma horai*

83 *Salmostoma novacula*

84 *Salmostoma phulo**

85 *Salmostoma untrachi*+

86 *Hypophthalmichthys molitrix*

87 *Hypophthalmichthys nobilis*

88 *Amblypharyngodon melettinus*

89 *Amblypharyngodon mola**

90 *Aspidoparia morar*

91 *Barilius bakeri*

92 *Barilius barila*

93 *Barilius barna*

94 *Barilius bendelisis**

95 *Barilius canarensis*

96 *Barilius gatensis*

97 Barilius vagra

98 Brachydanio rerio

*99 Danio aequipinnatus**

100 Danio devario

101 Danio fraseri

102 Danio strigillifer

103 Esomus barbatus

104 Esomus danricus

*105 Parluciosoma daniconius**

106 Parluciosoma labiosa

107 Rasbora caverii108Rasbora rasbora

109 Crossocheilus latius latius

110 Garra bicornuta

*111 Garra gotyla stenorhynchus**

112 Garra hughi

113 Garra mcClellandi

114 Garra mullya

115 Parapsilorhynchus prateri

116 Balitora mysorensis

117 Bhavania annandeil

118 Bhavani australis119Homaloptera montana

120 Nemacheilus altipedunculatus

121 Nemacheilus anguilla

122 Nemacheilus bhimachari

*123 Nemacheilus denisoni denisoni**

124 Nemacheilus denisoni dayi

125 Nemacheilus evazardi

126 Nemacheilus guentheri

127 Nemacheilus kodaguensis

128 Nemacheilus moreh

129 Nemacheilus pulchellus

130 Nemacheilus rendahli

131 Nemacheilus rubidipinnis

132 Nemacheilus rueppelli

133 *Nemacheilus semiarmatus*
134 *Nemacheilus shimogensis*
135 *Nemacheilus striatus*
136 *Lepidocephalus thermalis**
137 *Botia striata**
138 *Aorichthys aor**
139 *Aorichthys seenghala**
140 *Mystus armatus*
141 *Mystus cavasius**
142 *Mystus gulio*
143 *Mystus krishnensis+*
144 *Mystus malabaricus*
145 *Mystus montanus*
146 *Mystus punctatus+*
147 *vittatus**
148 *Rita kuturnee*
149 *Rita pavimentata*
150 *Ompok bimaculatus**
151 *Ompok malabaricus*
152 *Ompok paboa*
153 *Ompok pabo*
154 *Silurus cochinchinensis*
155 *Silurus wynadensis*
156 *Wallago attu+*
157 *Eutropiichthys googwaree*
158 *Eutropiichthys vacha*
159 *Neotropius khavalchor+*
160 *Pseudotropius atherinoides*
161 *Proeutropiichtrhys taakree taakree*
162 *Silonia childrenii+*
163 *Pangasius pangasius*+*
164 *Amblyceps mangois*
165 *Bagarius yarrellii+*
166 *Glyptothorax lonah*

167 *Glyptothorax madraspatanum*
168 *Glyptothorax trewavasae*
169 *Nangra itchkeea*
170 *Clarias batrachus**
171 *Clarias dussumieri*
172 *Heteropneustes fossilis**
173 *Osteogeneiosus militaris*
174 *Hyporhamphus limbatus*
175 *Zenarchopterus gilli*
176 *Strongylura leiura*
177 *Strongylura strongylura*
178 *Xenontodon cancila*
179 *Oryzias melanostigma*
180 *Horaichthys setnai*
181 *Aplocheilus lineatus**
182 *Gambusia affinis**
183 *Poscilia (Lebestis) reticulatus**
184 *Ichthyocampus carce*
185 *Chanda nama*
186 *Pseudambassis ranga**
187 *Pristolepis marginata*
188 *Etroplus canarensis*
189 *Etroplus maculatus**
190 *Etroplus suratensis**
191 *Oreochromis mossambica**
192 *Rhinomugil corsula*
193 *Glossogobius giuris**
194 *Glossogobius sadanundio*
195 *Anabas testudineus*
196 *Macropodus cupanus*
197 *Osphronomus goramy*
198 Channa marulius*+
199 *Channa orientalis**
200 *Channa punctatus**

201 *Channa striatus*+*

202 *Macrognathus aral+*

203 *Macrognathus pancalus*

204 *Mastacembelus armatus**

* = Target Fish Sepcies.

+ = Rare, Threatened and Endangered Fish Species.

KARNATAKA STATE BIODIVERSITY STRATEGY AND ACTION PLAN

COMMISSIONED ISSUE PAPER

Thematic group: Medicinal Plant Resources

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Backround note: *For the purpose of this document a target set of 261 medicinal plants species have been considered which are believed to be of "significance to Karnataka". Wherever relevant, references have been cited and non-citable material has been enclosed as numbered annexures.*

1.Current Status

1.1In terms of spatial distribution: The exact distribution of the selected 261 species in Karnataka is not available in a clearly documented form. However some information, though old, can be gathered from floras relevant to Karnataka [1-8].

Forest department of Karnataka is spearheading a pioneering medicinal plants programme in India for in situ conservation, conservation of threatened plants, in situ plantation, sustainable harvest of medicinal plants from the wild. A significant feature of this Southern Indian conservation initiative is the involvement of rural communities in conservation, cultivation and value addition. The conceptual and operational features of the Indian models for conservation of medicinal plants are described below.

In order to capture the diversity of medicinal plant species occurring in the forest, a network of in situ Medicinal Plants Conservation Areas (MPCAs) have been established across different forest types and altitude zones. Each of these sites is approximately 200 hectares in size and the choice of these sites has been guided by the following considerations :

1. Covering the range of forest types available in the region, while selecting the sites for the MPCA network.
2. Areas traditionally well know for their medicinal plant wealth have been given priority for selection.
3. Areas with known high level of endemism (hot spots) have been given priority.
4. Selection of sites has been done with fair representation of the range of altitudes.
5. Logistic considerations for proper management of the sites.

These sites make up the in situ gene bank network of Karnataka. A nursery network and seed banks linked to these in situ conservation sites connect these field gene banks to the users.

As per an estimate by Foundation for Revitalization of Local Health Traditions (FRLHT) there are approximately 2000 medicinal plant species occurring in Karnataka. A total of 933 species out of this have been recorded across the network of 13 Medicinal Plants Conservation Areas established in Karnataka since 1993. (**Refer annexure - 1**)

As per FRLHT database, a total of 60 Red Listed medicinal plants have been recorded across the different forest types of Karnataka. A map produced by FRLHT titled "Karnataka's Red Listed Medicinal Plants - Distribution across the Forest Types" records this information[9]. Another publication of FRLHT on 100 red-listed medicinal plants of conservation concern in southern India also records this information[10].

A recent survey report is available in the form of database developed by Prof. Kameshwar Rao, Bangalore University. The western ghats, Kodagu District Chikkamangalur District, eastern ranges like Biligiri-rangana hills, Savandurga hills, Ranganayakiguda (Chitradurga district), Sandur hills (Bellary district), Kappat (Kedar district), Manvi hills (Raichur district), Chincole forest (Gulbarga district) are believed to have relatively higher population densities of medicinal plants in Karnataka.

The information on the number of plant species in cultivation within Karnataka is almost entirely absent. Plants like *Cassia senna and Acorus calamus* are being cultivated regularly. Tumkur district alone grows a good percentage of the national requirement of *Acorus calamus* [11].

Forest and private landholders cultivate trees like *Mangifera indica*, *Tamarindus indica, Tectona grandis* as plantation crops extensively for their commercial value. *Alternanthera sessilis, Basella alba* and *Murraya* plants are often cultivated for their food values. Flower yielding trees and plants like *Artemisia indica, Barleria cristata, Clitoria ternatea, Michelia champaka, Nerium indicum, Ocimum sanctum, Wedelia species* are cultivated in kitchen gardens. Tree species such as *Acacia concinna, Acacia nilotica, Anogeissus latifolia, Bambusa arundinacea, Delonix elata, Feronia elephantum, Ficus racemosa, F. riligiosa, F. bengalensis, Gmelina arborea* and *Pongamia pinnata,* are cultivated by Forest department under social forestry and avenue tree planting schemes.

A lot of medicinal plants are considered as weeds which can be found along roadsides, barren waste lands and amongst commercial crops. 33 species of medicinal plants have been considered as weeds and are believed to be abundant in Karnataka [12]. Some plants like *Bacopa monnieri, Centella asiatica, Cynodon dactylon, Eclipta alba, Phyllanthus amarus, P. maderaspatensis, P. reticulatus* are by-products of cultivated water fed fields. Some other plants like *Aloe barbedensis, Cassia senna, Tylophora indica, Coleus forskohlii* and *Vetiveria zizanioides* are believed to be cultivated for pharmaceutical industries, in small quantities, in certain pockets of the state.

Several medicinal plants like *Elletaria cardamomum, Piper nigrum, Syzygium aromaticum*, etc., are being cultivated regularly and many of them are considered as conventional spice crops. Some information on the extent of land under cultivation of these spice crops is available with the Spice board of India, Cochin.

As per the reports available with the Indian Institute of forest management , Bhopal, Indian forest are considered vulnerable since the total forest area is only 18- 19% as against an ideal forest area of 33% (as in Canada). The situation in certain states is really alarming for example undivided Uttar Pradesh has a forest area of only 4%. The highest forest area is in undivided Madhya Pradesh (around 23%). Karnataka has around 19% forest area.

There are twenty eight National parks and sanctuaries in Karnataka covering more than 6719 sq kms area, which comes up to 17.68% of the total forest area in Karnataka.

Due to recent efforts towards conservation of medicinal plants about one dozen medicinal plant gardens have been developed with the objective of providing germ plasm / starting material to the interested farmers for cultivation. Specific details on this effort are available from the Karnataka state forest department.

1.2 In terms of ecosystem: Specific information on the current status of medicinal plants in terms of ecosystems is not available. However with increased depletion in forest cover and destruction of specific habitats it is not difficult to conclude that there

would have been reduction in the population of medicinal plants also. In the selected list of 261 medicinal plants, it is believed that most of them do not require any specific habitat and can thrive in a wide variety of ecosystems. There are approximately 400 sacred grooves in Karnataka[13].

Some information on the forest types in Karnataka and the species that they hold has been reported. Karnataka state has a total land area of 1,92,204 Sq. km., of which the forest area constitutes 38,000 Sq. km, which occurs between latitudes 11.31 and 18 North and longitudes 74.12 and 78.40m East[14]. Karnataka State has the following forest types viz., evergreen, semi-evergreen, moist deciduous, dry deciduous, scrub and thorny jungles. According to a report of Botanical survey of India, 1984, Karnataka state abounds in 3924 species belonging to 1323 genera and 199 families. Information on 1493 species with medicinal properties belonging to 808 genera and 179 families has been reported[15].

According to another report available with FRLHT, Bangalore there are six major types of forests in Karnataka which are reported to hold around 1839 different species of medicinal plants. 513 species occur in the west coast semi-evergreen forest, 280 in southern hill-top tropical evergreen forest, 143 in southern thorn forest, 316 in dry deciduous scrub forest, 376 in southern dry mixed deciduous forest and 211 in west coast tropical ever green forest.

1.3 In terms of taxonomic categories : Twenty two species are endemic to the western Ghats and three species are endemic to only Coorg district [4]. Further information was not available.

2. Ongoing changes (Extent of change in terms of:)

2.1 Spatial distribution: There is no doubt that there is a reduction in the total population of medicinal plants not only in Karnataka but nationally and internationally also. Unfortunately due to lack of data it has not been possible to quantify the extent of reduction.

According to a latest forest *survey state of forest report* prepared by "Forest survey of India", Dehradun, forest in Karnataka are going through a chequered phase. While on the one hand the total forest cover in the state has rightly increased by 64 sq km, however ironically about 22 km of dense forest have also been lost between the 1997 to 1999 assessment period.

While on paper figures suggested that the forest cover in the state is about 19.6 percent of total geographical area, however the actual forest cover of the state, says the Report is 32,467 sq. km, which constitutes only about 16.93% of the total geographical area.

Incidentally, Karnataka is one of the few states in the country, which has shown steady increase in the forest cover. During 1989 assessment total forest cover which stood at 32,100 sq. km had increased to about 32,467 sq. km during 1999 an increase of 367 sq. km of forest in a decade. The present assessment shows that Shimoga district has lost about 14 sq. km., while Dharwad 10 sq. km. and Dakshina Kannada 7 sq km which is due to extraction of old plantations. Gulbarga district topped the list by registering major increase in forest cover, about 84 sq km. This increase has been attributed to plantation efforts and protection of degraded areas[12]. In Uttara kannada district of Karnataka, the forest area has come down from 8,000 sq km to 6,000 sq km in about 40 years [16].

In Karnataka two million hectares of forest are in different stages of degradation. The forestry sector is facing diversified problems in order to meet the demand for timber, pulpwood etc. Obviously, there is a large gap between supply and demand and thus pressure on forests for land, firewood and small timber from village communities is tremendous. To compound the issue, environmental activism is gaining momentum in

the country and particularly in Karnataka forest department has taken the extreme by banning the felling of green trees in the forests. During the 1980's, due to an upsurge in investment in social forestry, lots of afforestation activities took place to compensate for the degradation of natural forests. In this context green trees were stopped from felling for industrial needs and reduced the harvesting levels in natural forests. In the corporate sector, production forestry was attempted in the degraded areas.

Plantation forestry continues to be cost effective activity on ecologically barren lands after mechanical site preparations and planting of fast growing species. This is necessary for increasing productivity at lesser cost. By means of production forestry done by corporate sector, the onslaught on natural forests have been reduced and what little is left in the natural forests can be saved along with its biodiversity[14].

The four main factors, which are considered responsible for overall reduction in bio-resources, are:

i. Deforestation
ii. Commercial utilization
iii. Fire
iv. Developmental activities like construction of roads, dams etc.
v. Overpopulation

Due to the impact of overpopulation of man and livestock, our ecosystem is under great threat. Unless there is a curb on the population growth or reduction in population and corresponding improvement in land use policies the current trend of overexploitation and ecological degradation is not going to stop. These are the factors, which will strike hardest as far as biodiversity conservation is concerned.

Poverty is one of the important factors responsible for environmental problems and requires top priority. Sustainable development aiming at poverty alleviation alone can help in biodiversity conservation.

Some positive changes have also come about due to increased awareness amongst users and because of the research, which conclusively proves that alternate plant parts can

yield equally good drugs and products in case of many medicinal species. For example: whole plant is now used for many species of *Sida* where earlier only the roots were used. As a result of this change the demand and the pressure on *Sida* roots has come down. Similarly root bark of *Gmelina arborea* and *Oroxylum indicum* trees have been used traditionally. In recent times people have started using the stem bark instead.

2.2 & 2.3 Ecosystems and taxonomic categories: Due to the erratic rainfall and reduction in wet lands, plants like *Drosera* species are nearing extinction. Changing food habits of people has virtually blocked the cultivation and usage of traditional food plants like *Dioscorea* sp. and beverage yielding plant like *Mucuna pruriens*,*Garcinia* fruit based drinks are also replaced by soft drinks marketed by multinational companies.

Non-grazing of domestic animals blocks the seed dispersal of plants like *Cyperus rotundus, Cynodon dactylon, Eclipta alba, Hygrophila auriculata, Pedalium murex* and *Tribulus terrestris,*. Sewage water flow into lakes and tanks make aquatic plants like *Ipomoea nil, Ipomoea* p*es-carprae, Nymphaea stellata* and *Rotula aquatica* loose their natural habitats owing to decrease tanks and tank beds.

Chemical weedicides are endangering the growth of small herbs like *Centella asiatica, Cynodon dactylon, Eclipta alba, Euphorbia hirta, Merremia tridentata, Phyllanthus* species and *Vernonia* species.

Medicinal plants like *Bacopa monnieri* grow amongst paddy fields. Indiscriminate use of banned pesticides like cypermethrin results in abnormally high levels of pesticide residues in *Bacopa monnieri* extracts and their formulations since the process of extraction causes enrichment of not only the *Bacopa* actives but of the pesticides also.

Rain forests have abundant growth of *Eupatorium*. This prevents the growth of several under shrubs like *Embelia* species, *Maesa indica*, *Rauvolfia serpentina, Uraria lagopodioides* and creepers like *Leptadenia reticulata, Rubia cordifolia* and *Smilax zeylanica*. Further, weeds like *Lantana camara* in shrub jungles restrict the growth of other medicinals plants like *Breynia retusa, Cadaba fruticosa, Cissus quadrangularis, Coccinea grandis Coscinium fenestratrum* and *Decalepis hamiltonii*. Parthenium is

another weed found particularly in plains of interior Karnataka. Growth of many plants like *Cassia* species, *Datura* species, *Mimosa pudica, Tribulus* species, *Withania somnifera* are hindered due to the menace of Parthenium. Cutting of bamboo before flowering and seed setting further damages the growth of new generations. A virus disease is also affecting bamboo in parts like Tiptur.

Plantations like *Eucalyptus, Casurine, Mangium, Japanese Acacia* damage the ecosystem. The smaller medicinal shrubs like *Achyranthes aspera, Amaranthus spinosus, Aerva lanata, Boerhaavia diffusa, Cassia abscus, Trianthema portulacastrum, Sida* species and *Solanum nigrum* hardly grow under these plantations.

Caterpillars and gross hoppers eat away the leaves of *Ailanthus excelsa* and *Azadirachta indica*. Similar fate is also noticed in *Abutilon* sp. at Kaivara, Kolar district. *Anogeissus latifolia* is considered as fuel wood tree as per the forest department records and the tree felling is common for fuel wood. Whole liana is uprooted to get stout tubers. Roots of *Hemidesmus indicus*, *Aristolochia* species, *Ichnocarpus frutescens, Cyclea peltata* and *Cissampelos pareira* make these plants susceptible. Sustainable use is not taught to the collectors or practiced.

3. Institutional framework governing change

3.1 Implication of tenure/access regime: At present in Karnataka state there are no regulations on the access to medicinal plants occurring outside Forest area except for medicinal trees like *Tectona grandis* and *Santalum album.* In fact the nature of prevalent laws related to *Santalum album* have become counter productive to such an extent that it has affected the natural regeneration of Sandal trees. As per the present laws the person in whose premises the sandal tree is growing is held responsible for the maintenance and protection of that tree (Section 85 of "The Karnataka Forest Act", 1963) . The penalties associated with the violation are so severe that many people prefer to quietly uproot and destroy a sapling of sandal, if by chance it comes up in their premises, rather than becoming vulnerable to the responsibilities and penalties associated with its protection and maintenance.

3.2 Regulatory / legal regimes: Twenty-nine different Indian medicinal plants are already banned from export nationally vide the Government notification No. 47(PN)/92-97 dated 30th March 1994. The export of these plants or plant parts in any form is completely banned, unless the 'cultivation certificate' accompanies the consignment. This certificate is to be obtained either from Regional Deputy Director (wildlife) or Chief Conservator of Forests or Divisional Forest Officers of the concerned state in whose area the nursery from which the cultivated stocks have been acquired exists. **(Refer annexure - 2)**

The latest public notification No. 3-2/93 -WL- L dated 4th October 2000 has a further list of 114 plant species believed to be "critically endangered and vulnerable," as evaluated by the Ministry of Environment & Forest . This notification permits the export subject to issue of legal procurement certificate from the division from whose jurisdiction the stocks have been acquired for the purpose of export. **(Refer annexure - 3)**.

As per a rough estimate, more than 80% of all medicinal plants, which are used commercially, are obtained from the wild. Out of this, a good percentage comes from the forest as Minor Forest Produce (MFP) or Non-Timber Forest Produce (NTFP). There are a good number of MFP contractors and LAMB societies registered within the purview of co-operatives societies act who collect medicinal plant resources with the permission of Karnataka State forest department. The forest department has defined "MFP" through the "Karnataka Forest Act, 1963" and listed the names of reserved trees and clearly mentioned what cannot be collected from the forest as MFP. The Karnataka forest act, 1969, rule 83, lists 167 different bioresources and their seigniorage rates, that are to be paid for obtaining the licenses, for lawful collection of these resources. **(Refer annexure - 4)**.

It is interesting to note that out of the 261 medicinal plants species considered for this project only 33 species are covered in the Karnataka state forest act, while the remaining 228 species are not included. This could imply that either the forest

department believes that a different set of plants are of "significance to Karnataka" or because these 167 species only are prevalent in the forests of Karnataka.

The procedure of collection involves the bidding for the tender and the highest bidder is "lawfully" allotted the contract for collection of pre-specified medicinal plants from the concerned forest areas. These MFP contractors sell the material generally in the local crude drug markets and sometimes directly to the consumer industries. Thus one could say that the collection of medicinal plants from forest is already "regulated". However the present mechanism obviously needs changes, as there is no mention of quantities that can be collected as minor forest produce. The plants, which are already endangered, should be totally prohibited from collection and those plants, which are vulnerable, should be collected in "controlled quantities" only.

At other times several other medicinal plants, not listed under rule 83 of Karnataka forest act, 1969 have also been classified as minor forest produce and their seigniorage values collected.

3.3 Infrastructure: There are more than 227 manufacturer's of ISM products in Karnataka alone, registered with department of Indian system of Medicine. It may be worthwhile noting that out of these 227 manufacturers there are hardly 5 of them who have a annual turnover of more than 10 crore rupees, and only 3 of them have a turn over of more than 1 crore rupees. Only 15 of these manufacturers have a turnover of more than 10 lakh rupees leaving behind 204 such manufacturers who are struggling to survive. Thus one can imagine easily about the quantum of medicinal plant resources that must be getting consumed by a majority of ISM manufacturers in Karnataka.

However, there is no data on the exact number of crude drug traders in Karnataka. These two groups are the major consumers of medicinal plants in Karnataka. With an increase in the demand and acceptance of herbal products globally many have joined this list which includes multinational pharmaceutical companies and biotech companies. Agarbathi industries, food industries and consumer product industries also consume some crude drugs in large quantities.

3.4 Market: The market for herbal-based products has increased significantly specially in the last decade. This increase has lead to over-harvest of certain species and mass scale cultivation of some species. A good example of over-harvests in Karnataka is the case of *Garcinia cambogia* and *Garcinia indica* species, which have become popular internationally because of its anti-obesity properties. Traditionally, the acidic fruits of this tree were used to pickle/preserve fish by Mangaloreans. The market rate of dried fruits until recently was only 5 to 8 Rs/Kg as there was no other known use of these fruits. Recently the rates of *Garcinia* had increased up to 80 to 100 Rs/kg because of heavy national and international demand for the extract of *Garcinia, which* is used in weight management products.

Similarly the fruits of the tree *Emblica officinalis* (Syn. *Phyllanthus emblica*) were available between 5-10Rs./Kg simply because there was limited use and limited market even though the trees of *Emblica* are abundant in India especially in Madhya Pradesh. Since the time several herbal companies started making 'Chavanprash' which has *Emblica* as the main ingredient and the demand of such products increased, the price of this material has increased up to 40-45 Rs./Kg. It is believed that the collection of Amla fruits has not led to reduction in the abundance of this tree species, instead it has encouraged many, people to plant this tree.

Cassia senna has become a popular laxative internationally and India is the second largest exporter of senna leaves in the world. Increased market has led to large-scale cultivation of this plant, especially in Tamil Nadu in the Tinnevelly district. Thus any generalization linking increase in market demand to over harvest or endangerment of any particular species could be erroneous and inappropriate.

3.5 Values: It is indeed true that nobody feels responsible for conservation of bio-resources, especially medicinal plants. Almost everywhere the attitude is of acknowledging that yes we should conserve our bio-resources but some else should do it. Human activities have resulted in loss of many natural habitats, displacement of uniquely adapted species and perhaps even hindered in the natural evolution process of certain species.

Most of us are clear and agree that something needs to be done. What is not clear is, who should do it and what should be done? In developed countries the conversationalist and environmentalist have utilized common public support to be able to achieve the objectives. For eg., till about a decade back in the US, use of animal fur as clothing was very much a part of fashion, until certain groups started creating mass scale awareness amongst people about the ruthless killing and poaching that goes on to provide animal fur for the garment industries. As a result within a few years people started condemning use of fur coats, even in cold countries, which led to a dramatic reduction in the market demand and thus the poaching activities. In a way this strategy involved creating awareness and instilling values in common public on respect for another species. Similarly these days attempts are being made world over to question the aphrodisiac potential of certain traditional medicines, including Chinese medicines, based on tiger parts, rhinoceros horn, Spanish flies and the like. As a result, it is being hoped that there would be a reduction in demand for such products and thus a reduction in poaching activities.

Non Governmental Organizations (NGOs) and several conversationalist feel that industries alone are to be blamed and should be held responsible. The industries on the other hand feel that the Government should be responsible for conservation and sustainable use of medicinal plant resources. It is clear that till date the policy makers have not given sufficient attention and importance towards conservation of medicinal plants. The "tunneled" visions of different groups have led to lack of an integrated approach and as a result in the past a lot of time has been lost in just blaming each other and passing the buck. One approach could be to involve the major beneficiaries of medicinal plants bio-resources *viz.,* Herbal based industries, traders, practitioners of ISM apart from Government and its related departments like forest department, the Horticulture department etc. For an integrated approach it is important to be able to find a balance in values and realize that conservation and sustainable use of bio-resources is a vital and gigantic task for which support and co-operation of 'all' concerned would be essential.

An attitude that industrialization must be supported at all costs might indeed allow mining inside national parks. At the same time we need to remember that the major reason for lack of development in African countries has been their inability to properly

utilize their natural resources. However it can be concluded that the present attitude towards industrialization and commercialization of bio-resources needs change, as it does not appear to be compatible and conducive to conservation and sustainable use.

3.6 Knowledge: Lack of information on the status of medicinal plant resources is the major impediment to formation of conservation strategy. The major users of these medicinal plants- herbal industries, are reluctant to reveal the exact consumption patterns. This reluctance is compounded due to improper protection available for intellectual property. Till date products patents are not allowed in India and thus many industries feel threatened to disclose the names of medicinal plants they use in their products.

This knowledge is the starting point of any conservation and sustainable use related plan since it is essential to know "what needs" conservation. The consumption patterns are also directly linked with the extent of vulnerability of a medicinal plant since a plant, which is abundant today, may become vulnerable tomorrow if the demands are much higher than the natural availability.

Knowledge on the spatial distribution and population densities of these medicinal plants is also crucial to the prudent utilization of those plants, which are in abundance and also in demand. Collection and trade of such items should be encouraged for the economic upliftment of the collection communities. Generally one gets to hear and read about how some species are getting endangered due to commercialization but one rarely comes to know about those tribals/villagers who find a new source of livelihood by simply collecting a plant which is in huge abundance in their localities.

Cultivation of medicinal plants is one of the major mechanisms by which conservation, sustainable use and utilization can be addressed simultaneously. The major bottleneck in cultivation of medicinal plant is the lack of knowledge,on agrotechnologies and economic viability of cultivating them. It is generally hypothecated that cultivating these plants and selling them at the present market rates would not be economically viable as there are very little input cost when the material is collected from the wild as compared to the input cost for cultivation. While this may be true for a few species, it is the belief of agronomists that such hypothesis is baseless and should not be used for

decision-making prior to investigation. Department of Indian System of Medicine, New Delhi, has set aside a substantial budget for generating agrotechnologies on more than 300 Indian Medicinal plants, which are in popular demand **(Refer annexure - 5)**. All these efforts are based on the assumption that with an increasing demand of natural products world over, cultivation of medicinal plants will actually be more profitable than cultivating conventional cash crops. The need of the hour is to generate reliable knowledge on agronomics and to develop good agricultural practices.

It may be noted that several institutions like Central institute of Medicinal and Aromatic plants (CIMAP), Regional Research Laboratories and Agricultural Universities have spent last few decades in developing agrotechnologies of several medicinal plants. Thus at present even though agrotechnologies are available for over one hundred medicinal and aromatic plants but very few of these technologies are being practiced and the same hundred odd plants continue to be collected from the wild. Main reason for lack of implementation of these agrotechnologies, by interested farmers, is the lack of agronomics. Thus focussed efforts are required to ensure that either the information on agronomics is made an integral part of agrotechnologies being developed or separate efforts are put in place to asses the economic viability. The information on agronomics should preferable be generated as per a format which is found acceptable to financial institutions like National Bank for Agriculture and Rural Development (NABARD) and other agricultural banks etc.

4. Activities governing change

4.1 Livelihood and commercial activities: Illegal encroachment of forest land, grazing of cattle in the reserve forests, collection of firewood, illegal felling of trees for timber and over harvest of certain medicinal plants are some of the main livelihood activities responsible for reduction in the forest cover and medicinal plant diversity. Illegal cultivation in forestland and monoculture of certain species are the commercial activities which have also lead to reduction in the diversity of medicinal plant resources. The wood from *Ficus* tree is used in brick manufacturing process to fire the brick kilns. The matchbox industries also relies heavily on wood from trees like Mahogany, Ficus and several other species.

4.2 Development activities: Construction of roads and dams, quarrying for granite, limestone etc, mining for coal, gold and mineral ores, erection of electric poles through certain parts of forests are some of the developmental activities responsible for reduction in forest cover.

4.3 Regulatory activities: As per the present law "head-loads" of fuel wood transport are allowed in reserve forests. This is perhaps based on the assumption that an individual can carry insignificant quantities of material as head-loads. Inside the deep forests of Uttara Karnataka, tribals fell the well-grown trees of *Acacia catechu*. The heart wood of *Acacia catechu* is extracted with water and dried extract is made in the form of small blocks to obtain the end product which is popularly known as 'Kachu / Katha / Catechu'. Overnight the matured trees are cut and their logs processed and smuggled out of the forests as head-loads of catechu. Thus, the natural wealth of *Acacia catechu* trees is vanishing in Uttara Karnataka district, since a single head-load of extracted material can account for a good quantity of the original plant material. The Karnataka Forest act, 1963, under chapter 11 titled "special provisitions related to catechu" forbids the felling and processing of catechu by anyone on any land (including private land) without obtaining a permit for the same from Division forest officer. The defaulters are punishable to a maximum of six months imprisonment or a fine of Rs.500/- only. The present mechanism however has not been able to protect *Acacia* trees in Uttara Kannada district.

5. Agents driving change

5.1: Individuals driving change: Tribals, landless labourers, women, children from villages nearby forest collect medicinal plants and fire wood to make their livelihood. Minor produced contractors and lamb societies (as described in section 3.2 of this document) collect major quantum of medicinal plant resources. For example at Yelandur taluk the LAMB societies collect the plant resources from the forest ranges of B.R. Hills. The benefits of which are shared amongst the society members.

5.2: Corporate bodies: Generalizations about any agent or any plant could be erroneous and should be avoided specially for the purpose of rule making or strategy planning. As mentioned earlier that matchbox industries use large quantities of trees having softwood. Some of the large corporate bodies have been extensively involved in commercial scale planting of several tree species which have soft wood, suitable for match box industry. Thus some of them may not have created any negative impact on the biodiversity of soft wood trees.

5.3: Wastage of Bio-resources: Large amounts of medicinal plants get thrown away / wasted due to transportation. Medicinal plants if not fully dried become very prone to microbial degradation. Improper drying before packing the material by untrained collectors and traders very often results in fungus infestations and the material invariably gets contaminated with mycotoxins. Certain mycotoxins like aflatoxin B1 can be fatal even in parts per million (**ppm**) levels. There are no reliable methods for getting rid of such contamination from crude drugs and the material gets thrown away. This problem is compounded by improper packaging and improper protection of the material from rains in the transport vehicles. Most crude drugs are packed, stored and transported in jute gunny bags. Wet gunny bags invariably develop fungus in less than 48 hours. The situation gets further aggravated when truckloads of crude drugs are detained at the check posts for verification of the documents and if any there is any discrepancy in the documents the consignments get seized for legal proceedings. Due to extensive procedures and bulky paper work there are generally some discrepancies or the other. The unwillingness of the transporters to part with the regular bribe to the concerned officials ensures that the trucks are detained at the check posts indefinitely. Such detainments for months together not only cause harassment to the crude drug traders, transporters and customer industries but it also ensures that the material becomes unfit for use.

Most of the pesticides, which are liberally used in India, like DDT, Hg, HCH (BHC), aldrin, dialdrin are banned from use in the developed countries. Many medicinal plants found commonly as weeds amongst commercial crops are collected and sold in crude drug markets. Apart from picking up pesticides from the soil, the medicinal plants also get contaminated with pesticide residues, post harvest and during storage. The dried material changes several hands before it reaches the industry. A few manufacturers who

are conscious of the quality of their produce test these crude drugs for pesticide residues. Contamination with pesticides generally renders the materials absolutely unfit for use by the industry since there is no method yet to rid the material of such pesticides.

6. <u>Gainers and losers in ongoing changes:</u> It is difficult to find any gainers with reference to the on going changes in the medicinal plant resources of Karnataka however there are many losers. The biggest losers in these changes are probably the ISM industries of Karnataka who are already in bad shape (refer **section 3.3 of this CIP)** and are very skeptical of any new legislation / regulation which could compound their difficulties rather than easing them. Long term availability of medicinal plants is one of their prime concerns. Apart from the ISM industries whose livelihood is at stake, thousands of those people who depend on ISM products for maintenance of health would also stand to lose.

At the same time over 18,000 practitioners in the state rely upon herbal and mineral drug industry. If the drugs are not available or made expensive, both the Ayurvedic practitioners and community at large might suffer. Ultimately it would lead to losing the heritage of Ayurveda as well as traditional health care delivered at village levels.

For example: Non-availability of *Vernonia anthelminticum* / *Centratherum anthelminticum* seeds could have a negative impact on the health of the tribal population of Dakshina Kannada district. These tribals use V. *anthelminticum* seeds for postnatal care with the belief that these seeds are very useful for the health of both the mother and the newborn.

Similarly tribals of B.R. Hills at Chamarajnagar use gum of *Pterocarpus marsupium* as cooling agent. It is put on the scalp of infants, as it is believed that this gum would provide good vision and strength to sensory organs in the head of the child. Lambani tribal women also depend upon forest products very much. They consume the kernels of Semecarpus anacardium along with the gum of *Anogeissus latifolia* during postnatal care and lactation. If these crude drugs are not available there might be a very negative impact on the future generations of the Lambani tribe. There are innumerable such

examples where many people would suffer because of their dependence on the crude drugs.

There are several thousands of people involved, in the crude drug collection / trade, in Karnataka as the sources of their livelihood. However exact numbers are not available. Many crude drug traders trade in herbs available in North Indian and Himalayan belt also. Such people will be largely affected if the medicinal plant resources decline. There seems to be confusion and lack of clarity everywhere related to the trade of these resources. The trade of these crude herbs attracts 4% sales tax. The sales tax act of Karnataka however does not specify as to which herbs are taxable and which are not. Whereas in Tamilnadu all medicinal plants which are cultivated are free from any sales tax when traded. Apart from a set of 50 medicinal plant species which do not attract any sales tax even when collected from the wild in Tamil Nadu state (refer annexure - 6)**. The Karnataka State does not have any such list.**

Apart from the ISM industries, the ISM practitioners, the crude drug traders and all those people who use herbal products there are several other losers who would suffer due to reduction and destruction of medicinal plant biodiversity. The students of the subject "Zoopharmacogonsy" could reveal a large number of wild animal and medicinal plant interactions. The floristic diversity at forest feeds many animals. Bamboo is favorite plant for grazing elephants. In search of bamboo, elephants wander from place to place and some times stray to plantations and get killed. Elephants relish bark of *Helicteres isora*. Monkeys love fruits of *Garcinia*, Birds, squirrels like fruits of *Madhuca longifolia*, *Ficus species*. If such valuable tree species are decreasing in number, the dependent animal / bird population will also get affected. Forest flowers like *Butea*, *Bombax*, *Mimusops elengi* , *Mitragyna parvifolia*, *Anthocephalus chinensis* attract large colonies of insects and honey bees. An over all reduction of biodiversity would obviously effect these species also.

7. Currently operative strategy & action plan: At present there are no specific strategies or action plans to deal with conservation, sustainable use and equitable benefit sharing related to the medicinal plant resources of Karnataka. As stated in

Section 3.2 of this CIP the two governmental notifications are implemented in Karnataka State also. The Karnataka state forest rules 1969, as described in **Section 3.2 (refer annexure 4)** of this CIP, regulates the access to 167 plant based resources. Other than these there is neither a check on the over-exploitation of medicinal plant resources nor a mechanism to encourage use of these resources. The Biodiversity Bill, 2000 is perhaps the first major effort in this direction. Thus most of the strategies and action plans are currently not operative and exist only on paper.

Small groups like FRLHT (Foundation for Revitalization of Local Health Traditions) Bangalore, Department of Horticulture, Lalbagh, Association for Promotion of Medicinal and Aromatic Crops cultivation (APMAC) Bangalore, Indian Institute of Horticultural Research (IIHR), Bangalore and Central Institute of Medicinal and Aromatic crops (CIMAP), Bangalore have made some praiseworthy efforts towards conservation and cultivation of medicinal plant resources in Karnataka. However there is a need for co-ordinating all these efforts.

8. Lacunae in the currently operative strategies & action plan:

Protected areas such as hot spots/ heritage sites, totally protected from all activity and interference have often been suggested as a measure of effective conservation. Total protection of areas, small or big would require heavy financial inputs. However in absence of any other suitable methodology for ex-situ conservation of medicinal plants and their habitats, the idea of heritage sites should find acceptability.

The aim and objective of any conservation programme is to identify components of biodiversity, which can be used sustainably for human welfare. Generally when faced with the challenges of conservation the impulsive reaction is to sacrifice commercial utilization. It is important to realize without utilization the purpose of conservation gets defeated as that which is of "use to man" alone needs conservation.

One of the suggestions made towards the conservation of medicinal plants, commercialized by man, is to ask the forest department to bring all these plants under its regulatory regime[15]. These suggestions are perhaps made on the assumptions that all the medicinal plants are occurring only in forest area. Lot of medicinal plants are

considered as weeds which can be found along -roadsides, barren waste lands and amongst commercial crops as described in **Section 1.1**. The forest department obviously cannot have any control on such medicinal plants which occur outside the forest area. This suggestion also assumes that the forest department in future will be able to conserve as well as promote sustainable use of medicinal plants even though it has not been able to do so till date. It may be worth noting here that out the 261 medicinal plants species considered for this project, 33 species are already covered in the Karnataka state forest act, 1969, rule 83. Seigniorage rates are collected from MFP contractors and LAMP socities who collect these plants. There has been no effort by the forest department towards the conservation or sustainable utilization of these 33 bioresources which are already under their "regulatory regime" as of now and it could be diastratous to assume that Karnataka forest department will be in a position to do so in the near future.

Though impolite but it is a fact that the Karnataka forest department is crippled as of now with rampant corruption. In such a scenario, where the forest department is struggling to fulfill the presently available responsibilities any further reponsibilities related to medicinal plants resources of Karnataka will definately remain unfulfilled. These generalization about the Karnataka state forest department however seek apologies from those few sincere and honest forest officials (like Mr.Yellappa Reddy, Mr.Nissar Ahmed etc) who have done lot of good work especially in the area of medicinal plants.

The Biodiversity Bill 2000, is one of the major attempts towards conservation of medicinal plant resources nationally, which is under consideration by the parliamentary standing committee on Science and Technology (Govt. of India). Most groups involved have expressed that this bill needs change, as in it's present form it may fail to achieve it's objectives. On behalf of the major stake holders and consumers of medicinal plant resources of Karnataka, the Karnataka Indian Medicine Manufacturers' Association (KIMMA) has expressed its concerns and also pointed out some of the lacunae in the Biodiversity Bill 2000. The National representative body of ISM manufacturers, the Ayurvedic Drug manufacturers Association (ADMA) has also expressed

the same concerns, in writing to the parliamentry standing committee in September 2000. (**Ref Annexure-7**).

9. Proposed strategies & action plan: Overall commerlization of medicinal plants can be categorized into three main groups namely a) Trade in crude drugs (as such or in powdered form); b)Trade of processed medicinal plants in the form of extracts,oils, oleoresins, fractions, phytochemicals etc.; d)Trade of polyherbal formulations.

For conservation, sustainable utilization and equitable benefit sharing of medicinal plant resources of Karnataka, it is first important to know the exact names of all those medicinal plants which are of "importance to Karnataka". For this purpose data needs to be collected and compiled from the department of Indian System of Medicine(for formulations), Centre for Research, Planning and Action(CERPA),CHEMEXIL, customs department, forest department (for all other types of crude and processed medicinal plants) in order to arrive at the exact list of those medicinal plant resources which are of "importance to Karnataka". This data should clearly mention not only the complete botanical names but also the plant parts used, their quantities and frequencies.

Having specified exactly "what" needs conservation and sustainable use, the list can be classified further into three major groups:

Set :- a) Medicinal plants collected from forest area of Karnataka.
Set :- b) Medicinal plants collected from non-forest area of Karnataka.
Set :- c) Medicinal plants cultivated in Karnataka.

With the help of the school project initiated by CES for KBSAP, floras relevant to Karnataka, available databases and knowledgeable people in the field. We should further classify medicinal plant resources of **Set a** (Medicinal plants collected from forest area of Karnataka) into categories as per their natural availability in Karnataka. The plants falling under categories declared endangered and nearing endangerment should adhere to "controlled access regulations". For all other plants (**Set b & c**)efforts should be towards promoting sustainable "use".

If the medicinal plant resources of Karnataka are to become an important source of livelihood for the people of Karnataka and an important source of revenue generation and export earnings for the Government of Karnataka, a lot of efforts would be required for upliftment of collectors,crude drug traders and ISM industries of Karnataka.

As stated in **section 3.1** of this commissioned issue paper the condition of ISM industries of Karnataka is already very weak. Positive incentives at varoius stages would be necessary for the upliftment.

1All cultivated medicinal plants (**Set c**) should be exempted from sales tax as done in Tamil Nadu state.**(refer annexure - 6).**

1Plants which are in use in Karnataka and found abundantly in Karnataka could also be exempted from sales tax as done in Tamil Nadu state.

The government notification No. 3-2/93 -WL- L dated 4th October 2000 **(refer annexure - 3)** mentions 114 different Indian medicinal plants export of which requires a "Legal procurement certificate(LPC)" . This LPC is to be issued by the concerned Divisional forest officer from whose jurisdiction the plant material is collected. The concerned DFOs are unable to provide these LPCs since most of these 114 plants are not listed in the Karnataka forest act, 1969, rule 83, **(refer annexure - 4)** and the MFP contractors are left at the mercy of the forest officials. In fact only two plants are common to both the lists ie., these two plants are listed under forest list for which LPC is essential prior to export.

1For Government notification to be effective in Karnataka, it is first important to include these 114 plants and all other plants of "importance to Karnataka" into the Karnataka forest act, 1969, rule 83 which already lists 167 different medicinal plants.

Further the procedure for obtaining the LPC should be simplified so that unnecessary harassment can be avoided.

Forest department should undertake planting of all those medicinal plants which are perennial in habit since the farmers are reluctant to grow such medicinal plants which requires high gestations period before the returns. Hence forest department should take up plantations under the reforestation /afforestation programme on degraded forest lands or waste lands. To undertake this job, resources are required.

1As a policy of the state all sales tax obtained, from the sale of medicinal plant based products, should be ploughed back in the conservation of these plants, partly through forest department and partly by encouraging cultivation of annual and bi-annual medicinal plants. The buyers can be asked to provide buy back agreements to farmers who are already very willing to grow medicinal plants since they are sure of obtaining a fixed price for thier produce unlike several horticultural crops whose market price keeps fluctuating on a daily basis and becomes a major cause of concern to the poor farmers of Karnataka.

1Incentives should be provided for research, in the form of grants and soft loans with easy repayment terms, in the following areas :

- ♦Exploring substitute plants for desired purposes (in order to discourage utilization of threatened plants and encourage use of those plants which are abundant).
- ♦Exploring substitute plant parts (to encourage use of renewable plant parts like leaves, fruits etc., instead of plant parts like roots, root barks, heart wood etc.)
- ♦Tissue culture and captive regeneration related to medicinal plants.
- ♦Research leading to development of agrotechnology and agronomics of cultivating medicinal plants.
- ♦Research related to optimum utilization of medicinal plants which are abundant in Karnataka state. (finding new uses for commercialization of abundantly available medicinal plant resources)

1Training programmes should be organized for scientific collection of medicinal plants, for MFP contractors, LAMP socities and cultivators of medicinal plants, in the following areas:

- ♦Collection of medicinal plants after natural seed dispersal
- ♦Seasonal variation of phytoconsitutents - such that the active contents are highest when collected/ harvested.
- ♦Post harvest technologies/ post collection technologies - such that the actives are retained at their optimal amounts.

9.1 Cultivation: The principles of conservation biology suggest that the success of a programme for sustainable cultivation of medicinal plants critically depends on a sound national conservation strategy. To understand this proposition it is necessary at a conceptual level to distinguish between the terms "Conservation" and "Cultivation" and to see the symbiotic relationship between the two. Cultivation has a very important objective of ensuring immediate large scale supplies of a selected variety of a plant. Cultivation programmes are aimed at multiplying uniformity for the purpose of consumption. Cultivation programme contributes to conservation in a very indirect way by reducing pressure on wild collection. A cultivation programme, however, needs germs plasm of a species (intra-specific variation) for selecting varieties suited for cultivation in different agro-climates and for breeding new varieties.

Conservation implies protection of the intra and inter specific species diversity. It is best done in nature in an in situ environment. Since conservation programmes conserve germ plasm apart from ensuring long-term survival of a species, they also have a symbiotic relationship with cultivation programmes. In the context of medicinal plants the most effective way of undertaking conservation of inter and intro-specific diversity is by creating a network of in situ forest reserves across different forest habitats that may exist in a country. The size of the forest reserves could be 200 to 500 hectares each. The network of these forest reserves can act as "in situ gene banks" of the medicinal plants of the country. This is a novel concept and the cheapest method for conservation of the germ plasm of the medicinal plants of the country. These in situ gene banks can provide breeders and growers access to the wild genetic resources for cultivation programmes.

Cultivation programmes can be developed on a sustainable basis only if they have the back up of gene banks that can help to select and breed new varieties as per the

cultivation needs. The linkage of in situ gene banks to a cultivation programme can ensure that even if a particular variety under cultivation fails, other varieties are made available from the germ plasm maintained in the network of gene banks.

Apart from ensuring the availability of germ plasm, data on agroeconomics should also be generated (for details refer section **Section 3.6** of this CIP). Some suggestions pertaining to cultivation of medicinal plants have been submitted to the Department of ISM, New Delhi on 5th February 2000 (**Ref Annexure - 8**) All these suggestions would be pertinent while developing action plan for cultivation of medicinal plants in the Karnataka state also.

9.2 Task Force: Several reports have appeared recently indicating about the poor share of exports of Indian herbal products in the International market. As per a recent report India has a meagre export of 450 crores as against 5000 crores of Taiwan and 20,000 crores of China[17]. As per another report published by a United Kingdom based consultancy India's share is a parlty 0.6 percent in the total world herbal market (**Ref Annexure - 9**), as per yet another report India share is 0.4 percent as against 4 percent of China(**Ref Annexure - 10**).

On November 15, 1999, Government of India set up a Task Force on Pharmaceuticals and knowledge based industries under the Chairmanship of the Union Minister for Human Resources Development. This Task force was set up to suggest measures for strengthening the development and growth of traditional medicine such as Ayurveda and natural products for significantly augmenting their production and exports. After detailed deliberations the task force has submitted on elaborate set of positive recommendations to the Government of India in February 2000 (**Refer annexure 11**). For the purpose of promoting utilization of medicinal plant resources in Karnataka, suggestions must be taken from this report also.

9.3 Good Manufacturing Practice - Certificate from ISM: As per the recent notification from Ministry of Health and Family welfare (Department of Indian system of medicine and homeopathy), 23rd June 2000, published in The Gazette of India, Extraordinary, Part II, Section 3, sub-section(i) it is mandatory for all ISM

product manufacturing units to posses a Good manufacturing practice(GMP) Certificate (**Refer annexure 12**).

There is a heavy demand for Ayurvedic medicines/herbal products not only in India but also in many developed countries. This field thus holds tremendous potential in near future. It is also clear that we cannot really tap much market share if we are not quality conscious. Thus GMP or any other quality related proposal should always be welcomed.

However, as mentioned in **section 3.3** of this CIP, most small scale manufacturers are already struggling for survival. In such a prevailing scenario, if the GMP certification will insist on investment in expensive infrastructures and resources, manufacturer's of Indian system of medicine products will face a slow death. As per a recent report nearly 600 ISM industries in the state of Gujarat face a threat of closure due to this notification (**Refer annexure 13**).

9.4 Good Manufacturing Practice - Certificate from WHO: The GMP certificate issued by Department of Indian System of Medicine and Homeopathy is however not recognized by many Governmental organizations abroad. WHO has proposed a certification scheme for the quality control of pharmaceutical products issued by them in Pharm 82.4, Revision1 (**Refer annexure 14**). 101 different countries have agreed to participate in this certification scheme through their designated national authorities, Page17 of this annexure lists the names of competent authorities from nine states of India including Karnataka. Since the ISM products come under the preview of Department of ISM, the Drug controller of Karnataka is unable to provide this certification. The Department of ISM, Karnataka has not received any instructions/ guidelines from Department of ISM, New Delhi as a result they also express inability to issue the WHO-GMP certificate. The exporters of ISM products in Karnataka have thus being running from pillar to post in futility. Most of the importers have being insisting on this WHO-GMP certificate and as a result the exports of ISM product from Karnataka is suffering.

1In order to fulfill the ambitious figures of export of ISM products in India set by the Planning commission of India through the Task Force, it would be very crucial for the Karnataka state government to quickly resolve this issue and encourage WHO-GMP certification for the manufacturers of ISM products in Karnataka.

9.5 Testing Laboratories for ISM products: Another major problem faced by herbal drug industry is in Quality Control of raw material as well finished products. Many industries do not have all the necessary facilities towards conducting the analytical tests. The main objective of the standardization is to ensure that a drug is safe, effective and consistent (batch after batch). To ensure this objective, Government of India has proposed the "Approval of Laboratories" for carrying out tests and analysis of Ayurvedic, Siddha, Unani medicine and raw material used in their manufacturer as per the latest notification - Gazette of India, Extraordinary, Part II, Section 3(1), XVI(A) dated 31st January 2001(**Refer annexure - 15**). However the department of ISM, Karntaka has not received any clear guidelines towards issuing the relevant certificate of approval as the "testing laboratories for ISM products". As a result this noble idea has only remained on paper.

9.6 Good Agricultural Practice Certificate: Many importers are now insisting on the Good Agricultural Practices (GAP) certificate for all herbal based products. GAP is meant to provide defined and reproducible production conditions for medicinal and aromatic plants. Guidelines for GAP have been proposed (**Refer annexure - 16**). Unfortunately the same chaotic scene is prevalent and manufacturer are in a dilemma as there is no clue as to "who is authorized" for issuing this certificate. Some medicinal plants are in cultivation in certain districts of Karnataka, and the state Government has to realize the urgency of the situation and take a lead before it is made mandatory by importers bringing all exports of ISM products to a complete halt.

9.7 Categorization of medicinal plants: The *1997 IUCN Red list of threatened plants* has categorized the status of plants into Extinct/ Endangered/ Vulnerable/ Rare / Indeterminate[18]. However the basis on which the red status of the plants is decided, is not clear. *Boerhaavia diffusa* belonging to family Nyctaginaceae has been stated to be 'endangered' in the IUCN Red list, where as it is a readily available plant and

considered a weed of pastures and waste lands[12]. Similarly *Piper longum* which is cultivated and exported commercially is also listed as endangered in southern India[10]. Such gross errors in assessment of status of medicinal plants creates an element of doubt about the authencity and reliability of such efforts.

Acknowledgement: I wish to thankfully acknowlege the valuable suggestions and inputs from Mr.Darshan Shankar, Foundation for Revitalization of Local Health Traditions, Bangalore and Dr.Yoganarasimhan, Regional Research Laboratory(Ayurveda), Bangalore.

LIST OF ANNEXURES

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2. List of 29 Medicinal plants banned from export.
3. List of 114 Medicinal plants, export of which requires legal procurement certificate.
4. The Karnataka forest Rules 1969, R. 83.
5. Central scheme for Development of Agro-Techniques and Cultivation of Medicinal Plants.
6. List of 50 crude drugs exempted from sales tax in Tamil Nadu.
7. Copy of the petition to the parliamentary Committee on Bio-diversity Bill 2000, by ADMA.
8. Suggestions on cultivation of Medicinal plants - By M/s Natural Remedies Pvt Ltd.
9. Report on Ayurvedic medicine, Chennai
10. First National symposium of Ayurvedic drug industries.
11. Recomendation of Group II Task force-Government of India
12. Gazette of India Notification, Part II, Section 3, sub-section(i) dated 23rd June 2000
13. "Implementation of GMP norms for ISM threatens survival of 600 small units in Gujarat", Phytopharm, 2001, Vol.2(1),26
14. World Health Organization - Certification scheme on quality of pharmaceutical products
15. Gazette of India Notification, Part II, Section 3, sub-section(i) dated 31st January 2001
16. "Good Agricultural practice and the quality of phytomedicines", Mathe.A., Journal of Herbs, spices & Medicinal plants, 1999,6(3),101-112

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17) "Market Potential of Ayurvedic Medicinal Plants" by Hrishikesh Damle (2001 Page.94-95) Papers published at the National seminar on "Assessing The Economic Potential of the vedic Plants of India", during June 20th -22nd, Bangalore.

18)"1997 IUCN Red list of Threatened plants", edited by Walter K.S., Gillet H.J., Pub: IUCN-The world conservation union, 1998

List of Medicinal plants conservation Areas (MPCA) in Karnataka .

MYSORE DISTRICT

1. B.R.T. HILLS

KODAGU DISTRICT

2. TALACAUVERY

DAKSHINA KANNADA DISTRICT

3. CHARMADI
4. KOLLUR
5. SUMRAMANYA TEMPLE

BANGALORE RURAL DISTRICT

6. SAVANADURGA

TUMKUR DISTRICT

7. DEVARAYANADURGA

CHIKKAMAGALUR DISTRICT

8. KUDUREMUKHA

9. KEMMANGUNDI

SHIMOGA DISTRICT

10. AGUMBE

UTTAR KANNADA DISTRICT

11. DEVIMANE

BIDAR DISTRICT

12. KARPAKAPALLI

BELLARY DISTRICT

13. SANDUR

Reference: Directory of Medicinal sources in South India- A Green Health campaign series- Page 6 to 10.

Dated: 25th September 2000

To
The Parliamentary Committee ,

Dear Sirs,

Sub: Bio-diversity Bill, 2000

You may be aware that ADMA is a national body comprising of representatives from hundreds of herbal-based industries, from all over our country. With this letter, on behalf of all these industries, we wish to humbly submit that the proposed Bio-diversity bill, (Bill no. 93 of 2000) posses serious threats to the very existence of our industries. We wish to bring to your kind notice the disastrous implications, of each of the clauses of this bill, to our kind of industries. We are very hopeful that you would patiently listen to our serious concerns and help us in sustaining our industries.

Chapter II, Clause 3(1): " No person referred to in subsection (2) shall without previous approval of the National Biodiversity Authority obtain any biological resource occurring in India or knowledge associated thereto for research or for commercial utilization or for bio-survey and bio-utilization".

- The enormity of the implications of this clause alone are unfathomable, since this clause prohibits access to all Indian "biological resources" by all non-Indians for any purpose. In other words export of any "biological resources" by any Indian individual, organisation, association, institution, whether governmental or non-governmental would not be possible until and unless the concerned importing individual, organisation, association, institution, whether governmental or non-governmental takes prior approvals from the Indian National Biodiversity Authority (NBA).

- The implications of this clause alone would necessitate unimaginable amounts of paper work, to manage which several thousands of NBA officials would be required to process all the incoming applications and their approval/disapproval. As this would cover all

kinds of exports of Indian commodities from forestry, agriculture, horticulture, floriculture, animal husbandry, marine life, herbal products etc.

- "Knowledge associated with Indian biological resources" is again a very wide topic, which would cover apart from many other things, items like books, journals, magazines and pamphlets made by Indians describing any aspect of Indian biological resources. This clause prohibits access, without the prior informed consent of NBA, even to such items, by non-Indians.

- This would mean that all our Non-Indian customers would have to take prior approval from the National Biodiversity Authority (NBA) before being able to purchase any of our products. The definition of the words "biological resources", as given in Chapter I, reads as "*plants, animals and microorganisms or parts thereof, their genetic*

material and ***by-products*** *with actual or potential use or value but does not include human genetic material"*. Thus all herbal formulations, extracts, essential oils, oleoresins and phytocompounds isolated from plants can be categorized under **by-products** of Indian bio-resources. Further the Law Commission of India, in its 171st report to the Ministry for Law, Justice and Company Affairs has defined the word "by-product" also as "a compound, molecule or any extract of a living or dead organism resulting from any metabolic process".

- This will very adversely affect all our exports since we already have a serious competition from countries like China, Sri Lanka, Malaysia etc. Our customers would prefer to obtain the same material from these other countries where they do not have to undertake time-consuming and bureaucratic paper work of approvals from the National Biodiversity Authority.

- Our country is earning valuable foreign exchange equivalent to several crores of Indian rupees by regularly exporting plant material like Isabagol, Senna and several other spices etc.

- This clause might also mean that Indian bio-resources based companies might have to pay royalty/cess/fee to the National Biodiversity Fund, every time they wish to export any of their products. This would seriously deter/defeat all the efforts by the Indian Government to promote exports from India.

- This clause might also mean that prior informed consent of National Biodiversity Authority will have to be sought before sending any samples outside India, even in small quantities for any analytical testing, research and approval purposes, even before receiving any business/orders.

We have similar concerns regarding the subsequent clauses no-19, 20 & 21.

We believe that the bill intends to prevent large scale access of non-value added Indian bio-resources directly by Non-Indians. If this is the only objective of this clause, the same can be achieved by rewording it without affecting the exports of Indian bio-resource based products.

Chapter II, Clause 3.2 (C ii) " incorporated or registered in India under any law for the time being in force which has any non-Indian participation in its share capital or management".

- Because of this clause any Indian company, which is dependent on Indian bio-resources, would be reluctant to collaborate/joint venture with any non-Indian/non-Indian companies. It would also deter Indian companies from employing foreign scientists, marketing experts, advisors etc. since in doing so these companies may be clubbed under sub-section (2) of section 3 which refers to "non-Indian participation even in management".

Chapter II, Clause (4) " No person shall without the previous approval of the National Biodiversity Authority, transfer the results of any research relating to any biological resources occurring or obtained from India for monitory consideration or otherwise to any person who is not a citizen of India or a body corporate or organisation which is not

registered or incorporated in India or which has any non-Indian participation in its share capital or management".

- This would mean that if an Indian firm has its office abroad and they want to transfer the results of an unpublished research on an Ayurvedic product which is either already in the market or is proposed to be marketed abroad, this clause does not permit the same, unless and until the prior informed consent of National Biodiversity Authority is taken.

- The terms "any body corporate, association or organisation which is not registered in India" would by implication also include the **Foreign Patent Offices** or **Foreign Drug Regulatory Offices**. This would mean that submission of data to the Foreign Drug Regulatory Authorities for approvals and also filing the patent applications abroad by Indian bio-resource based companies would not be allowed under this clause without prior informed consent of the National Biodiversity Authority.

- *Thus while clause-3 directly and adversely affects exports, clause-4 makes it very difficult to share even that information which is required to be shared with customers, Drug Regulatory Authorities etc. before being able to export.*

Chapter II, Clause 6(1) " No person shall apply for any intellectual property right by whatever name called in or outside India for any invention based on any research or information on biological resource obtained from India without obtaining the previous approval of the National Biodiversity Authority before making such application".

- As per this clause if a person wants to file a patent related to an invention, either in or outside India, it is mandatory for him to first take the approval of the National Biodiversity Authority. This is in contraindication to the spirit of the amendment in the Indian Patents Act through the Gazette notification of Feb '99 under which the section 39 has been deleted. Section 39 made it mandatory for Indian citizens to first file the Patent Application in India and after 6 weeks they could file abroad. In order to meet the requirement of TRIPS Agreement, this section has been deleted. This clause is discriminatory and is in contraindication to the amended patents act. The point to be noted here is that usually patents are applied, keeping in mind the future economic

potential, the royalty may be imposed by National Biodiversity Authority even before the patent is either granted or rejected. This would be a sheer waste of money, in case the patent application is rejected.

- IPR definition is very wide as per the TRIPs agreement. It also includes copyright. The labels on Patent & Proprietary Ayurvedic Products may be copy righted but the moment one applies for it, it becomes IPR and one has to approach NBA for permission. The composition of all the Patent & Proprietary Ayurvedic Product is the result of some R&D work. As per this benefits on every product because some "invention" is always implied in every Proprietary & Patent Ayurvedic Product.

- The Indian Patents Act 1970 as it is does not allow product patents yet. The life of patents is only 7 years as compared to 20 years in the USA and many other countries. Recently the patent fees for filing complete specifications has been hiked from Rs. 300/- to Rs. 5000/- per application already (16 times). Due to these reasons and several more, most Indians are reluctant to file the patents on their inventions in India. This clause will further deter those few Indians who are filing patents in India as of now since the cost of patenting will further increase. The applicants would have to part with precious information to yet another Government body (NBA) where they may constantly fear the loss of confidentiality of their inventions.

- We have been informed that the Biodiversity Bill is based on Convention on Biological Diversity (CBD) 1992, which in its introduction reads as "the need to share costs and benefits between developed and developing countries" as well as "ways and means to support innovation by local people." In our opinion this clause is against the spirit of CBD, since patenting by local people/Indians is being made difficult and expensive.

We request that if this clause is not very essential to the objectives of the Biodiversity Bill, it should be preferably deleted or alternatively it should be made applicable only for non-Indians.

Chapter II, Clause 6(2) " The National Biodiversity Authority may, while granting the approval under this section, impose benefit sharing fee or royalty or both or impose conditions including the sharing of financial benefits arising out of the commercial utilization of such rights".

- The patent applicants generally do not know whether or not their invention will ever lead to a commercializable product. In such a case the issue of benefit sharing would be like putting the horse before the cart. This will very seriously deter filing of patents in India.

- Due to this clause the research and development efforts by private companies could come to stand still if clause no. 3, 4, 6 & 7 are read together. Possibility of big manufacturing units which have good R&D facilities, leaving India and setting up their units abroad, may be in the neighboring countries, cannot be ruled out. This may happen because of the following reasons:
    - New use of known substance is not patentable in India as per the Indian Patents Act 1970.
    - What is known, falls under public domain and, therefore, again not patentable. Hence, research efforts, which as on today are directed toward finding out a new use of a known herb, would be futile.
    - As stated earlier results of Research and Development activities on biological resources used in Ayurvedic Medicine cannot be transferred even to the subsidiaries or branch offices of the Indian companies abroad, without paying royalty.
    - There may not be adequate funds left with the Ayurvedic industry to spend on research activities due to additional cess/fee/royalties which the industries will be required to pay at the following stages.
        - Access to herbs for research (even in small quantities)
        - Application for IPR protection, including filing of patent application
        - Access to herbs for production.
        - Export of Finished products.
        - Exporting the products based on Indian Biological Resources.

- No ruling out the possibility that later these bodies (NBA/SBB) might start to levy a cess/fees/ royalty on sale of herbal products even in the domestic products.
- *These additional financial bodies will again be at three levels*
    - *NBA*
    - *SBB*
    - *Local Biodiversity committee.*

Over and above all this there is proposal of benefit sharing which may be imposed on to the industry even though it is not clear as to

1. *Who is the actual benefit claimers*
2. *How is this benefit claimers suppose to claim any benefit. From either NBA/SBB/ Local Biodiversity committee.*
3. *What information is in public domain and what is not.*

Because of this the industry will all be in a continuos apprehension that even though it has developed a product based on pure research, hard work utilizing its previous reviews. There may always be a possibility that this 'new use' of this plant may not actually be a new use. It might be a practice of some tribe/village in some remote corner about which the industry may be totally unaware. Just as the Government of our Country even the industry has no mechanism to know in advance as to what is in public domain. This after having done all the work someone might suddenly appear from this remote corner claiming equitable benefit sharing claiming that this product from the industry is based on his/their ancestral knowledge etc.

What mechanism can NBA/SSB apply to distinguish a fake claimer from genuine ones. How will the benefit be shared when a mass people claim to be holders of a particular knowledge about a particular end-use of a specific plant.

What mechanism can NBA/SBB apply to distinguish fake benefit claimers from a genuine one. How will the benefits be shared when a mass of people claims to be holders of a particular knowledge about a particular end use of specific plants.

Keeping in the mind the narrow margin of profit of Ayurvedic industry, if the above new cess in addition to the cess for National Biodiversity Fund is imposed, it is going to paralyze the Ayurvedic Industry which is already effected by the recent increase in excise duty from 8% to 16%.

We humbly suggest that this sub-section of clause (6) should be limited only to those inventions, which are developed based on information collected from tribals/particular group of people. This clause should not be applicable to inventions based on traditional knowledge, which is available in the public domain.

Unless and until a clear definition of benefit claimers is ascertained and a transparent system for benefit sharing is laid down, collection of any kind of cess / fees /royalties for the purpose of benefit sharing should not be allowed.

The bill should be so designed that it involves a minimal need for funds and whatever funds that are generated by a "suitable means", should be used for conservation only. One such "suitable means" can be the sales tax collected from the sale of all those finished products, which are based on the biological resources.

Chapter II, Clause 7 " No person who is a citizen of India or a body corporate, association or organisation which is registered in India shall obtain any biological resources for commercial utilization of bio-survey and bio-utilization except after giving prior intimation to the State Biodiversity Board concerned;

Provided that the provisions of this section shall not apply to the local people and communities of the area, including *vaids* and *hakims,* who have been practicing indigenous medicine".

- This clause will have very serious repercussions on thousands of herbal based industries, crude herb traders and millions of poor people who actually collect these bio-resources

from forests, fields, waste lands and road sides etc. In our opinion it is perhaps not very clear to the promoters of this bill as to how the herbs/medicinal plants are obtained by the industries. About 70% of the material is generally obtained from minor forest produce (MFP) contractors who with the permission of and payment to forest departments collect these plants and sell further. The remaining 30% material is collected by millions of poor Indians who are often landless labourers, tribals, women and children. The only livelihood for these people is often the collection of plants, many of which are found in abundance and will die a natural death even if not collected/utilized. Thus this clause will lead to mass scale unemployment, as these poor and often illiterate people will not be able to apply and take approvals from the SBB.

- We believe that this clause will utterly defeat many of the objectives of CBD which talk of upliftment of tribals, instead it will cause harassment to them in the name of making applications and obtaining approvals from the SBB.

- There are several medicinal plants that are weeds and they grow in and around fields competing for nutrition with cash crops. Farmers adopt weedicides and extra labour for getting rid of such plants. As per the book ('Weeds of Karnataka' by Sastry K.S.K *et al*., 1980) there are 378 varieties of weeds in Karnataka alone, out of which more than 30 species are of medicinal value and are used commercially. Thus controlling access of such bio-resources will only create abundance of such useless weeds.

To summarize, so far, these few clauses alone are sufficient to totally cripple the Indian herbal Industries as:

Clause 3:	*adversely effects our exports; joint ventures*
Clause 4:	*adversely effects our research; exports*
Clause 6:	*adversely effects our patenting; also their research and the overall business.*
Clause 7:	*Totally effects access to all our 'raw materials'*

According to our understanding the prime objective of CBD, 1992 is to protect those species of flora and fauna, which is either already endangered or nearing endangerment, as of now. As per some reports there are more than 75,000 different varieties of plants out of which only 750 are popular as medicinal plants. Out of these 750 plants a maximum of 200 to 250 varieties are in good demand by

the industries. Thus the majority of the industry uses less than 0.4 % of the total Indian flora. Though there is no accurate data available but on a rough approximation out of 250 plant species in demand only a maximum of 40 to 50 of these plants, could be nearing endangerment (which is less than 0.2 percent of the total floral biodiversity). Thus we strongly believe that the bill should limit itself only to those bio-resources which are already endangered or are nearing endangerment.

It should be noted that the plants, which are used as raw materials to our industries, are not like exhaustible bio-resources viz. Petroleum, coal or bio-minerals. All these plants can be easily cultivated and can be replenished very well, so they should not be treated as if they were exhaustible bio-resources.

It should be noted that there are several parts of a plant, which can be used sustainably. Parts like leaves, fruits, flowers, seeds etc., are produced by the plants regularly and shed away as a natural phenomena whether anybody uses these parts or not. Our efforts should be to utilize these resources to the best possible extent and provide employment to many people.

We have the same concerns regarding these subsequent clause no. 23 sub-section (b) and clause no. 24 sub-section (1) and (2)

Clause no: 8, subsection (4) and clause no: 22, subsection (4)

- *Since it is the herbal industries, which are affected the most by this bill, we fervently request you to please allow atleast one representative from our herbal industries to be an official member of the NBA and one at SBB.*

Clause no: 18, subsection (1) and Clause no: 23, subsection (a) to (c)

- As per chapter II, the definition of the word "benefit claimers" is quite confusing. As every other definition it is too vast in its scope. It reads as *"the conservers of biological resources, their byproducts, creators and holders of knowledge and information relating to the use of such biological resources, innovations and practices associated with such use and application".* Any person can claim to be a knowledge holder on some beneficial use or the other of some bio-resources. The herbal industries themselves could claim to be the conservers and holders of knowledge pertaining to the use of bio-resources. In such a case the issue of equitable benefit sharing amongst the "benefit claimers" can become extremely confusing, impractical and meaningless.

These clauses are against the open and transparent policies of the government. These will lead to major corruption, bureaucracy, red-tapism, harassment, unusual delays in approvals, loss of

productivity, bribery, retardation of industrial and economic development, etc. We do not have sufficient words to properly describe both the short term and long term implications of these clauses to the mass of public without any objective. It appears that the bill adopts an extreme approach like the swing of a pendulum from a totally carefree scenario to a 100% restricted/regulated situation wherein instead of conservation a state of preservation is being achieved. We need to have a balanced approach. In fact as per Chapter I section 2 the words sustainable use have been defined as " *the **use of components** of biological diversity **in such manner** and at such rate that does not lead to the long-term decline of the biological diversity thereby maintaining its potential **to meet the needs** and aspirations of **present** and future **generations**".* This definition is clearly **not** against utilization, it promotes "prudent use".We understand and appreciate that it is wise to save for tomorrow but for the sake of it, to starve today would be foolish.

We believe that for conservation it is essential to know as to "what" needs to be conserved. Unfortunately the entire bill is attempting to address 'how' to conserve which should really be the second question and not the first one. We must first record the consumption patterns of all those bio-resources, which have commercial value to man and are therefore in demand.

The assessment of status of any species into categories endangered, threatened, rare is meaning less unless and until this assessment is made in a scientific manner by first learning about the consumption pattern followed by survey to determine the extent of natural availability. Since the natural availability of any species is very intimately related to its potential value to man. That which is abundant today may become rare/scarce if the rate of consumption is greater than the rate of regeneration.

To find out precisely 'what' needs to be conserved, a survey is inevitable. But ones does not need to survey all the 75,000 plus species of the Indian flora. A survey of 750 to 1000 species is far more practical than a survey of 75,000 species. This survey will reveal as to what is the extent of natural availability of those species, which have commercial value.

Having known (i) which species are in demand, (ii) what is the extent of their natural availability. It can become possible to prepare guidelines for the regulatory bodies to decide as to which of the species are in:

Category 1	**-**	**Endangered**
Category 2	**-**	**Nearing Endangerment/naturally rare**
Category 3	**-**	**Sufficiently available**
Category 4	**-**	**Abundant /surplus**

Wherever possible the Bill should try and utilize existing systems and infrastructure. For example based on these guidelines the Departments of ISM&H could ensure that licenses are not issued for preparations containing category 1 bio-resources. Encourage applicants to avoid/minimize usage of category 2 bio-resources. Allow 'hindrance free' license' to preparations made with category 3 and category 4 bio-resources. The use of plant parts which can be used sustainably (viz.- Leaves, flowers, fruits, seeds etc) could be encouraged for use, by the same licensing authorities.

In a similar manner one could select/find an appropriate/related government body/institution which is governing/controlling/monitoring 'all' the specific end uses of biological resources or end users industries. For instance, exports of all bio-resource based substances could be 'controlled' by governmental agencies like Chemexcil, Customs departments, etc.

If, the bill can be restricted only to the endangered species, we strongly believe that there is no need to create an enormous infrastructure of a national biodiversity authority and several state biodiversity boards, employing thousands of officials and spending crores of rupees annually in just the maintenance of such a gigantic infrastructure and facility, which will be an additional burden on the exchequer. If this financial burden is passed on to the industry it will curb the industry which is already under pressure after the recent hike in the central excise tariff on herbal products from 8% to 16%. Instead, only a National Bio-diversity authority should be created which could serve in an advisory capacity, guiding the existing infrastructure and systems like the forest departments and the departments of Indian System of Medicine & Homeopathy, the customs department etc. These departments can enforce the National Biodiversity Act by promoting sustainable use and also promoting cultivation of species, which are either already endangered or nearing endangerment.

Clause no: 53 to 63

- *These clauses make this bill more strict and punishing than the TADA act. The officers of NBA and SBB have been bestowed with indefinite powers. The penalties proposed are absolutely disproportionate. The offences have been made cognizable and non-bailable. These clauses absolutely ignore the fact that in this bill there is enormous scope of unintentional offences occurring, in mass scale and high frequencies, all over the country at the same time by poor,*

illiterate and ignorant common Indians. These clause violate several basic human rights, leave no room for any fair justice, poses serious threat to development simply out of fear of accidental offence by the people involved.

Please note that the industry is not against conservation, in fact we fully appreciate the objectives of this bill, since it would ensure availability of raw material to our industries in the long run. What we are against is the assumption/misconception that conservation and utilization cannot be achieved parallely and to achieve one the other has to be necessarily sacrificed. We strongly believe that enough effort and time has not been spent in finding out ways and means to achieve conservation without sacrificing utilization.

The present bill does not suggest any concrete measures for sustainable use or conservation. It only regulates / prohibits access and is not pro-active at all. The two powerful tools for conservation are cultivation and tissue culture. The present day belief, with the majority, is that both cultivation as well as tissue culture are economically unviable since it is always cheaper to collect these bio-resources from nature / from the wild. However scientists who have spent more than a decade of their scientific pursuits believe that cultivation as well as tissue culture of several medicinal plants is not only economically viable but it is rather a economically lucrative proposal for many species of medicinal plants. For most other species the need of the hour is to generate accurate / reliable agro-economics, adopt good agricultural practices so that yields can be improved per acre of land.

In order to promote ex-situ conservation and propagation, commercial users who involve in cultivation / tissue culture / multiplication or any other means of captive regeneration should be given incentives by the NBA & SBB for those medicinal plants which are either already endangered or nearing endangerment. Further the bill should allow "hindrance free" access to any bio-resources which have been captively regenerated, by any one for any purpose.

Sir, please also note that even though this bill has been in the making since several years, the industries were made aware of this bill only as recently as May 2000. In this little time available to us, we have tried to list the implications of this bill to herbal-based industries. There may be some more clauses, which also adversely affect the herbal industries specifically. "We strongly believe that this bill in it's present form does more damage than good and also that the scope of this bill is far too wide. We strongly recommend that the

scope of this bill should be narrowed down to only those bio-resources, which are either already endangered/threatened or face endangerment in the near future. For the sake of any meaningful and lasting conservation, a thorough footwork is required involving the prime users of bio-resources, that is the herbal industries themselves. We believe that the herbal industries can play a significant role towards materializing the objectives of CBD, 1992 and the Biodiversity Bill 2000.

Based on the above issues and many more, we strongly believe that this bill in its present form should not be passed on further for implementation in a hurry unless all other possibilities of achieving the objectives, of the biodiversity bill, are explored wherein conservation and utilization are supported simultaneously. Thus we fervently request you to kindly delay the implementation of this bill until it is suitably amended and we also request you to kindly mark a copy of all the further revisions of this bill to ADMA.

Thanking you,

Yours faithfully

KISHORE D. SHROFF
President - ADMA

Karnataka State Biodiversity Strategy and Action Plan (KSBSAP)

For Protected Areas

(National Parks and Sanctuaries)

COMMISIONED ISSUE PAPER

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Bangalore,

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1. Details of National Parks and Sanctuaries of Karnataka State

	NAME	N.P./SANCTU-ARY AREA	District Forest Area Sq.km.	Geogra - phical Area Sq.km.	DISTRICT
1	Anshi National Park	250.00	8291.5	10,247	U.K
2	Dandeli Wildlife Sanctuary	834.16	8291.5	"	U.K
3	Attiveri Bird Sanctuary	2.23	8291.5	"	U.K
4	Mookambika Wildlife Sanctuary	247.00	5182.3	8336	D.K
5	Someshwara Wildlife Sanctuary	88.40	5182.3	"	D.K
6	Ranibennur Blackbuck Sanctuary	119	1436.7	13,782	DHARWAR
7	Arabithittu Wildlife sanctuary	13.50	4129.6	12,363	Mysore
8	Nugu Wildlife Sanctuary	30.32	4129.6	"	Mysore
9	B.R.T Wildlife Sanctuary	539.52			Chamrajnagar
10	Bandipur National Park	874.2			Chamrajnagar
11	Ranganathittu Bird Sanctuary	0.67	271.81	4982	Mandya
12	Melkote Temple Wildlife Sanctuary	49.82	271.81	"	Mandya
13	Adi Chunchanagiri Peacock Sanctuary	0.88	271.81	"	Mandya
14	Brahmagiri Wildlife Sanctuary	181.29	1259.5	4108	Kodagu
15	Pushpagiri Wildlife Sanctuary	102.92	1259.5	"	Kodagu
16	Talakaveri Wildlife Sanctuary	105.01	1259.5	"	Kodagu
17	Nagarahole National Park (R.G.N)	643.39			Kodagu & Mysore
18	Kudremukha National Park	600.32			Chikmagalur / D.K / Udupi
19	Bhadra Wildlife Sanctuary	492.46			Shimoga / Chikmaglur
20	Sharavathy Wildlife Sanctuary	431.23	3270.2	10,576	Shimoga
21	Shettihalli Wildlife Sanctuary	395.60	3270.2	"	Shimoga
22	Gudavi Bird Sanctuary	0.74	3270.2	"	Shimoga
23	Cauvery Wildlife Sanctuary	526.96			Bangalore / Mandya

24	Bannerghatta National Park	104.27	1094.4 8028	Bangalore
25	Ghataprabha Bird Sanctuary	29.78	2245.6 13,444	Belgaum
26	Daroji Sloth Bear Sanctuary	55.87	1743.5 9562	Bellary
27	Kokrebellur People's Pelicanry			Mandya
28	Mandagadde Bird Sanctuary			Shimoga

2. Legal Status and Formation of N.Ps. and Sanctuaries in Karnataka

In Karnataka under the Wildlife Act 1972 one N.P.(Nagarahole) and 21 sanctuaries have been finally notified as N.P and Sanctuaries. The Pelicanry at Kokrebellur is not declared as a sanctuary, presumably on account of its being situated in a village; and is managed by the villagers. The heronry at Mandagadde on Shimoga-Teerthahalli road also appears as not declared as a sanctuary. The following three National Parks however, are still awaiting final declaration as N.Ps. under the section 26a of the Wildlife Act 1972 (amended in 1991), though proposals were sent years earlier :

i. Anshi National Park Proposed date = 2-9-87
ii. Bandipur National Park " = 5-6-74
iii. Bannerghatta National Park " = 6-9-74

It is, therefore, seen that final notifications under the law is unduly taking a long time. Proposals to create new Sanctuaries / N.Ps. and upgradation of sanctuaries into National Parks should not be kept pending for more than six months. Such proposals should be got processed and approved expeditiously. This should be the responsibility of the Chief Wildlife Warden of the State. (e.g formation of the new Bhimagada Sanctuary of Belgaum District, and final declaration of four National Parks listed above).

With amendments to the Wildlife Act 1972 in 1991, the legal procedure for setting up a sanctuary has been made the same as that of a national park i.e. State Govts. will now have to first notify intention (Section 18(1) to declare a sanctuary, and finally notify it under Section

26a (1) only after completion of steps under sections 19 to 26. Most of the sanctuaries of Karnataka, however, were constituted prior to the amendments in 1991.

The boundaries and areas of the National Parks and Sanctuaries should not be reduced. The changes may be made, if the areas of these N.Ps. and Sanctuaries are to be increased and not otherwise. Betterment of wildlife and biosphere should always be kept in view, instead of extraneous considerations. Power to denotify Sanctuaries, Biosphere should rest with the Parliament as is the case with the National Parks.2.

3. Percentage of Protection Areas (N.Ps./Sanctuaries)

According to the guidelines for preparation of working plans issued by the Forestry Division, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, guideline no.9 (Protection Areas), Working Plans should identify protection areas (N.PS, Sanctuaries, Biosphere Reserves) aiming at reaching 4% of the total geographical areas to include tropical evergreen, semi-evergreen, littoral, mangroves forests (internationally it is 10%). This guideline should be strictly implemented to increase the percentage of existing protection areas and / or by creating new sanctuaries / N.Ps taking Districts as units. Most of the districts do not have protected areas at present. Protected areas for animals/birds to the extent of 4% of their geographical areas should be identified in these districts as stipulated in the guidelines.

4. Biodiversity of the Western Ghats

The two richest biodiversity areas of India are the Eastern Himalayas and the Western Ghats.. The biological diversity of the Western Ghats is one of the richest in the world, next only to the Amazon Valley. The high level of biodiversity and endemism in the Western Ghats have conferred on it the status of one of the biodiversity "Hot Spots"of the world. High rate of endemism is one of the most interesting aspects of the floristics of the region. Nearly 63% of the tree species of the low and medium elevation evergreen forests of the Western Ghats are endemic to them (Ramesh,1991).The Western Ghats are estimated to have nearly 27% of India's total plant species, and the number of endemic species found is estimated to be 1500.Of the total 15000 flowering plant species, over 4500 species occur in the Western Ghats. Out of the 4500 plant species, 1720 are

endemic. Along with many endemic species scores of economically and medicinally important species are also found. In addition wild varieties of cultivated plants are found in the region viz. rice, pepper, turmeric, ginger, nutmeg etc. Nearly a third of these are rare and threatened and several are believed to have become extinct. About 1000 species are so far listed as endangered in the Western Ghats of the Karnataka region. (Anandarao, 1993).

The Uttara Kannada District alone supports about 1750 species of flowering plants, which amounts to 40% found in the Western Ghats, in addition to a variety of ferns, algae, mosses etc. Many more plants are being identified over the years. Of the 112 medicinal plants of South India considered endangered about 60 are found in the Uttara Kannada District.

The forests of the Western Ghats may be classified into Evergreens, Semi-evergreens, Solas, Moist Deciduous, Dry Deciduous, Degraded Scrub and Grass lands. The interesting and rare evergreen species include Dipterocarpus indicus, Calophyllum elatum, Toona ciliata, Chukrasia tabularis, Amoora spp., Canaium structum, Dysoxylum malabricum, Litsea spp., Artocarpus spp., Myristica spp., Garcinia spp., Diospyros spp., Mesua ferrea, Palaquium ellipticum, Poeciloneuron indicum etc. The Moist and Dry Deciduous forests contain Teak, Laurel Wood, Ben Teak, Sandal etc.

About 586 bird species are listed in the Western Ghats, of which Uttara Kannada District itself boasts of having 465 species. This comes to 79% of the total species found in the Western Ghats. The avifauna of the Western Ghats consists of interesting birds like the Fairy Blue Bird, the Southern Trogon, the Frogmouth, the Thrushes, the Hornbills, the Woodpeckers, the Brown Fish Owl, the Greyheaded Fishing Eagle, the Crested Hawk Eagle, the Crested Serpent Eagle, the Grey Jungle Fowl, the Spurfowl etc. The wild animals found in the region are also rare and interesting like the Tiger, the Panther, including the Black Panther, Dhole, Leopard Cat, Rustyspotted Cat, Civets, Stripednecked, Brown and Ruddy Mongooses, Elephant, Gaur, Sambar, Chital, Barking Deer, Mouse Deer, Fourhorned Antelope, Giant and Grizzled Squirrel, Flying Squirrel, Pangolin, Porcupine, Sloth Bear, Draco, Wroughton's Free-Tailed Bat (found only at Bhimgad forests in the entire world), Theobald's Tomb Bat (the only third place found at Bhimgad in the world). The endangered Nilgiri Langur and the Liontailed Macaque, are

found in Karnataka in the Brahmagiri Wildlife Sanctuary of Kodagu District. Recently a new species of frog belonging to the genus 'nyctibatrachus' (night frog), endemic to the Western Ghats, has been discovered at the Kudremukh National Park. It is named as 'Nyctibatrachus hussaini', after S.A. Hussain, the famous naturalist of Dakshina Kannada. In the bordering Eastern Plains endangered animals like the Wolf, Blackbuck, Chinkara, Ratel, Slender Loris, Fox and the rare bird the Great Indian Bustard etc. are found.

5. Listing of Biodiversity

At present complete inventory of biodiversity of our Sanctuaries / N.Ps / Biosphere Reserves has not been made, except the major animals, birds, reptiles, flora etc. This inventory to include the whole of the biodiversity should be made, if necessary by commissioning experts in various faculties.

6. Management Plans

Most of the N.Ps. and Sanctuaries are not covered by Management Plans. Detailed management strategies and protection measures etc. should be incorporated in the plans. These M.Ps. should be drafted by senior officers trained in wildlife management course at the F.R.I. or any other equivalent and recognized institutions; and reviewed by a committee consisting of the wildlife R.F.O. in charge of the N.Ps. and sanctuaries, the Wildlife Conservator of Forests, the author of the drafted plan and a recognised Environmentalist/Naturalist.

7. Collection of NTFP products

Non Timber Forest Products (minor forest products) should not be farmed / collected / sold in the protected areas. The resident tribals and resident villagers, however, may be permitted to collect these for their bonafide use. There shall not be, however, any sustainable use and equitable sharing in benefits from the use of biological diversity resourses in the protected areas.

8. Removal of dead, dying, fallen trees and bamboos etc.

Dead, dying, fallen trees should not be extracted from the P.As., as these are required by animals, birds and plants (orchids, epiphytes, fungi etc.) for various considerations like

protection, procreation, nesting, food, shelter etc. Even bamboos and canes should not be extracted for rural, urban, industrial needs. Even if the bamboos flower and die, no extraction of these should be taken up for considerations of revenue and preventing wild-fires. Extraction of these create tremendous disturbance to the welfare of the biodiversity.

9. **Insitu and exsitu Tribals and villagers of the protected areas.**

Tribals and villagers form part of the ecosystem of the National Parks and Sanctuaries. They should not be ousted from these areas, unless they are a menace to the wildlife conservation. Wildlife protection that disregards human interest cannot succeed for long. There is no sense in evacuating these primitive residents from the protected areas, and bringing outsiders either temporarily or permanently for doing the various works in these areas, which are required to be taken up through out the year for the maintenance of the protected areas. Eco-development works should be taken up for the resident villagers around the protected areas.

10. Introduction of Exotic Plants / Animals

No exotic animals and plants should be introduced in the P.As. There was a proposal to introduce the rhinoceros into the 'hadlus'(grassy patches) of Nagarahole National Park in the past, which we got discarded during the State Wildlife Board Meeting during the seventies. Such funny ideas suggested by any person or authority should be footed down at the highest level.

Likewise no exotic plants should be introduced in the P.As. like the Eucalyptus, Acacia auriculiformes, Caliandra, Yellow bamboos etc. The Eucalyptus plantations in the Ranibennur Blackbuck Sanctuary is gradually wiping off the local endangered species like the Blackbuck, the Great Indian Bustard, the Wolf, the Fox etc. Even the local scrub species have disappeared. The campuses of the offices and tourism zones are planted with the exotic flowering trees, which should be done away with; and only local plants should be encouraged. If the exotics are found planted in the P.As., the same should be uprooted and removed by stages. The Great Indian Bustard was observed collecting in great numbers, and even nesting in a cleared patch of about 100 ha. Eucalyptus plantation at the Ranibennur Sancuary. In the bird sanctuaries only local plants should be planted on the islands for the nesting of the birds.

11. Welfare activities in the Sanctuaries/N.Ps.

Welfare activities for the wildlife should be taken up by increasing basic facilities of providing water, food, shelter and protection to the wildlife. In the name of habitat-manipulation no vegetation should be cleared.

12. Decimating Factors like Wildfires, Poaching, Diseases and Grazing

Poaching, wild fires, Diseases and grazing are the four great enemies of the Protected areas. These should be effectively controlled by strengthening the infrastructure and by taking preventive measures to pevent the diseases, which normally spread into the protected areas through the domesticated cattle. These cattle borne diseases are rinderpest, foot and mouth and anthrax. So grazing of cattle inside the protected areas should be stopped; and the livestock of the surrounding villages need to be vaccinated periodically for these diseases. Bandipur, B.R.T.Hills (1968) and Bhadra (1989) sanctuaries were struck by the Rinderpest epidemic causing wiping out of populations of the gaur. According to the amended section 33 (A) 1 of 1991 amended wildlife act the Chief Wildlife Warden has to take measures for immunisation against communicable diseases of the livesock kept in or within five kilometers of a sanctuary. Again according to section 33(A)2 of the amended act no person shall take any livestock in a sanctuary without getting it immunised.

13. Mines and Quarries

Mining and mining industries have destroyed the biodiversity in most of the P.As. like at Dandeli and Kudremukh. At Dandeli and Anshi Prospective Licences are issued for exploring manganese and iron ores; and for iron at Kudremukh. There are also already existing mines of these at the Protected Areas. In and around P.As. there are quarries for extracting stones and metals etc. for using in the constructions of roads, buildings, bridges and dams etc. Even sand is collected from the rivers and streams. The mines ad quarries cause great damage to the biodiversity of the P.As. Hence the existing ones should be closed at the end of the leases already granted, and no new mines and quarries should be opened up in the Protected Areas. For the existing mines modalities and rules should be framed to effectively control the damage and disturbance, and to cancel the lease at the end of lease-periods. However the

existing quarries for extracting minor minerals can and should be cancelled. No quarrying should be permitted within 5-10 kilometers around the P.As. At the damaged sites afforestations may be taken up by planting local species. The conveyance pipes laid at Kudremukh and the pipes laid from the Mangalore to Bangalore city to transport petroleum products have caused severe damage to the P.As. and to the forests, which should not have been done.

14. Construction of dams, hydro-electricity power stations, atomic plants, reservoirs etc.

These , if permitted, destroy the biodiversity of the western ghats. The Kali and Sharavathy hydro-electric projects at Dandeli, Kodasali, Jog Falls and round about, and the atomic energy plant at Kaiga have already caused immense damage to the biodiversity. The over-head transmision lines laid for the electricity power stations also cut through the virgin forests causing damage to the rich and rare biodiversity. The proposed diversion of the Mahadayi river for conveying its waters to the Malaprabha river will cause damage to the biodiversity of the proposed Bhimagada sanctuary, where the rare Wroughon's Free-tailed Bat (found only at Bhimagada in the world !) and the Theobald's Tomb Bat (only the third breeding place in the world!) are found. This is also one of the richest biodiversity regions of the W.Gs. At the Iruppu Falls of the Brahmagiri Sanctuary a hydroelectric project is proposed by constructing a mini-dam at the head of the falls and bringing down its waters through 3 meter girth pipes to the base of the hills for rotating the turbines. This is the only place in Karnataka where the rare and endangered Nilgiri Langur is found along with another endangered animal, the Liontailed Macaque. If the hydroelectric project is taken up here both these animals will be disturbed and destroyed along with other rare fauna and flora.

15. Buildings, watch towers etc.

Buildings for lodging tourists, administrative offices etc. should be constructed to merge into the natural surroundings. They should have eco-friendly designs. No concrete structures should be raised. The watch towers should be erected in wood only and covered with either country tiles, leaves or grass and not by asbestos, plastic or tin sheets.

16. Vehicles, boats etc.

The vehicles for transporting tourists and staff should have green, blue or black or any other darker colours. They should not have any rattling sounds. The vehicular engines should have least sounds; and free from polluting emissions. The vehicles should not be honked. They should not be fitted with loud-speakers and musical instruments. If boating is provided, the same should be don e by rowing-boats, which should not be fitted with engines.

17. Libraries, museums, information centres etc.

The P.As. should have libraries containing old records, good books and periodicals on wildlife, environment etc. Museums and information centres should be opened for educating the tourists. Audio-visuals should be provided for educating the tourists.

18. Seminars and workshops

Seminars and workshops should be conducted once in a year by inviting knowledgeable naturalists, wildlifers etc. for creating awareness in the public in the conservation of biodiversity. Courses in bird-watching, nature photography etc. also need to be conducted.

19. Census of wildlife

Annual census of wildlife should be carried out; and census records maintained for research and to keep track of the welfare etc. of the animals and birds. Suitable practical census methods should be evolved and adopted. The services of the interested N.G.OS, naturalists, wildlifers, wildlife wardens should also be taken for the census works.

20. Publication of brochures, pamphlets, Newsletters

Brochures, pamphlets and other information mateials about the P.As. shouldbe periodicals published. Bimonthly newsletters should also be published on the wildlife of the P.As.

21. Capturing of animals, birds, butteries and collection of botanical specimens

Animals and birds should not be captured in the P.As. under the pretext of supplying to the zoos etc. and for exsitu translocations. Otters were captured at the Ranganathittu bird sanctuary in the past for breeding at Sunkadakatte, which was a flop. Tuskers were tranquilised, captured and de-tusked at Nagarahole in the past to protect them against the poachers, which also fumbled. Such misadventures should not be carried out authoritatively, but got discussed and approved in a technical committee; and responsibility should be fixed for any misadventures and deaths.

22. Compensation for damages by wildlife

At present compensation for damages caused to the agriculture crops is being given for certain types of damages. The procedure followed is also time-consuming, causing great inconvenience to the crop and cattle owners, which creates hatred towards the wild animals and the department. Prompt methods should be evolved to relieve the loss of the owners of the cattle and crops. The amount of compensation should also enhanced.

23. Eco-development

Eco-development works should be taken up around P.As., in the surrounding villages in order to alleviate human pressure on the wildlife habitats to protect the environs of the P.As. as is done around the Nagarahole and Bandipur N.Ps..

24. Use of pesticides in and around P.As.

Use of harmful pesticides should be prohibited inside the P.As. and around them to the extent of at least 10 kms. The pesticides being used around the Ranganathittu, Gudavi, Mandagadde bird sanctuaries in the paddy and sugarcane fields has affected the breeding of the wader and water birds as their food in the form of insects, molluscs, crustaceans, frogs, fish etc. get destroyed; and the egg-cells get thinned, which affects hatching. The pesticides used around the Ranibennur Sanctuary has also affected the breeding of the Great Indian Bustards. Aerial spraying of the pesticides on the extensive cashew nut plantations along the sea coast has affected human-health and its effect on sea birds and

on the birds and animals of the Someswara and Mukambika Sanctuaries is yet to be evaluated.

25. Corridors for wildlife

Disforestations (for settling tribals at Kabini, and villagers at Ramanagar due to construction of Supa dam etc.) encroachments, industrial developments (Dandeli), construction of dams, reservoirs, hydroelectric projects (Sharavathy, Kabini, Chakra, Varahi, Supa, Bommanalli, Kodasali, Tattihalla etc.) buildings, laying of pipes (Kudremukh) etc. have cut short the corridors of larger animals like the elephants, tigers etc. While taking up giant projects due consideration should be given for preserving the corridors for the animals for their routine movements and migration.

26. Accommodation and other Tariffs

Of late there has been a tendency to increase the various tariff rates in the National Parks and Sanctuaries. The accommodation tariff rates at the Nagarahole N.P. are Rs. 750/- to Rs. 1500/- and at Bandipur Rs.300/- to Rs. 1000/- per day. Even the dormitory rates have been increased to Rs. 35/- to Rs. 40/- per day per bed. The P.As. are meant for educating the people in appreciating and loving nature and in knowing the rich biodiversity of our country and its value of preservation. The prohibitively high tariff rates discourage the public in visiting the P.As. The low and economic tariff rates encourage and enable the people to visit these areas along with their family and children, which inculcates interest in them to preserve the biodiversity. The tariff rates should not be more than Rs.150/- per day for suites and Rs. 15/- per bed in the dormitories.

Wildlife Tourism

Wildlife tourism should be restricted to the carrying capacity of the P.As. to hold the tourists at any time of the year.

27. Meetings, gatherings, film shooting etc.

These should be prohibited in the P.As. as they cause terrible disturbance to the animals, birds and the peaceful environs.

28. Wildlife Boards

These are hardly held in the years. In the interest of the P.As. the wildlife board meetings should be held at least once in six months to discuss various wildlife problems and to give guidance to the wildlife managers. The members appointed for these boards should be knowledgeable in wildlife, its management and conservation. The members should be drawn from the naturalists, animal scientists, wildlife researchers, nature photographers etc. Political appointments should be avoided.

29. Wildlife Wardens

The wildlife wardens appointed should be drawn from the local active wildlife lovers, conservationists, retired wildlifers and any others who are really interested in the conservation of biodiversity.

30. Staff, equipment and transport

Normally these three requirements are either inadequate or neglected in the Protected areas**.** The staff is normally inadequate to manage various activities in the protected areas. Either the posts are inadequate or the vacancies are not filled. By experience it is also seen that wildlife posts have become punishment-postings. This should not happen. Special pays, incentives, bad weather allowances, medical allowances, and out of the turn promotions should be provided in the wildlife wings. Efficiency, merit and wildlife interest should be the criteria in posting staff to the protected areas. The posts upto the watcher, the guard, the forester should be filled by the local tribals. There should be time-bound promotions and not the ones based on seniority. Stagnations in promotions for want of posts etc. discourages the subordinates.

The staff above the grade of Foresters (R.F.OS and above) should be trained in wildlife management courses, and the lower staff at the regional level courses.

The staff should be well equipped with weapons and ammunitions to deal with the poachers. Wireless and walkie-talkies should also be provided. Jeeps and motor cycles should be also given to the staff for efficient protection of he protected areas.

COMMISSIONED PAPER ON TRADITIONAL CONSERVATION PRACTICES

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1.Current Status

Karnataka has diversity of landscapes associated with biological and socio-cultural diversity. The physical geographical features have been largely responsible for the ecology and the cultural affinities of people with the biodiversity. The State can be broadly divided into 2 regions in terms of physical geography: Western Ghats and Eastern semi-arid plains.

The secular and sacred cultural traditions linked with the biodiversity are more of a function of the physical geography of the region and the biodiversity supported by the geography and hence the climatic conditions. The Western Ghats is part of one of the megadiversity hot-spots in the world and harbour a range of cultural practices like sacred groves, sacred stretches of riverbeds, streambeds and tanks, sacred mangroves, sacred species of plants and animals. And historically it also supported totemism associated with the local people in the area.

The Western Ghats consists of part of Uttara Kannada district, Udupi and Dakshina Kannada districts. consists of the Uttara Kannada, Shimoga, Chikmagalur, Hassan and Kodagu districts. Locally the whole region comprising the West Coast and the Western Ghats is referred as *Malnad*. The sacred elements (SEs) in the Malnad region can be described as follows:

The most common SE in this region is sacred grove (SG). But the SGs vary in terms of size, ownership patterns and also with respect to the vegetation. These factors are influenced by the biogeography of the species harboured and the human influence on SGs. The groves broadly come under two classes. The smaller groves are entirely protected; no tree felling or other biomass extraction may be carried out. The smaller SGs are generally referred as devarbana, nagabana (serpent groves).

Smaller groves: These SGs are the ubiquitous features of the landscape in the Uttara Kannada, Udupi and Dakshina Kannada districts. The size usually ranges from a *gunthas* (40 *gunthas* = 1 Acre) to few acres in rare cases. In Uttara Kannada the deities in SGs are mainly Bhutappa, Jatakappa, Mariamma, Chowdamma, Hulidevaru and occassionally Naga. The majority SGs are owned by the State Forest Department and managed by the local people. Siddapur taluk of Uttara Kannada district has about 100 SGs. Whole district could be a single unit culturally similar in terms of Areca nut economy, major landuses like Reserved forests, Soppinabettas, Paddy fields, Bena lands, minor forests and SGs. Hence, the Siddapur case study data can be extrapolated for the entire Uttara Kannada comprising of 11 taluks totally covering 10,291 sq. km. could suggest the existence of more than 1000 SGs in the district. Some of the rare ecosystems like *Myristica* swamps are often found as SG in the district. In many cases the present day smaller SGs amidst soppinabetta lands represent the smaller fragment of earlier larger devarkans.

The Nagabanas are abundant in Udupi and Dakshina Kannada districts. They are smaller in size ranging from few *gunthas* to few acres in rare occassions. The Nagabanas are mainly owned by families and ocassionally are linke with the temple complexes in the districts. The number of Nagabanas will be very high in these two districts. Both these district form a single cultural unit based on the Coconut and Areca nut plantations, paddy fields, reserved forests, protected areas and family owned nagabanas.

Larger groves: These groves function as resource forest also, offering both sustenance and ecological security. The people of the village may gather fallen deadwood, non-wood produce such as pepper, mango, jackfruit, etc., and tap toddy from a palm (*Caryota urens*). They tend wild pepper within the *kans* (Brandis and Grant, 1868). The SGs are referred by names such as devarkadu, devarkan, etc. These SGs are mainly reported from Uttara Kannada, Shimoga and Kodagu districts.

Devarkans used to be an important landscape in Uttara Kannda, Shimoga and Chikmagalur districts about 150 years back. The forest management by the British regime in these districts altered the landuse pattern substantially by either discontinuing the traditional practices or neglecting them for the revenue and timber. The substantial alterations in the traditional landuse pattern in the Western Ghats have made the devarkans as historical sacred forests. Uttara Kannada was part of the erstwhile Bombay Presidency where British regime abolished the rights of local people over the devarkans. In the sacred *kans* timber felling became a taboo assuring their preservation as a traditional practice. But collection of various non - wood produce

and in some cases fallen leaves for manure were carried out, if the community had no other source, without endangering the ecology of the *kan*. Obviously referring to such sacred *kans* (Chandran and Gadgil 1993a).

Wingate (1888), the forest settlement Officer of Uttara Kannada, noted that the kans were of "great economic and climatic importance. They favour the existence of springs, and perennial streams and generally indicate the proximity of valuable spice gardens, which derive from them both shade and moisture" (Chandran and Gadgil 1993a).

Buchanan (1870) observed that wild pepper requires human attention for better yield. He found people taking care of pepper vines in evergreen forest patches called "*Maynasu Canu*" meaning *menasu kan or pepper kan*. Such *kans* were intermixed with gardens and rice fields. High demand for pepper in other lands could have been good incentive for village societies to maintain `kans'. Pepper cultivation in *kans* may be even older to the spice gardens started by the Havik Brahmins.

But the old records of Village Forest Registers mention the survey numbers of ‘Kan’ lands in each revenue village. These records suggest that Sirsi taluk had 106 devarkans whereas Siddapur taluk had 116 devarkans. It is quite likely that there could be about 1000 devarkans in Uttara Kannada district. Now it is quite necessary that to identify the overlap between smaller SGs and the devarkans. All the Kan survey numbers are mainly under Reserved Forest status (Gokhale, Y, unpublished).

Shimoga and Chikmagalur districts were part of erstwhile Mysore State. Kan lands were recognised by the State Forest Department till almost 1970. But after that those survey numbers were merged in Reserved Forests and other kinds of forests including Minor Forests, State forests and District forests. But even today Sagar division in Shimoga circle has 314 kan survey numbers on official record, which need to be crosschecked in the field for the status of forest (DCF office, Sagar).

Devarakadus are important feature specific to Kodagu dsitrict in the Western Ghats. Kodagu district could be called as hotspot of sacred grove tradition not only in the state but also in the country and world since this district has the largest number of sacred groves in proportion to the area of the district in the world and all the eighteen native communities including Muslims are stakeholders in this unique tradition. There are 1214 listed sacred groves in

Kodagu covering an area of 2520 hectares. These devarkadus are owned by the forest department and managed by the community with the help of Devarkadu committees. Apart from that SGs are also associated with the Matta (monastries) and the in private ownership with the families. Every village has at least one and there are 39 villages having more than 7 groves. These groves have been protected in the names of 65 deities of which Iyappa, Bhagavathi, Bhadrakali and Mahadeva are common. Though the district has a large number of sacred groves nearly 45% of the groves are less than one acre in extent and 80% of the groves are less than five acres. Hence the sacred groves in Kodagu are small islands surrounded by other landscapes like coffee estates, paddy fields, reserve forests and habitations.

Sacred species: Many species of the genus *Ficus* are protected by people through out Malnad as sacred. The species like *F. religiosa, F. benghalensis, F. tsiela, F. retusa, F. glomerata* are often found protected amidst the habitations by constructing the platforms around the trees. Often these trees have sacred importance because of the local deities associated with these species. But such platforms without any shrine underneath the *Ficus* trees are also a common feature of human habitations in the area.

Several sacred groves are protected for a particular species of animals like Nagabanas are supposedly protected for the cobras. It is believed in Dakshina Kannada and Udupi districts that citing of **king cobra**, **python** or cobra in the paddy fields before harvesting time will result in good harvest for the year. And hence the species are protected by the local people (Bhat, 2000).

There are occassional reports of **Indian Fruit Bat** roosts getting protected like the Bawali vana sacred grove at village Koli, Belthangadi taluk, Lakshmi temple premise at Puttur, Dakshina Kannada district (Gokhale Y., unpublished).

Primates like Bonnet macaques, Hanuman Langoors are found in wooded areas of towns and cities. But their presence go unnoticed as well as undocumented. In the village Naravi, Belthangadi taluk, Dakshina Kannada district Malekudiya tribals annually perform a ritual to propitiate the monkeys in their surroundings. Every year the Malekudias in Naravi village visit a place on the periphery of the forest called ‘Pingar Koni’. They carry jaggry, beaten rice and coconut and spread the eatables on the flat rock over there and pray for the bonnet monkeys to come and have those eatables. The tribals believe that by doing this ritual

monkeys will not invade their orchards and will not trouble them for rest of the year (Bhat, H. unpublished).

Most of the temple premises having ponds in Dakshina Kannada and Udupi districts are having **tortoises** and **Mahaseer** fishes protected in them.

A temple near Belthangadi town is known to protect a **crocodile** in the pond in the premise. It has been named as 'Babiya' and is fed everyday after the worship. Once in a month a chicken is offered to the crocodile by the temple authorities (Bhat, H. unpublished.).

Waterbodies: The sacred patches of rivers prohibited from fishing are found in Malnad at places like Shishila, Subramanya in Dakshina Kannada disctrict, Sringeri in Chikmagalur district, Kaveri at Ramanathapura in Hassan District. The species of fish called Mahaseer is abundant in most of these stretches.

Most of the villages in this region have village tanks. At several places chain of tanks connected to each other is found in Sorab taluk in Shimoga district for storing the overflow from the tank on upper slope. Devarkans associated with tanks are common in Shimoga and Uttara Kannada districts.

On coast the fishing is traditionally prohibited in the monsoon which is the breeding season for fishes.

Eastern semi-arid plains / Bailseeme: The sparsely vegetated areas of semi-arid plains on eastern side also support the sacred species of plants and animals. The sacred groves are not a common landscape feature as compared to the Western Ghats.

In this region of the State the traditional conservation practices are mainly confined to smaller patches of forests like Gundu Thoppus of Old Mysore regions and isolated sacred trees. Gundu Thoppus were very common as components of the village landscapes in Southern Karnataka. These were community lands where the villagers planted the local keystone species like *Ficus* sp., Mango, *Madhuca*, Neem and other native trees. The villagers were permitted to collect the usufructs and to conduct the annual village festivals. These community forests were mainly established in and around the village tanks for watershed development. These groves also provided shelter for native faunal biodiversity. This unique

tradition of management of local bioresource is under threat and many Gundu Thoppus have been encroached for habitation and cultivation (Yathiraju, pers. comm.).

Sacred species: Protection to heronaries like the one at Kokre-Bellur is very significant in this region. Many places are getting identified like Kaggaladu in Tumkur district (Ameen Ahmed, pers.comm.)

The traditional conservation practices with respect to individual plants the traditional concepts like **Sthala Vriksha** the concept of each place having its own unique keystone species protected and **Kula Vriksha**, the concept of each race protecting a tree species is the earliest attempt to conserve the biodiversity involving communities. These concepts have evolved and now there are large number of sacred trees and animals, which have been protected in the village landscapes. The traditional concepts like Panchavtis, Rasi vanas and Nakshthra vanas are examples of such traditional conservation concepts. In Northern Karnataka , *Acacia ferrugenia* (Banni) is a keystone species and is protected as Kula vriksha (Reddy, Y. pers. comm.).

In addition to these practices there are other mechanisms like taboos and fear associated with certain elements of biodiversity, which have helped in their conservation. Even with respect to utilization of the resources there are traditions of restrained resource utilization called Sangraha Vidhana about which the documentation is not available.

Waterbodies: The traditional conservation practices with respect to water bodies include a large number of sacred tanks in all parts of the state, as part of a larger temple complex.

In terms of **taxonomic categories** since the sacred groves in the Western Ghats and the West Coast harbour diverse species representing the threatened ecosystems like evergreen forests habitats, *Myristica* swamps, mangroves in form of islands and provide protection to many species of plants, birds, small mammals, reptiles, amphibians and insects sometimes confined to these small islands. Thus, these islands of ecosystems many times serve as refugia for a range of organisms specific to those particular ecosystems like isolated population of *Vateria indica* an endemic dipterocarp species of the Western Ghats in Kari Kan sacred forest in Kumta taluk (Chandran and Gadgil 1993a).

2. Ongoing changes

Extent of change in terms of :

2.1.Spatial distribution:

In Kodagu, the first inventory of SGs was done in 1873 when 873 groves covering an area of 4398 hectares was listed. The area increased to 6277 hectares during the year 1905 and during the last inventory undertaken during 1985 there were 1214 groves covering an area of 2550 hectares. Hence in the last eighty years 42% of the area under sacred groves was lost and the groves got fragmented resulting in an increase in their number (Kushalappa and Bhagwat 2001).

Kans are reported only in Uttara Kannada and Shimoga districts. 10% of the total landscape was historically under traditional conservation practices like sacred kans, groves, in Uttara Kannada district of the Western Ghats (Chandran and Gadgil 1993a). The sacred groves in Siddapur taluk in Uttara Kannada district the extent of the sacred groves shrunk from 5.85% to 0.31% (Chandran and Gadgil 1998). The sacred groves in Uttara Kannada, Dakshina Kannada and Udupi districts are undergoing the process of sanskritisation where local flora is replaced by few indicator species like *Plumeria acutifolia, Ficus spp., Thivetia peruviana* and the platforms or small temples are replacing the vegetation of the groves.

The nagabanas in Dakshina Kannada and Udupi district might not have reduced in number but the smaller sizes are still getting shrunk or sometimes encroached for platforms for the deity.

Gundu Thoppus, which were part of the village landscapes, have been lost and at present are seen only in few villages in Mysore, Mandya, Tumkur and Hassan.

In coastal areas the traditional seasonal ban on fishing during monsoon is diluted because of change in fishing method. The new trawler system can overcome the rough sea and weather conditions than the smaller boats in the past. So fishing can be continued even during the monsoon.

In most of the agrarian and forest dwelling villages annual hunting or ritual hunting practices are continued to some extent. Wild boars are reported to be hunted in ritual hunting around Deepawali. There are also reports of hunting of jackals from eastern plains as a ritual hunt. The questions in this case are :

- What are the beliefs associated with such ritual hunting practices and why the communities are still following these beliefs?
- Does the ritual hunting affect the population of those species? If no then should it be justified as community tradition? If yes then what action could be suggested?

The village tanks system in Malnad is totally neglected by the government and even by the stakeholders to some extent. The ownership is with the government so the users of the waterbodies do not have any right or stake in management of these waterbodies. The channels connecting between the tanks are also filled with silt.

2.2.Ecosystems

With respect to Devakadus of Kodagu in addition to the physical loss in the area a large number of groves have undergone changes in their forest structure and composition and have been degraded. This is mainly due to biotic pressures since there is a great demand for land and forest resources in the present situations.

With respect to Kans *Myristica* swamps have been converted to other land uses. Chandran et al (1999) reports 51 Myristica swamps from Uttara Kannada district. Out of 51swamps 9 are having the history of protection being the sacred groves. The 9 sacred swamps cover an area of 25,800 sq. km.

The sacred groves are supposed to harbour near natural vegetation in the local area because of minimal anthropogenic impacts. Hence, in the Western Ghats the SGs are mainly evergreen in species composition as it is the natural vegetation type in the area.

Gundu Thoppu ecosystems are managed for maintaining orchards of mango and other horticultural species. Gundu Thoppu ecosystems have also been altered physically and structurally.

3.Institutional framework governing change

Implications of tenure / access regime:

In case of sacred element practices the tenurial system varies from place to place as these practices never got recorded in the government records. Hence, the land having such element was never classified separately. Hence, such elements occur on the individually owned lands, revenue department lands, private trusts lands, forest department lands.

In case of the forest department's lands theses elements do not fall into the same kind of classification and are again found in various forests such as Reserved forest, Minor forests, Protected forests, Privileged forests, etc. There were a few efforts where government took notice of sacredness being attached to these lands as like in Kodagu district. So the inventory of these elements regarding the tenurial and access rights becomes a difficult task without the participation of local communities.

On revenue department land also there is no special recognition for the waterbodies or the forest patches having sacred values.

Kodagu was among the few exceptional cases where sacred groves were noticed by the froest department and kept records of those groves – Devarakadus. But the revenue department did not handover the SGs to the forest department untill 1985. As an effect of that these survey numbers were never treated as the lands with sacred values by the government for the development programmes and hence again got clasified under reveneue land categories.

Since the sacred elements can not be traced efficiently from the government records the local studies are require to understand the tenurial system in the respective taluks in each district. Chandrakanth and Nagaraj (1997) tried to work out for Kodagu district where the sacred groves can be traced to large extent with the help of the records of the forest department. The sacred groves in Kodagu are classified by Chandrakanth and Nagaraj (1997) as:

Basadi kadu: These are the Jaina Basadi Kadu (*Jina kadu*).

Privately managed *devara kadu*: Some families have donated part of their forest lands for developing *devara kadus*, which are managed privately by the respective families. For instance,

Mutthappa devara kadu in Nemmale, Machangala devara kadu in Kottangeri, in Virajpet taluk and Bhadrakali devara kadu in Balamuri and Palengattu keri in Madikeri taluk.

Paisari devara kadu: Most *devara kadus* in Coorg belong to this category. These are owned by the government, and are jointly managed by the village community and the government. Norms, rules and taboos developed by village communities over several years have provided social fencing to these *devara kadus*. In some *paisari devara kadu* like the Bhadrakali devara kadu in Hudukeri, exotic silver oak trees have been planted after almost clear - felling a 50 acre patch. Similarly, in Iayyappa devara kadu at Konageri, Eucalyptus saplings are planted. Both these *devara kadus* have been fenced to prevent cattle grazing.

Pavitra katte: In some villages, an altar is built around trees belonging to the *Ficus* family, which provide latex. These provide a common place for community functions, rituals and for circumambulation. In some of the *kattes*, the *peepal* (god) and the neem or *jambu phala* (goddess) are married by growing them together. For instance, we find the *Peeliyat mandu* for Bhagawathi in Heggala village and *Kaimudike mandu* for Igguthappa devaru in Kunda village, Virajpet taluk.

Hole devara kadu: These are sacred groves which belong to scheduled castes. In particular, this tradition is practiced by the Kembatti community who is said to be the aboriginal people of Coorg. Similarly, Marangi and Kukka communities also have *devara kadus*. Pannangala Thamme is the main goddess of the Kemabatti community and Pannangala thamme devara kadu in Yuvakapadi, Madikeri taluk is dedicated to this goddess.

Kai mada or Karona kadu: In Coorg, the *Kai madas* represent structures built in the memory of family ancestors to whom prayers are offered. Ancestors are also called *Guru karona* and are regarded as almighty. Machangala family karona kadu in Kottangeri, Airee Bellappanna karona kadu in Kaikeri, Badagarakeri and Mugutageri, Karona devara kadu in Teralu village in Virajpet taluk and Chillanda Iayyappa family Karona kadu in Naladi, Madikeri taluk are a few examples.

Suggi devara bana: These sacred gardens are maintained for worshipping the *gram devatha* or harvest goddess during the harvest festival. They are generally associated with Heddevaru (symbolising serpent), Beeredevaru and Bhadrakali. The Suggidevara bana in Hanagal-shettalli, Thaltare-Shettalli, Kumaralli, Kundahalli, Chikkatoluru, Koothi, Yedur, Chodlu, Nagarahalli, Gharvale and Thakeri in Virajpet taluk are a few examples. The harvest festival is during April-May, after the Hindu new year.

Mutt kadu: The Veerashaiva religious sect in Coorg district has their sacred forest called *mutt kadu* for the purpose of worship. These *mutts* have *samadhi* (mausoleum) of saints, worshipped by the devotees. We find *mutt kadus* in Bachalli, Suntikoppa, Kodlipet, Shanivarasanthe and Somvarpet in Somvarpet taluk. Goddess Chowdamma is generally worshipped in the *mutt kadus*.

Palli kadu: The term *palli* means mosque. The Jamma Mapillais of Coorg have a *palli kadu* attached to their mosques. Most rules of *devara kadu* also apply to these. The *mapillai palli* in Kedamallur, *mapillai palli* in Emme madu and *palli kadu* in Mytadi village near Arameri, Virajpet taluk and *palli kadu* in Kakkabbe, Madikeri taluk are a few examples. During Huttari (harvest festival), the deity is adorned with paddy panicles as in the *devara kadu* tradition.

Miscellaneous *devara kadus*: There are *devara kadus* for spirits like Puli Chavundi, Panjurli, Kuttichatha, Masthi (*Sati*-for women who self-immolate on the death of their husband); for *Naga bana* to worship serpents; for folk games like *Ummathat*-dance performed to appease goddess Cauvery (in Ammathi); *Kuriyat*-game of sheep; *Koliyat*-game of cock (*Para kunyi*); and *Peeliyat*-for peacock dance.

Thus, the case study of Kodagu tries to show the nuances and complexity in the tenurial systems and rights in the sacred element practices in the State.

In Dakshina Kannada and Udupi districts these elements are privately owned areas whereas in Uttara Kannada district most of the sacred groves are owned by the forest department.

In case of several secular traditions there are neither historical records nor studies done to understand the current or historical status about tenurial rights.

Regulatory/ legal regimes:

There was confusion in the regulatory and legal status of the sacred groves in Kodagu. Though these areas are protected forests under the forest department as per the government notifications issued in the year 1888 but it was presumed that they were transferred to the revenue department in the year 1905 and remained as revenue lands till 1985 when the state government came out with an new order to transfer these lands back to the forest department. This resulted in dual ownership of these sacred groves and is the main factor that has contributed to their loss in area.

In other parts of the state the tenurial regimes are not as defined as in Kodagu. In Dakshina Kannada and Udupi districts ownership is mainly with private regimes like individual households, temple trusts, etc. Hence, in any of the government records but for the cadestral maps to some extent in this area no information is recorded. So the legal regime can not be defined for this area.

In Uttara Kannada the State forest department owns most of the sacred elements. But all these elements are part of various categories of forests like Reserved forests, Minor forests and Soppinabetta. Hence, the forest laws are applicable to these elements.

The 73rd and 74th amendments in the constitution related to Panchayati Raj act have given more rights to the local communities to assert right on their cultural traditions where sacred elements could be one of the traditions. But it has not been used in the State.

3.3 Infrastructure:

In Kodagu sacred groves were presumed to be revenue lands before 1985 and hence in some instances were distributed to the landless for habitations and all the facilities needed for habitations like houses, the government provided roads, water, power and amenities. Similarly more than 4000 ha of kan lands were thrown open for industrial timber felling in Uttara Kannada district.

3.4. Market

Market forces are certainly having negative impact on the cultural traditions. It has changed the views of people about harvesting NTFPs like *Garcinia gummi-gutta* fruits in Uttara Kannada. About 8-9 years back the fruits of *Garcinia gumm-gutta* did not have commercial value and people used to pluck the riped fruits only. But in recent years these fruits started getting good rate in local markets, which prompted local people to harvest the unriped fruits or even sometimes to cut the trees for fruits.

Area nut prices have raised considerably in past decade. Hence, people have started gorwing areca gardens by converting the paddy fields in Uttara Kannada district. Also in this district British government gave people privilege of lopping trees on the forest department lands for areaca gardens in 1:9 proportion (1 acre of areca garden gets 9 acres of privilege land) called as Soppina betta lands. But after 1930s no new Soppina bettas are sanctioned. So all the plantations after 1930s have to illegally depend on the minor forests or reserved forests for

the mulching material. Smaller sacred groves surrounded by soppina betta lands in Uttara Kannada are getting shrunk for the mounting demand of mulching material for areca gardens.

Since the market for coffee increased during the last 20 years there was a heavy pressure on vacant lands for coffee cultivation and the groves were encroached. The increased demand for timber and their non-availability from the reserved forests has resulted in illegal felling in these groves. The forest department for their valuable timber worked certain groves in the dry deciduous areas.

3.5 Values.

The larger forces of Sanskritisation or Aculturation are acting on all the sacred elements in the State. As a result lot of changes are occuring many times at the cost of the biodiversity of the element. The most primitive form of nature worship could be the worship place without any idol; in such places idol are appearing. Where the deities were kept open inside the groves or on banks of the tanks, temples are getting constructed for the deities at times by clearfelling the vegetation. The faith of people is changing from nature worship to idol worship. The purposes for which range of such elements have been continued by the local people are becoming irrelevant with the change in the livelihood practices. For example, the sacred grove of Bete Devaru (Hunting god) in Kumta town has been converted to a small temple. Traditionally people had to pray the deity for a success in hunting. But with the change in the livelihood practices accompanied by the loss of forests around the relevance of the deity to the local people is marginalised.

3.6 Knowledge:

The traditional beliefs or practices of nature conservation could have two important characteristics which could be of use to modern day conservation programmes such as:

- biological information of species
- thumb rule of sustainability or long term utility

According to the discussion regarding Current Status it is quite evident that range of organisms are associated with these cultural conservation practices, which are poorly documented. Lack of knowledge of these practices even at local could result in the loss of the information about species or at times loss of the species in itself. This also hinders the furtherance of local knowledge of biodiversity.

Joshi and Gadgil (1993) argue that the traditional conservation systems probably work on thumb rules of sustainable utilisation. The controlled utilisation with the help of belief system probably have a notion or thumb rule followed by the local people. Hence, lack of knowledge of these practices also does not give understanding of the functioning of the local resources with respect to the requirements.

5. Gainers and losers in ongoing changes.

Gainers and losers at various scales – local and global. The processes of change, agents of change also should be looked in local-global fashion e.g. construction of Murudeshwar temple complex against the CRZ rules to attract the tourists in the name of the god and at the cost of marine diversity and added pollution on the sea beach.

The gainers of the ongoing changes are individuals who have encroached into the grove or who have illegally removed the trees, firewood or fodder. The losers are the village communities, temple committees and forest department.

6.Aspects of

6.1 Institutional framework

6.2 Activities and

Agents promoting ongoing negative changes.

The issue of dual ownership of the sacred groves in Kodagu has resulted in the revenue department permitting landless people form outside the district to build houses in the sacred groves. Since the forest department did not take any action on these settlers they have constructed proper houses and all the amenities have also been provided and today these areas have become villages. The adjoining coffee planters claim that they have encroached portions of the grove to prevent the government from converting the groves into settlements of outsiders, which would cause social problems to the native people. These enchrochments by outsiders and locals resulted in the local people losing their faith in this tradition, which resulted in other negative changes like illegal tree cutting, firewood removal, grazing and soil collections. The changes in the worship concept where the temple has become important than the grove and the shift from annual worship to daily worship has resulted in lot of human interference in the groves.

Gundu Thoppus have been allotted to community projects like Ashraya housing schemes; Primary health centers, schools and later powerful local villagers have also occupied these areas.

7.Aspects of

7.1 Institutional framework

7.2 Activities and

Agents promoting potentially negative changes.

Intentional negligence of historical resource management systems of local people by the state beaurocracy leading to erosion or even extinction of the local conservation practices and their benefits to nature and people. e.g. *Kans* in the Malnad was a joint management for existing forests. While implementing the Joint Forest Management scheme the historical linkages of people and forest in terms of management were neglected resulting into continued degradation of existing evergreen forests unique to the Western Ghats.

The inaction of the government departments, local temple committees and villagers in Kodagu may result in more of these community areas being encroached and lead to other changes like tree felling, firewood collection and grazing.

8.Aspects of

8.1 Institutional framework

8.2 Activities and

8.3 Agents promoting ongoing positive changes.

The awareness and action plan proposed for the conservation and management of sacred groves in Kodagu by the working group on sacred groves consisting of reprasentitives of the College of Forestry, Forest department, CEE, community leaders, and media has generated lot of awareness about the legal and management issues related to the sacred groves. The results of the research work undertaken by the College of Forestry have highlighted the ecological and economical values of the sacred groves. CEE has undertaken educational and awareness activities among students to highlight the importance of sacred groves in conservation of biocultural diversity. The forest department in association with temple committees has started to resurvey and protect the sacred groves in Kodagu.

9.Aspects of

9.1 Institutional framework

9.2 Activities and

Agents which may potentially lead to a positive change

The working group on sacred groves in Kodagu has prepared a draft plan for the Joint Forest Planning and Management of the sacred groves and this draft after discussion by the temple committees and community leaders was approved and has been submitted to the forest department for approval and this action will lead to revival and sustenance of the sacred grove tradition.

10.Currently operative strategy for conservation, sustainable use and equitable sharing of benefits of biodiversity.

The present strategy in Kodagu involves legal protection of the sacred groves as protected forests as per the Indian Forest Act of 1927 and the management of the temple and groves by a traditionally constituted head or Thakka and temple committee constituted by the villagers. With respect to sacred trees and animals there are some efforts initiated by local groups for their protection.

The sacred groves in other part of the state on the land owned by the state forest department come under the purview of the Indian Forest Act of 1927 all over the state.

There are no specific strategies available for the conservation of other sacred elements as well as for secular cultural traditions.

11.Lacunae in currently operative strategies.

In Kodagu the forest department, the legal owners did not ascertain their ownership on these sacred groves and the officials of the revenue department gave permission to build houses in these protected forest. The temple committees the stakeholders did not have any legal authority to evict these encroachers and hence these groves reduced in size. There is no co-ordination in efforts being undertaken by the government departments, communities and institutions to develop and implement conservation strategies.

The traditionally protected streambeds having mahaseer fishes in the Western Ghats are frequently poisoned many times by outsiders of the village. On 26th May 1996, at Shishila fishes were poisoned and 6 truckloads of fishes died. But local people could not do anything to find the culprits and punish them (Jayaram 1997). Similarly it happened at near Subramanya. There is no mechanism to safeguard cultural interests of the local people leading towards conservation of biodiversity. Since these systems are not recognized by any

of the government office even at local level the local stakeholders are having limited powers to take action against the defaulters of the traditional system.

With respect to sacred trees and animals there are no strategies evolved for their protection.

13. Lacunae in currently operative action plans.

Very few groves have been resurveyed and only the remaining areas have been demarcated without taking into consideration the original area. There have been no attempts to involve any local groups like temple committees, community leaders in this effort. Hence the information generated has remained only as a report without any action.

14. Proposed strategy for conservation

The proposed action plan for Kodagu involves a Joint Forest Planning and Management proposal for conservation of sacred groves. This action plan involves formulation of village and district level committees involving the local communities, existing temple committees and local government organizations to propose a management plan and implement the plan. This action plan proposes to empower the committees with respect to management of the groves. With respect to drier parts of the state there is an urgent need to document traditional conservation practices with respect to their present status and develop a Joint Forest Management Practice.

The effort of Forest department in establishing the pavithra vanas is a recent effort to revitalize the tradition. Give more details of pavitra vana implementation.

15. Proposed action plan for Kodagu for sacred groves has the following practical activities

Resurvey of the sacred groves, sacred water bodies ,sacred trees and sacred animals in a village and know their present position.

Documentation of the biodiversity in the village landscapes

Preparation of management plan for the sacred groves.

Constitution of joint forest management committees at the village and district level.

Empowerment of these committees through legal powers for management.

Discussion on strategy and action plan for cultural elements of biodiversity in Karnataka State

The cultural landscapes in the State of Karnataka can be broadly classified as:

1. Sacred landscapes and waterscapes – e.g. sacred groves, sacred waterbodies
2. Non sacred landscapes and waterscapes – e.g. Gundu Thoppu, village tanks
3. Sacred cultural practices – e.g. Vratas, annual hunting for local deity,
4. Sacred species – e.g. primates, *Ficus* sp.
5. Non sacred cultural practices – e.g. annual hunting after harvest

Even though 5 broad categories can be classified, a limited number of practices could be considered for the exercise of preparing strategy and action plan because –

- There is a dearth of documentation regarding several practices which are specific to local areas e. g. in Dakshina Kannada pythons and King Cobras are never supposed to be killed if seen in the fields before harvests.
- There are no ways by which crosschecking can be done to know whether a particular tradition is practiced or it is only a belief e. g. the above mentioned example can not be checked for its validity.

Considering the limitations mainly with respect to the information available on these cultural practices, only those practices are considered having wider distribution and to some extent information from many parts of the State and hence, would probably have an important role to play in conservation of biodiversity. Those practices are as –

1.Sacred groves
2. *Ficus* sp.
3. Sacred and non sacred waterbodies
4. Primates
5. Heronaries
6. Gundu Thoppu
7. Annual and ritual hunting

Strategies for conservation

1.Sacred groves – The tradition is reported from almost all parts of the State but it varies from region to region mainly with respect to species protected, size, ownership pattern and local taboos. In spite of having non-similarity in various aspects related to biodiversity conservation, the sacred groves share common problems all over the State.

Removal of biomass - Mainly due to dwindling of local natural resources like firewood people have started exploiting the resources from the sacred groves as well. Hence, it is needed to work on the alternatives to stop the removal of biomass from the SGs. It mainly involves the alternatives for firewood.

Sanskritisation – In many places, local folk deities have been, and continue to be, replaced with Hindu gods and goddesses. This has resulted in the erection of temples in side the sacred groves by destroying the vegetation of the SGs.

This process needs to be halted by conducting awareness programmes regarding the importance of vegetation of the SGs among the local people and mainly among the stakeholders of the SGs like SG committee members, priests, owners of SGs.
The SGs owned by the Government department can prevent the destruction of the vegetation using the forest conservation laws.

Ownership – Very diverse patterns of ownership from region to region. There is a need to have a statewide study to understand regarding various ownership patterns for concrete and region specific strategies for the conservation.

Economic incentives to the sacred groves could not be the viable option for sacred groves in all situations considering the large number of groves all over the State. There could be a threat to rest of the groves, which would not receive the economic incentive. But the strategy of economic compensation could be considered in case of very unique habitats like *Myristica* swamps, which are basically getting converted to areca nut plantations. The economic incentives need not be given for sacred importance but for the ecological values. But there could be social recognition by publicising such places in media lauding their role in conservation efforts.

2. *Ficus* species – Protection to species of *Ficus* like *F. benghalensis, F. glomerata, F. religiosa, F. retusa* is a common practice through out the State for being sacred as well as a part of local culture.

These protected trees have are even though not threatened, at some places in Tumkur district they are reported to be used as firewood for brick kilns.
There should be proper record of all available individual of *Ficus* sp. In all the villages and towns with the respective Grampanchayats or Municipal corporations with a copy with the concerned Territorial Range Forest Office. Since these are trees on revenue lands mainly, they have legal protection under the laws applicable to tree protection.

3. Sacred and non-sacred waterbodies – Karnataka State has more than 40,000 tanks and reservoirs reported in the Government records. These waterbodies come under the jurisdiction of Minor Irrigation Department. There is no system for desilting these tanks and reservoirs. There used to be systems locally practiced in various parts of the State, which are no more practiced due to the reasons like unidentified stakes in the efforts of desilting and the further benefit sharing of the silt for the agricultural purposes and the financial support for desilting in case of bigger waterbodies.

It is required to initiate the processes like mobilizing local people to take care of the waterbodies in terms of maintaining those by forming Joint Waterbody Maintenance Committees similar to Joint Forest Committees. Care should be taken to make these committees financially sustainable once they are formed by providing seed money by the State government wherever the waterbodies are owned by the government. Pisciculture can be mooted through these committees in the villages having tanks all over the State.

In many areas like Malnad and also on Plains the waterbodies are connected to store the overflow from the upper storage. These connections between the waterbodies are either filled with the silt or are broken at many places. These connections should be traced and restored.

4. Primates – The troops of Hanuman langoor and macaques are protected around many temple complexes. Usually these primates are not hunted because of their linkage with the Hindu god Hanuman. But in towns and in cities these troops have become nuisance as the

animals do not get the food to feed on. Hence, in the areas where the nuisance is reported from such wandering troops of primates, arrangements for food could be made by the Charitable organisations, Temple trusts and the Forest department. There is also need to control the group size of these troops as availability of food might result in growth of population increasing the nuisance.

5. Heronaries – The practice of protecting roosts of birds like herons, storks, bills, ibises is known from dryer Plains of the State. At many paces these roosts popularly known as Heronaries are found on *Tamarindus indicus* (Hunase mara in Kannada) the fruits of which yield good harvest to the owner. In cases where there is economic loss of the owner, it should be compensated not as a compensation but should be given as a reward to the owner.

6. Gundu Thoppu – This practice in the Old Mysore State served as community lands for community gatherings like feasts, fares. They had protected vegetation of species like *Mangifera indica,* (Mango), *Madhuca indica* (Hippe) where the fruits were collected and sold. These places also served as watershed catchment for the village tanks. But now these landscapes can not be seen any more in villages. Even though the function these places had is even today important and valid especially watershed catchment.

Efforts should be made to develop the protect the watershed of the large number of tanks and reservoirs in the State based on the concept of Gundu Thoppu.

7. Annual and ritual hunting – This practice is also known from almost all parts of the State. The control or support to such practice needs to be done with respect to the species hunted e. g. the species like Wild Boar is a pest in Malnad resulting in destruction of crops. In such cases the practice of hunting of wild boars could be supported in Malnad. But this decision requires careful monitoring on the population and the damage done by the species every year. Otherwise the support to hunting of such species might threaten the existence of the species.

In cases where rare or threatened species are hunted, education and awareness campaigns need to be conducted to educate people about the ecological importance of the species. There could be replacement suggested for the species from domesticated animals like goat or chickens as a symbolic hunting.

Another way in which education component can be addressed is the dances of symbolic hunting. In village Begur, Kodagu district, a dance is performed inside the sacred grove where a tree is targeted as an animal and the performer hunts the tree with an arrow as a part of ritual. Such examples can be promoted to tackle the issue of sacrifices to the god making them more and more symbolic and non-violent.

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Biodiversity Strategy and Action Plan for Wetlands of Karnataka

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Introduction

Biodiversity encompasses all living organisms and the web of life, from the genetic variability in microorganisms to the largest of animals and their ecological niches, ecosystems and landscapes.

The Convention on Biodiversity defines biodiversity as : "The variability among all organisms from all sources including *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and ecosystems."

Wetlands are among the most dynamic and complex ecosystems in the world. There is a great variety of wetland types, and in addition these systems are highly dynamic, changing with the seasons and over longer periods of time. The net result is that wetlands are biologically very diverse systems, harboring a high biodiversity, often in combination with a high productivity ratio. But wetlands are yet to be considered for "hot spots" of biodiversity, as the worlds attention is currently focussed on rainforests and other terrestrial habitats.

Whilst wetlands cover only a relatively small area of the Earth's surface , they support a disproportionately high biodiversity, which is consequently more affected by loss and degradation of wetlands. The underlying causes of loss, through lack of appreciation of wetlands, are often economic in nature but are not well understood.

Despite their high biodiversity and their cultural and historical importance to man, wetlands remain under threat. A recent analysis of nearly 1000 Asian wetlands of International importance, for example, showed that as many as 56% were considered to be moderately or seriously threatened, while only 10% of these internationally important wetlands had any protected status, while a further 15% are partially protected. The plight of the wetland biodiversity is succinctly described by Denny (1994), who observed that " It is pertinent to note that 66% of all continental extinctions are aquatic taxa, which highlights the exceptional sensitivity of the wetland and the fresh water ecosystem".

Initiatives which attempt to conserve wetland biodiversity without addressing the fundamental forces that lead to the degradation of the wetlands and consequent loss cannot be expected to succeed in the long run. Hence the economic valuation of the unmeasured wealth of goods and the services the wetland biodiversity provides to the people is an essential

instrument in countering these injurious forces. It is in this context that initiatives to identify and evaluate the wide range of benefits from wetland conservation and protection should be encouraged. Results on benefit can be applied to a number of programme needs including the strategic review of existing economic policies, which are considered to be inadequate for conserving the wetland biodiversity, and developing economic instruments to appropriate these values.

Wetland Values

The values of wetlands in terms of their biodiversity and functions are only now gaining the recognition they deserve and there is a compelling need for further cooperation and development of linkages between scientists, conservationists, policy makers, and end users. A quality information network and establishment of an appropriate network and database are essential for dissemination of knowledge and exchange of know-how.

Public awareness, education and training are the fundamental requirements for assessing and protecting wetland biodiversity. Target oriented research is vital to the conservation of biodiversity, wise management strategies, designing effective alternatives for development and the estimation of incremental costs.. These goals can be achieved only by working with and through the people at the local, regional and national levels.

Wetlands are a major contributor to the earth's biodiversity. At the taxon level their 'island biogeographical' characteristics suggest they have one of the richest diversity per unit surface area and may contribute up to 20% of the world's taxa and genetic resources. Thus, although wetlands occupy only about 6 % of the world's surface (MITSCH and GOSSELINK, 1986), proportionally, their degradation and loss has a significant impact on biodiversity resources. At the landscape and ecosystem level their worth is no less important. They have inborn variability, link terrestrial and aquatic ecosystems and, especially in the floodplains and at the interface zones between water/ wetland and wetland/land, support rich diversities of habitats. Their link gives them a paramount place in landscape variegations.

Wetland ecosystems afford delicate 'stepping-stones' for the mobility and dispersal of aquatic organisms in an otherwise hostile (terrestrial) environment. This facilitates gene flow by out-breeding so population health and genetic adaptability can be sustained in changing environmental conditions. Therefore, it could be debated that the loss of smaller wetlands is one of the greater threats to wetland biodiversity.

Whilst development is the burning desire of all countries and government's rise and fall on its success or failure, less developed countries have a particular emergency for improving the quality of life of their electors. Honest and pragmatic arguments then come to the fore. A case has been made for wetland, biodiversity conservation. How is a government of a impoverished country able to justify the long-term, apparently esoteric, aspirations of conservation when immediate needs are for food, good health, clothing, housing and education? There is no easy answer. BRUNDTLAND REPORT (1987, page 2) provides a foundation and the axiom that aid strategies should "help people to help themselves" indicates a mechanism. FALLOUT and TALBOT (1993) remind us that "Environment and development far from being opposed to one another as many have believed in the past, are and mutually reinforcing"

Wetlands are complex ecosystems that are responsible for contributing an incredible array of unmeasured goods and services that benefit people. Yet even to this day, many decision makers continue to think of wetlands as wastelands. These so called 'wastelands' continue to be depleted at an alarming rate through conversion to what some would consider 'better' alternate uses. According to some estimates only about 6% of the world's land area is now covered in wetlands, about half of the amount in existence around 100 years ago (TURNER *et al.,* 1994). There is an urgent need for conservationists to clearly quantify and illustrate the importance of wetlands in order to check further degradation, and to restore them where it is still practicable. If we accept this dramatic threat, economic valuation of wetlands becomes a necessary step in achieving that objective.

There are fundamental socio-economic forces at play which lead to wetland degradation and loss, and in order to counter them wetland resource economists will have to understand these forces, and to develop strategies to counter them with genuine valuation insights.

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Table 1 Anthropological Significance of Biodiversity

i) Global Benefits

Biodiversity maintains the interactive dynamics of the ecosystem of the world and provides the buffering capacity and stability to life on the planet. The global biodiversity is an integral factor in the equation to ameliorate detrimental global changes by human actions such as global warming and the 'hole in the ozone layer'.

ii) Economic Benefits

Direct economic benefits, *eg.* in terms of food, medicines, and industrial raw materials; and exploitation of natural ecosystems for tourism, Genetic richness of wild plants and

animals for developing new agricultural, fishery and medicinal varieties for example for resistance to disease and physiological stress and higher crop yields.

iii) Services to Humanity

Protection of watersheds; cleansing the air; modifying climatic extremes; degrading wastes; recycling nutrients; generation and maintenance of soils; controlling diseases; regulating hydrological cycles *etc*

iv) Ethical, Moral and Aesthetic values

Ethical and moral justification argues that plants and animals have an intrinsic value interdependent of

their values for humanity. The aesthetic justification is that many species and ecosystems are a source of

irreplaceable wonder, spirituality, and inspiration to humanity.

(Source: Various; including HMO 1994; WCMC, 1992 and Dugan, 1990.)

Benefits derived from Wetland Biodiversity

Wetlands provide many benefits to human societies, and while some of these are directly attributable to the biodiversity of these systems, others can be ascribed to their historical, cultural or traditional significance.

Because wetlands are important as long term resource supporting society's needs, their values need to be accounted for in development processes. The most effective approach in the world driven by economic growth is to demonstrate the economic values of wetlands, the techniques that can be used successfully to put value on different functions and values of wetlands, and the means of building such resource values into planning process so that they receive the due consideration.

The view that every thing in life can be reduced to financial units is perceived by many to be a fallacious approach. Therefore it may not be a wise step to address only the economic valuation methods, but stress should be on those benefits that go beyond purely economic considerations. While some wetland products are useful to rural populations across our country, many wetland plants can be effectively used for removal of toxic wastes from waste

waters. Mangroves also help as nutrient sinks. The emphasis today is the important role of wetlands in recharging ground water levels.

Wetland Functions

If one accepts that the ecosystem is a basic unit for biodiversity conservation, some mention of the processes and dynamics of wetland ecosystems is necessary. Processes, functions and values of wetlands need to be appreciated for conservation of wetlands and biodiversity.

The natural functions and rich biodiversity of wetlands gives them an intrinsic value as meaningful as their value to mankind and their real and potential value for exploitation. Thus, their conservation and judicious use is paramount. Yet our knowledge of wetland ecosystems and processes, and the public and political awareness of their benefits, is sadly inadequate. Accordingly the issue of wetlands and development need to be significantly highlighted, prioritized and addressed.

The intricate and complicated biological and hydrological processes within wetlands result in a number of functional attributes. Wetlands are in dynamic equilibria with, and dependent upon, other natural systems. They are an integral part of the catchment mosaic and are dependent upon the water resources for example. It is the inter-dependence of systems which necessitates conservation strategies beyond the wetland ecosystem to the wider countryside; to, say, Prime Biodiversity Areas and ' Catchment management and river/lake basin strategies. Biodiversity conservation will ensure that natural wetland processes are protected so their functions can be maintained.

The word 'function' implies an anthropogenic judgement and value; - what wetlands do, and value of their doing it. People utilize and exploit these functions. Natural wetland functions - Therefore probably others yet to be identified - can be placed into five broad categories: (i)climatic (ii) biodiversity, (iii) habitat, (iv) hydrological and hydraulic, and (v) water quality functions).

Table 2 Natural functions of wetlands

Climatic functions

Global warming amelioration

Carbon fixation and CO, balance Methane equilibria

Rainfall and humidity increases

Micro-climate influences

cooling effects

rainfall and humidity effects

Biodiversity functions

Centres of endemiem

Ecosystem diversity

Wetland Losses

The losses of wetlands, globally, is of prime concern and is the major driving force for developing a conservation strategy. DUGAN (1990), WCMC (1992) and others present alarming statistics of wetland losses. The loss of taxa from the freshwater ecosystems is higher than from most other ecosystems - thought to be due to the exceptionally high species diversity and endemism. Therefore the degradation and loss of wetlands has a proportionally greater consequence on loss of global biodiversity, species resources and genetic pools (WCMC, 1992).

Integrating a wetland conservation strategy with biodiversity conservation ensures that policies identify the most important wetlands for priority management plans.

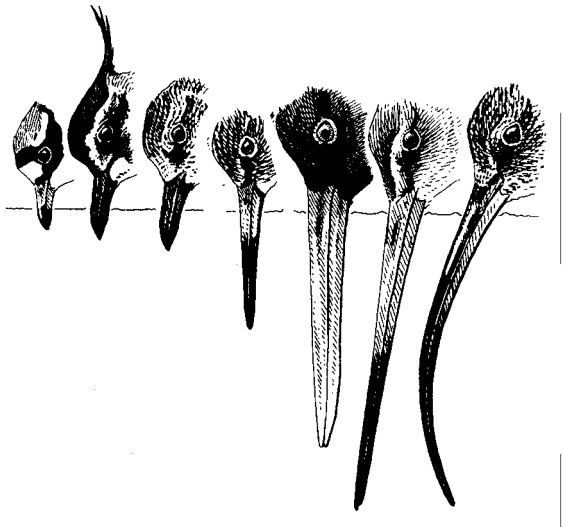
Qunatifying Injury to or Loss of Wetlands

It is of paramount importance to understand the nature of the resulting injuries to wetlands and the extent of the losses. This task can be accomplished best by experts such as ecologists, hydrologists, and biologists having the necessary skills to study and document the phenomenon for different type of wetlands. Those scientific results are essential in helping economists assess damages by providing essential insights for the valuation scenarios, which are a vital part of determing the injury or loss of wetlands.

Many wetlands are also affected by run-off containing large concentrations of fertilizer and pesticides from adjoining farmland. This siltation, caused by deforestation in the catchment areas of the rivers, is leading to a decrease of the size of the resorvoirs.Quantifying the rate of siltation is a challange to hydroligists.

While the list of negative impacts is long and extensive, positive impacts of development on biodiversity appear to be too few. The country’s 50 years of development present a significant number of river valley projects, half of which remain incomplete. Reservoirs constructed for these projects were anticipated to provide significant benefits from pisciculture, but a survey in 1991 showed that a mere 10% of the targeted fish production has

so far been achieved. There is some documented data on new waterfowl habitat resulting from the creation of dams and reservoirs in Karnataka, and this would be worth further investigating, especially during the annual waterfowl count in the month of January, now being conducted by a network of NGOs through the initiative of the Wetlands International.



ImportantWetlands

Karnataka in general contains important wetlands, many of which, by virtue of certain criteria, can be designated as Ramsar sites.

An important stipulation for accession of any country to the Ramsar Convention is to identify and designate at least one wetland to the list Ramsar sites. This highlights the commitment of the country to the conservation of its wetlands. In India 33 wetlands supporting more than 20,000 waterfowl at one time have been listed in the publication “The Asian Waterfowl Census 1994-96”. Two of the said wetlands are Ramsar Sites and Three wetlands ; Badrana kere, Belandur tank and Byramangala Reservoir of Karnataka are also included in the list.

Over the years there have been changes in the ecological character of many of the Karanataka wetlands.

Siltation of tanks and lakes continue to gain ground, which in turn is affecting ground water recharge and hastening lowering of water table.

Demographic lopsided development associated with growth of population and migration to cites, is exerting heavy pressure on habitats and their renewable natural resources.

For better understanding and effective management of wetlands and their biodiversity there is an urgent need for capacity building, training and research in biosystematics, rapid assessment techniques for biodiversity, wetland processes, socio-economic values, impact of introduced species, antropogenic activities in the catchment and wetland rehabilitation and restoration.

Methods should be developed to classify wetlands according to their relative values including *inter alia* biodiversity, local and regional benefits. Management plans should be developed in relation to their values. Wetland management should address the issue of population pressures, arising through human density, consumption pattern and inappropriate technology that have the over riding, detrimental effect upon the wetland biodiversity.

The major impacts on wetlands are caused by different factors in differtent parts of the state. In urban areas like Bangalore, wetlands in the nighbiourhood have undergone drastic changes due to unabated flow of unterated domestic sewage and dranage water. A large number of wetland have been reclaimed for new housing projects or construction of roads and commercial buildings. A classic example is the reclamation of over 80 lakes by the Bangalore Development Authority to put up new layouts. Over a period of 25 years more than 75% of the wetlands around Bangalore have been partially or fully reclaimed or used as dumping grouds for debris, urban refuse and so on.

Open access or common property has lead to excessive extractive uses and severe degradation through neglect since there are no incentives for individuals or the communities to maintain them.

Annexure: I Case studies

1. **Amanikere**
2. **Bhadra Tiger Reserve**
3. **Fish Sanctuary – Davangere**
4. **Fish Sanctuary - Hassan**

TUMKUR AMANIKERE – A CASE STUDY*

OCTOBER 2001

** Conducted as a part of Karnataka state bio-diversity Strategy and Action Plan (KBSAP)*

WILDLIFE AWARE NATURE CLUB

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8. ACTION PLAN TO CONSERVE AMANIKERE

9. CHECKLISTS

10. REFERENCES

1. PREFACE

Wildlife Aware Nature Club: WANC - as it is popularly known, was established in 1990 by a few young nature lovers. It was the first organization to be formed in Tumkur district for the cause of nature and wildlife conservation. WANC today is considered as the most active & dedicated environmental NGO in this region. Among its activities WANC has been involved in surveys of many important wildlife areas of Karnataka, to help in their better management. This case study on Tumkur Amanikere is an extension of its activities and its commitment to conservation. WANC is proud to be associated with the KBSAP under the agesis of the prestigious Centre for Ecological Sciences of Indian Institute of Science (IISc), Bangalore and the Karnataka Forest Department.

2. ACKNOWLEDGEMENTS

This report is the outcome of the faith reposed in WANC by Prof. Madhav Gadgil of CES, for which WANC is grateful to him.

3. LIST OF PHOTOGRAPHS AND MAPS

4. Tumkur Amanikere

4a) Background:

Tumkur district has a large network of wetlands and Tumkur town environs have many like the Tumkur amanikere, Shettihalli kere, Upparhalli kere and others.

According to the Tumkur District Planning Map of the National Atlas and Thematic Mapping Organisation of the Dept. of Science and Technology there are 1542 tanks serving the purpose of irrigation in the district.

But, according to the Mysore Gazetteer, 1930 the District had a total of 1,428 tanks of which Tumkur taluk had 202. The major tanks of Tumkur taluk were

1) Maidala Amanikere, which had the capacity of 1,001 units and an area of 1,147 acres.

2) Tumkur Amanikere, which had the capacity of 632 units and an area of 835 acres.

3) Bugdenhalli Amanikere, which had the capacity of 697 units and an area of 796 acres.

Irrigation Tanks of Tumkur district in 1930:

Taluk	Tanks in action	
	Major	**Minor**
Sira	57	98
Koratagere	17	51
Turuvekere	11	29
Gubbi	62	87
Pavagada	36	33
Madhugiri	61	75
Tiptur	42	73
Kunigal	30	65
Chiknayakana Halli	32	133
Tumkur	62	116

But many of the wetlands in Tumkur town like Ballenkatte and one more small lake near Kunigal gate have been filled up and exist no more. With an estimated population of 2 lakh in the 2001 census, the human pressure is likely to claim many more lakes, unless strong measures are taken to reverse this damaging trend.

4b) LOCATION :

With the hills of Devarayana Durga state forest as backdrop, Tumkur amanikere is picturesquely located in the heart of the old parts of Tumkur town.

Geographical co-ordinates:

N: 13° 21' N
E: 77° 07' E

Altitude: Apx. 785 meters above sea level

4c) AREA: The records of Minor irrigation department show the area as 508 acres, although the Mysore Gazetteer of 1930 mentions the tank as having an area of 835 acres.

4d) CLIMATE:

Rainfall: Tumkur taluk receives an average annual rainfall of 688m

Humidity: The maximum humidity is in monsoons and early summer is the period of minimum humidity.

Temperature: The maximum temperature is 38 degrees C, while the minimum is 11 degrees C.

4e) ATCHKAT: An area of 750 acres forms the atchkat, where even today crops like Paddy, different vegetables, coconut and areca are grown. The right and left canals, 2 and 2.5 km long, feed this area. The bund is 1800 mts long.

4f) CAPACITY: 165.44 million Cubic feet.

4g) CATCHMENT AREA: The total catchment area is 35 Sq. km. It includes the western slopes of the western part of Devarayana Durga state forest.

4h) BUNDS/SLUICE GATES: In the southwestern corner of the tank the stone bund is depressed as an outlet which permits the over flow of the rainwater when the lake is full. Also in the northwestern portion of the tank there are sluice gates, which are mechanically operated.

The water that overflows this tank enters Bheemasandra tank to the west of Tumkur town. This downstream joins the upper Shimsha and finally enters into Kaveri river basin.

4i) WATER SOURCES: The two major, west flowing seasonal nullahs which feed this tank are Devarayapatna nullah and Hanumanthpura nullah.

4j) LEGAL STATUS: the Minor Irrigation department owns this tank.

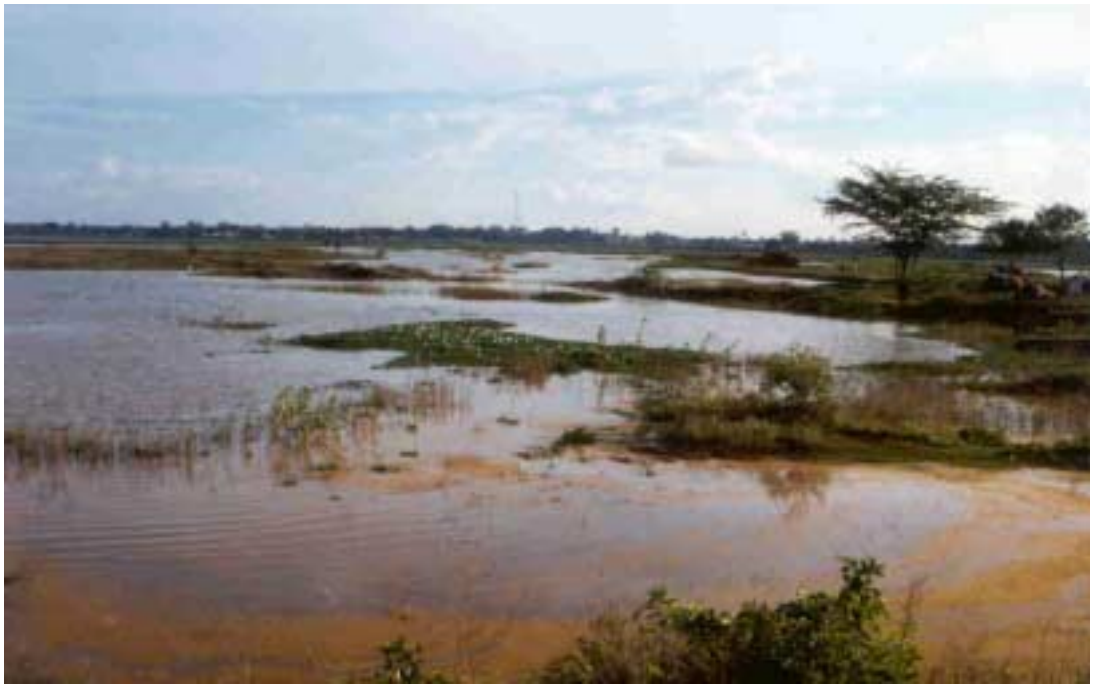
4k) USES: Spread over an area of 22 Sq. km, Tumkur has a population of two lakh with an average floating population of fifty thousand. Even after the supply of Hemavathi waters to Tumkur town, the problem of drinking water is growing everyday. Tumkur needs an estimated 5 MLD water everyday, 3.44 MLD of which is supplied by Hemavathi project and Tube wells. It still has a shortage of 1.56 MLD water. With an average rainfall of 688 mm falling over a period of 45 rainfall days mainly from June to October, this tank is extremely important in trapping rain water and recharging ground water. Due to the indiscriminate digging bore/tube wells, the ground water table level of Tumkur is going down drastically, hence the need to conserve this tank acquires utmost importance.

Cultural uses: The tank was earlier used for immersion of idols of Lord Ganesha annually. Due to the steep decline in the water quality, this tradition has now almost stopped. There is a temple named after the stone outlet of the tank known as *'Kodi Basaveshwara'* temple. The *'Nagarakallu'* statues attract many religious people. Whenever this tank over flows, the sight of over flowing water itself is the greatest attraction of Tumkur town.

4l) HISTORY:

The records of Chandramouleshwari temple near T.Begur mention Tumkur Amanikere as being constructed in 1130 AD by the Chola king, Rajendra Chola. There are also records of the tank being cleaned by the Palegars of Gubbi Hoshalli and the Ganga – Gowri prayers being offered. The Mysore rulers then maintained the tank efficiently.

1. *View 1 from north of Amanikere*



2. *View 2 from north of Amanikere*

3. *A View from south of Amanikere*

4. *View from west of Amanikere towards southeast. Note the coverage of water hyacinth. In the background are some of the hills of Devarayan a Durga state forest*

4m) FLORA: 

Profile: Amanikere has been surveyed in all the four directions to have a better view for sketching the tank profile.

1) <u>View from eastern direction</u>: Along the eastern boundary of the lake there are agricultural fields. Many of the encroachments have taken place here.

<u>The following are the features of the existing profile</u>:

<u>Trees on the bund</u>: There are few trees like "Rain tree" (*Samanea saman*); "Copper pod tree" (*Peltophorum pterocarpum*); "Gul mohar" (*Delonix regia*); "Jaali mara" (*Prosopis juliflora*) etc, growing on the bund.

Shrubs that grow are mainly *Datura matel, Zizyphus jujuba, Solanum xanthocarpum, Solanum indicum, Cassia auriculata, Lantana camara, Parthenium hysterophorus,* ocassionally *Parkinsonia aculeata*.

Herb layer includes more hard species like *Sida acuta, Sida rhombifolia, Abutilon indicum, Croton bonplandianum, Cassia tora* and some climbers like *Cardiospermum helicacabum, Ipomoea muricata, Ipomoea hederifolia*. Grasses like *Eragrostis unioloides, Eragrostis bifaria, Cynodon dactylon, Aristida setacea* grows profusely. Marshy/Aquatic plants like *Polygonum chinense, Typha angustifolia, Cyperus haspan, Ipomoea carnea* grows very well.

The most troublesome aquatic weed is water hyacinth (*Eichorina crassepis*) occupies near the peripheral region of the tank where more effluents, sewage water flows in and gets collected.

Towards the east- north part of the tank there are human settlements and cultivation.

2) <u>View from the southern side</u>: The old Bangalore – Mumbai national highway, National Highway No: 4 forms the southern boundary of the lake. The major sewage inlets into the tank are located in the southern part of the tank, one towards southeast and the other at the centre.

The following are the features of the existing profile:

A) Stony bund: It lacks woody vegetation on the upper surface of the bund, except for few shrubs, herbs and grasses.

B) Towards the lower region of the bund on the inner surface there are aquatic plants like *Cyperus haspan, Typha angustifolia, Polygonum chinense.*

C) Water hyacinth occupies 20% of the tank towards the bund where the washermen wash clothes and also there is an inlet of the sewage water.

3) View from the western side: Towards the right hand side there is a bund along the road and human settlements towards the left hand side of the tank. Water hyacinth prevails even here.

The following are the features of the existing profile:

Encroachment areas are towards West-northwest.

There are some aquatic plants like *Polygonum chinense, Typha angustifolia, Cyperus haspan*, and *Ipomoea carnea* growing well.

There are also some trees as mentioned in 1 growing on the bund.

Water hyacinth occupies at least 40% of the tank due to the sewage water inflow.

Some shrubs as mentioned in 1 are present.

4.) View from the northern side:

The Sira Gate –Satyamangala road passes along the northern boundary of the lake. A large number of encroachments have taken place here. Here the water hyacinth occupies about 20% of the tank.

The following are the features of the existing profile:

The encroachment area has mainly human settlements, cultivation, and brick making factory.

The stony bund bears very little woody vegetation.

There are a few aquatic plants as mentioned in 2 growing well.

Water hyacinth occupies 20% of the tank at the polluted regions where the sewage water flows in.

5. *Amanikere in Sep.2001, the tank over flew after a gap of 11 years*

6. *Young boys with their catch of fish in Amanikere, Sep. 2001*

4n) FAUNA: 

Hundreds of life forms are dependent on Tumkur Amanikere. Many species of birds, amphibians, reptiles and insects can be seen in and around this lake.

Birds

A total of 121 Species of birds belonging to 42 families have been recorded in this lake. This lake is very important because it is a breeding ground for many resident birds and a feeding/resting place for many migratory ones. 42 species breed in this tank and 46 species are migratory. Some of the migratory birds come from far away countries of Siberia, Europe, East, North and Central Asia, while some of them are local migrants coming from different parts of Karnataka and Peninsular India.

Many of the birds using this tank are endangered and hence their habitat should be protected.

Asian Waterfowl Census:

Asian Waterfowl Census (AWC) is an International wetland birds' conservation project initiated in the year 1987 and coordinated by Wetlands International based in Malaysia. The census is important in increasing the general awareness of wetlands and their water birds. Since 1993, many wetlands of Tumkur district are being surveyed each winter by members of Wildlife Aware Nature Club (WANC), to count the water birds. This helps in determining the population trends of the water birds and action can be taken, based on the information, to conserve the water birds and their habitat i.e. wetlands.

Tumkur Amanikere – Data from AWC

Year	No. of birds	Total species	Coverage
1993	621	15	100%
1994	-	-	-
1995	1453	26	100%
1996	156	15	25 to 50%
1997	336	13	25 to 50%
1998	1721	20	75 to 99%
1999	17	263	75 to 99%
2000	21	243	75 to 99%
2001	19	237	75 to 99%

BUTTERFLIES

***Note:* -** Although a large variety of insects are found in this lake, only a few species, which could be identified, are mentioned here.

A total of 24 species of butterflies belonging to 6 families have so far been recorded in the lake. Many of these butterflies are endangered and breed on suitable host plants found around the tank environs. All of these species are protected under Wildlife Protection Act 1972.

SPIDERS

Spiders are a very important agent against mosquito menace as they are very helpful to people living around the lake, to control the mosquito population. A total of 12 species of spiders have been sighted here, of which 3 could not be identified.

MAMMALS

6 Species of mammals have been recorded.

AMPHIBIANS

Like spiders even frogs/toads play a major role as biological agents against mosquitoes.

5 species of frogs and 2 species of toads have been sighted here.

REPTILES

A total of 3 lizards, 1 skink, 12 snakes and 3 species of tortoises have been recorded.

SCORPIONS

Two species of unidentified scorpions have been recorded.

FISHES

An unspecified number of fish are found here, yet to be identified.

5. INTRODUCTION TO KBSAP (Karnataka state Biodiversity Strategy and Action Plan)

India is a land rich in diverse forms of life. But unfortunately much of this is under threat due to a host of reasons. Serious attempts are being made from various quarters to save this precious natural wealth. The Government of India under the Ministry of Environment and Forests (MoEF) has initiated a project for the preparation of a National Bio-diversity Strategy and Action plan (NBSAP). This project, which is participatory in nature with inputs from a broad spectrum of the society, aims at conservation of biological diversity, its sustainable utilization and equal sharing of benefits.

The Centre for Ecological Sciences at the Indian Institute of Science is co-ordinating at state level the preparation of Karnataka state Bio-diversity Strategy and Action plan (KBSAP). This attempt in Karnataka will broadly include the following six themes:

(a) Management of protected areas
(b) Medicinal plants
(c) Freshwater fishes
(d) Wetlands
(e) Cultural traditions of conservation, and
(f) Land races of cultivated plants.

To harness the ideas of the common man and expertise of technical people in Karnataka, a 4-way approach is being adopted. Among these are case studies of selected areas by leading NGOs. Wildlife Aware Nature Club (WANC) has been identified by the CES to do case studies on Tumkur Amanikere and also Bhadra Tiger Reserve.

6. THE CASE STUDY

6 a) BACKGROUND:

Karnataka has approximately 40,000 wetlands most of which are man made. They were primarily meant for the purpose of irrigation, drinking water and related domestic purposes.

In the meanwhile, they also have evolved as an extremely important habitat for a diverse variety of flora and fauna particularly fish, amphibians and waterfowl.

Of late due to industrialisation and developmental activities, a large number of these wetlands are under sever pressure. Also many of them are choking due to the invasion of aquatic weeds like Water hyacinth.

6 b) AIMS OF THE STUDY:

The main aim of this study is to enquire in to the ecological health of Tumkur amanikere wetland and develop a strategy and action plan to protect it from threats and sustainably use it. This could be taken up as a model to conserve wetlands facing similar threats in Karnataka.

6 c) METHODS OF STUDY:

As mentioned, WANC as been closely associated with the tank since many of the members are residents of Tumkur and residences of many of the members are located near it. All the data collected till date and the personal experiences have been channelled for this case study. New investigations like the status of the Catchment area, feeder nullahs, extent of encroachments etc were done for this study. Much of the data collected has been documented on Photographs and Video.

6 d) RESOURCES / BASE LINE DATA:

Before initiating the actual fieldwork, attempts were made to collect the updated information on the wetland. The following documents were referred:

i) Gazetteer: Mysore Gazetteer, 1930

ii) Topo Sheets: The following Survey of India Sheet was used
57 G/3 (1:50,000 scale)

iii) Books / Literature: The literature, which proved very helpful in getting reliable data of the wetland particularly its flora and fauna is listed in the references section.

iV) Field visits by WANC members: Since its formation in 1990, WANC members have been regularly visiting the tank. All this

has placed WANC in a better position to carry out the case study in a fair manner and do justice to the faith reposed in it.

6 e) FINDINGS / DATA COLLECTED:

Threats to Amanikere

A) **Sewage water inlets:** Sewage from a number of localities of Tumkur town is directly let into the Amanikere. This sewage brings in heavy amounts of salts, organic and inorganic wastes everyday, as a result of which even the watercolour has changed. The level of dissolved salts has risen from 0.5 to 1.78 dsm. Calcium, sodium, potassium & magnesium salts have been traced out. If this is left unchecked, sooner or later the ground water table will definitely be affected.

B) **Garbage dumping:** The ever growing Tumkur town is generating large amounts of waste everyday. Much of this waste is dumped in to the Amanikere, which has directly led to the deterioration in the quality of water and in turn affecting entire natural cycle. Waste that is dumped not only includes solid debris like material from demolished structures, poultry waste but alarmingly medical waste from hospitals and nursing homes. There have been instances when amputated limbs and terminated foetuses have also been thrown in here. Lack of implementation of strict guidelines to segregate toxic and non-toxic waste and the absence of incinerators to dispose it have been major reasons. A large number of pigs are dependent on the garbage dumps and reside in and around the amanikere. This has led to the lake acting as a source of many deadly diseases.

C) **Encroachments:** At least 15 acres of Amanikere has been encroached till date. The areas in the northern part where residences are present and along the eastern boundary where agriculture is being practised are prone to encroachments.

D) **Water hyacinth:** This exotic weed has choke vast expanses of the water cover. It has been reported that this weed spreads in waters that have high content of heavy metals. Hence the existence of this weed is directly related to the level of water pollution.

E) **Developmental projects:** Of late Big *'land sharks'* of Tumkur district are trying to take undue advantage of the ever expanding urban localities of the town. They

intend upon filling up amanikere for commercial purposes. In spite of public opposition, the President of Tumkur City Municipality Council has written a letter to the Chief Engineer, Minor Irrigation Department, requesting for the handing over of 35 acres of amanikere for the construction of a bus stand. Encouraged by this, some others are suggesting the building of a road in the middle of the tank and similar plans. All this will sound the death kneel for the centuries old amanikere.

F) **Threats to Catchment areas:** There are a number of activities that are threatening the catchment areas of the tank like the western slopes of the hills in western part of Devarayana Durga state forest. Illegal grazing, illicit felling of green cover for firewood etc are contributing to the soil erosion which leads to decreased inflow and increased silt deposition.

G) **Destruction of feeder / inflowing nullahs:** The nullahs feeding amanikere are threatened due to various reasons. Encroachments, diversion for agricultural purposes, overgrowth of vegetation in the beds and dumping of solid debris have vastly reduced their water holding and flowing capacity. The destruction of sources feeding a wetland is the beginning of the cycle of destruction of any wetland. Once the nullahs are destroyed, it will drastically reduce the inflow of water which in turn will dry up tanks. This will encourage encroachments, unwanted activities and ultimately demands by land grabbers to declare the tank as dead and its filling for commercial purposes.

H) **Large Scale Defecation:** A large number of people use Amanikere daily, to answer their call of nature. This has directly affected the water quality, apart from the resultant visual pollution and the foul smell that has emanated.

I) **Illegal sand lifting:** A large amount of sand is lifted in the nullahs feeding the tank, near the places where the nullahs join the tanks. This creates deep trenches and results in heavy localised water logging and decreased inflow into the tank.

J) **Poaching / hunting:** A number of birds are poached every monsoon by people from the nearby slums, mainly for the purpose of cheap meat. This has decreased

the population of many birds like Whitebreasted water hen, Moorhens and Little Cormorants.

K) **Silt:** A large amount of silt is deposited on the tank bed, which has reduced the capacity of the tank.

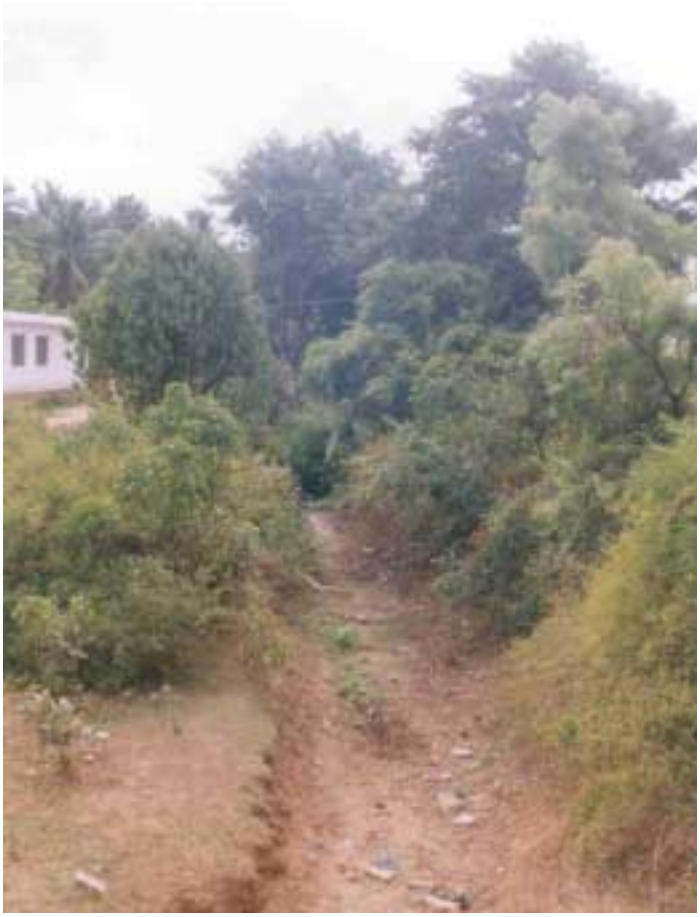
L) **Brick kilns- A threat or Advantage?** A large number of brick kilns have come up along the dry eastern and northern parts of the tank. In order to supply bricks these factories are creating huge craters in the tank. This has disturbed the Amanikere's ecology. The aquatic species also find it difficult to improve their productivity. There have been instances were trees around the tank have been felled to be used for baking the bricks. The black soot emitted from brick burning has polluted the air in the area and has also affected the water quality.

But some experts feel that Brick kilns actually help the tank's ecology in a major way by removing silt deposits. This in turn creates more space for inflowing water and helps in rejuvenating some of the springs which feed this tank with fresh water.

7.View from east. The brick kilns can be seen.

8.Encroachments in the dried up tank bed in the eastern portion.

9.One of the nullahs feeding Amanikere



10.Another nullah feeding the Amanikere with its bed relatively intact.

11. View of one of the Nullahs feeding the tank. Note the overgrowth of the vegetation and the filed up bed.

12. Amanikere has become a major ground for dumping of waste, which includes toxic medical waste

7. RECOMMENDATIONS FOR STRATEGY TO CONSERVE AMANIKERE

1. Stop the inflow of sewage
2. Prevent dumping
3. Protect incoming/feeder nullahs
4. Stop encroachments
5. Prevent illegal sand lifting
6. Protect catchment area
7. Prevent large scale defecation
8. Prevent land sharks from grabbing the tank in the name of developmental projects
9. Remove silt
10. Regulation of brick manufacturing activities
11. Prevent poaching
12. Prevent occurrence of Water hyacinth
13. Involve masses in conservation of the wetland
14. Create recreational facilities for common man

8. RECOMMENDATIONS FOR ACTION PLAN TO CONSERVE AMANIKERE

1. **<u>Preventing the inflow of sewage</u>:** There are two options to achieve this. The first is to have a common point where the sewage can be collected and treated at a plant. The treated water can then be let in to the tank. The second option is to direct all the sewage away from the tank into a treatment plant. Either way a large number of resultant problems like emanating of foul stench, breeding of pigs and their carrying of diseases, profusion of water hyacinth and others can be avoided.

2. **<u>Protecting the feeder nullahs / streams</u>**: The protection of nullahs, which fed this tank, no matter how small or big they are, is extremely important in conserving the tank. The debris should be cleared of them, encroachments if any should be removed, the vegetation overgrowth should be removed and their banks should be strengthened.

3. **<u>Encroachments</u>**: Although encroachments pose a major problem, they should be tactfully handled. The first and the most important task is to prevent further encroachment into the tank. This can be done by fencing off the entire area. Trees can be grown along the boundary without destroying the existing vegetation *(<u>NOTE</u>: Tree and shrub species suitable to the area are indicated in the suggested tree and shrub species checklist).* These pre-emptive measures will avoid all the encroachment related problems which will obviously arise later.

   As for the existing encroachments, action should be taken depending on the nature of encroachments

a. If there are residences and places of worship on the encroached lands, then their eviction is bound to create law and order problems. Hence they should be regularised only on the condition that their owners pay a fixed rate of fee. This fee should be balanced taking in view the existing market rates. The fund so collected can be exclusively utilised for the development of the tank. This will have a major effect on deterring further encroachments.

b. If the encroachments are being used for commercial purposes including agriculture then they should be evicted according to the law. This way prime land belonging to the tank can be reclaimed and fore shore planting can be done on it.

4. **Protecting the catchment area**: Steps should be taken to protect the catchment area. Deforestation, over grazing particularly by the goats should be prevented.

5. **Remove Brick kilns**: The authorities should take serious measures to prevent brick manufacturers from setting up brick kilns on the tank bed.

6. **Stop Dumping**: The dumping of urban waste should cease immediately.

This can be done by:

A) Solid waste can be used for land filling like old and unused quarrying sites.

B) Organic waste be segregated and can be converted into bio manure.

C) The district administration and health authorities should take urgent steps to set up incinerators to safely dispose bio medical waste generated from the City's hospitals and clinics.

7. **Eradicating Water hyacinth**: Since the presence of sewage encourages the growth of Water hyacinth. The diversion of sewage will make conditions unfavourable for this weed to profuse. Once the sewage inflow is prevented, the deweeding then will bear good results. After deweeding, aquatic plants such as *Nelumbo nucifera, Nymphaea nouchali* can be

introduced to keep the tank hygenic.

8. **Open Air defecation**: The city municipal authorities should initiate steps to prevent public from using Amanikere as a toilet. Pay and use toilets can be constructed and can be maintained on the lines of organisations like Sulabh International.

9. **Silt Removal:** The Karnataka Government has recently embarked upon a massive desilting programme covering thousands of tanks through out the state. The Government should also include the Tumkur Amanikere in this programme.

10. **Prevent poaching**: Steps have to be taken by the forest department to strictly enforce Wildlife Protection Act. Cases if any booked against poachers, should be widely publicised so that poaching is prevented. Awareness to this effect has to be created by local wildlife NGOs.

11. Fish can be introduced by the fisheries department to keep the tank healthy and provide employment to many people.

12. **Ideal Centre for Nature and Environmental education**:
Facilities should be created to use the tank as a centre for educating common man to learn about environment particularly the wetlands. School children can be encouraged to study the tank as an ideal wetland ecosystem. Since hundreds of birds' breed in the tank and hundreds more migrate into it- many from other countries, bird watching can be promoted as a creative hobby. Youth can be invited to nature conservation movement, thereby building a healthy society.

13. <u>As a recreation centre</u>: Infrastructure for recreational facilities should be created for the common man to avail. This will strongly involve the common man to conserve this tank.

A) A jogging track should be created within the fenced area along the boundary of the tank

B) Structures for sitting should be created for the people to enjoy the serene climate

C) A small portion of the tank towards southwestern part can be used for boating. Care should be taken to see that this does not disturb the birds.

D) All relevant measures should be taken to prevent plastic from polluting the area.

13. A committee should be created to overlook the development of the tank and prevent it from threats. This committee should include elected representatives, representatives of district administration, forest department, Environmental NGOs, and prominent members of the public.

SUGGESTED TREE SPECIES TO BE PLANTED:

1) *Terminalia arjuna*

2) Lagerstroemia lanceolata

3) Tamarindus indica

4) Prosopis juliflora

5) Acacia ferruginea

6) Acacia polyacantha

7) Terminalia tomentosa

8) Artocarpus hirsutus

9) Mangifera indica

10) Acacia farnesiana

11) Muntugia calabura

12) Azadirachta indica

13) Madhuca longifolia

14) Bauhinia purpurea

15) Bombax malabarica

16) Ceiba pentandra

17) Butea frondosa

18) Erythrina stricta

19) Syzygium jambos

20) Ficus racemosa

21) Ficus religiosa

22) Ficus benghalensis

SUGGESTED SHRUB SPECIES TO BE PLANTED:

1) Ziziphus jujuba

2) Parkinsonia digitata

3) Adhatoda vasica

4) Bambusa arundinacea

BRIEF REVIEW OF THE STRUGGLE OF TUMKUR'S PEOPLE TO SAVE AMANIKERE

Tumkur district is considered to be a hot bed of environmental activism. When it comes to conservation issues, large section of people of the district whole-heartedly involve themselves in any way they can. This has been a major reason for the periodic highlighting of environment related issues in the district.

The rapid urbanisation has beset its own ecological problems. Tumkur amanikere has been threatened for quite some time now. The will of the people came into open when there was a move in 1999 by the chairman of the Tumkur Road Safety Panel supporting the release of a portion of the area to set up a bus stand for private busses. A public meet was organised in Tumkur city by Tumkur Science Centre. The meet was called to discuss whether to protect Amanikere or not and was chaired Former Secretary for Environment and Forests, Shri. A.N.Yellappa Reddy. Among the guest of honours were, Shri.Gopala Krishne Gowda, Deputy Commissioner of Tumkur district, Shri. Harish Bhat from Centre for Ecological Sciences, Dr.Chakrapani, Shri.M.N.Narayanswamy,IFS, Deputy Conservator of Forests, and Shri.C.Jayaram,IFS, Deputy Conservator of Forests. The meet overwhelmingly resolved to protect the tank and not let it be used for any commercial purposes. It was decided to set up a committee to prepare a report to suggest ways to protect the tank. Members of the committee included Dr.H.S.Niranjan Aradhya, Dr.Mahesh G.S and Shri. Ameen Ahmed of WANC, Shri.Naveed Ahmed Khan, Shri.Panchalinge Gowda and Shri. Krishna from Karnataka Forest Department. Accordingly, Tumkur Science Centre prepared an excellent report under the guidance of Shri.C.S.Yatiraju. The report was submitted, in public, to all the elected representatives of Tumkur town. The responsible persons present on the dais spoke and promised to conserve amanikere. In the mean time WANC persuaded Karnataka Forest Department to put up a hoarding at a strategic location near the amanikere to educate people about the presence of migratory birds and the punishment for their poaching or disturbance.

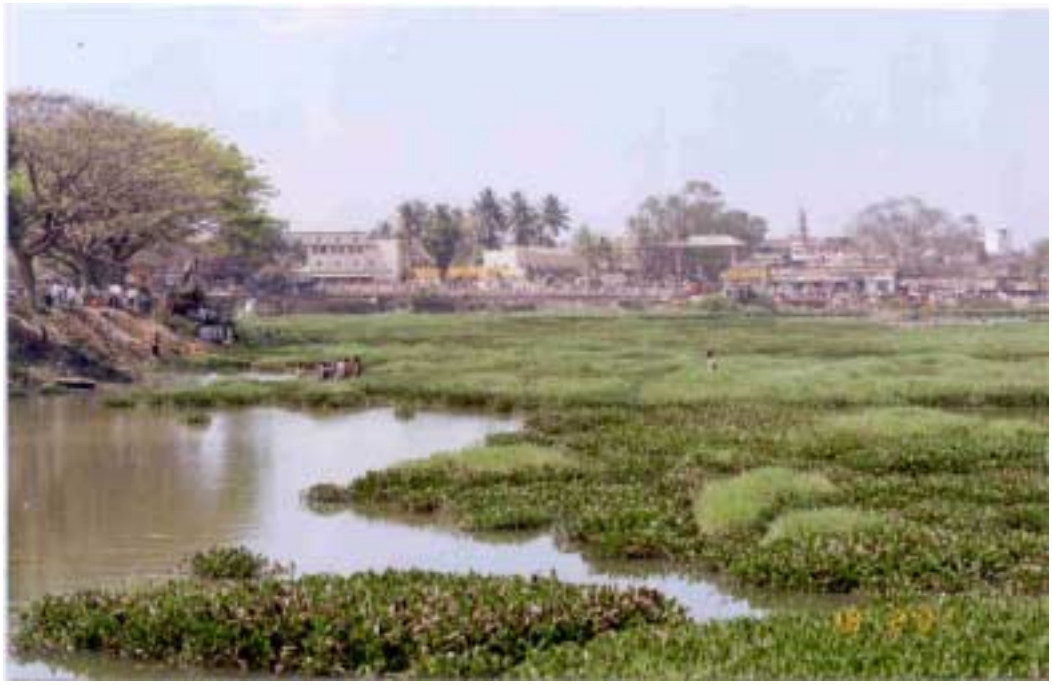
But shockingly, a few months later the President of the Tumkur City Municipality Council (CMC) wrote a letter to the Chief Engineer, Minor Irrigation Department, with a request to hand over 35 acres for the construction of a bus stand. The word is that many of the elected representatives of Tumkur town want to destroy the tank for commercial purposes, or else

how could have such a step been taken by the CMC? Seeing the threat to the tank, some concerned citizens have gone to the Honourable High court and have forced a halt on converting the tank in to a commercial centre. Also the Minor Irrigation Department has put up a board warning about the punishment against any sort of dumping in the tank.

Due to the constant pressure from the public, the district administration recently launched a massive programme involving the public to remove water hyacinth. But only a very small amount of the tank could be cleared in spite of hundreds of men and many machines struggling for about a week. Even though the exercise was given up, the volunteering of a large number of people proved that the common man wants Amanikere to be protected at any cost.

Although for the time being the tank is secure against major threats like bus stand or a road, it continues to suffer due to the inlet of sewage and the strangulating encroachments, which are enough to kill this pride of Tumkur.

13. 'Operation clean up' of Amanikere



14.'Operation clean up' of Amanikere –Another view

CHECKLIST OF FLORA AND FAUNA OF TUMKUR

AMANIKERE

Checklist 1: BIRDS

Common Name	Scientific Name	
1. Family: PODICIPITIDAE - Grebes		
Little Grebe -	*Tachybaptus ruficollis*	**Br.**
2. PELECANIDAE - Pelicans		
Spotbilled Pelican -	*Pelecanus philippensis*	**LM**
3. PHALACROCORACIDAE - Cormorants, Darters		
Large Cormorant -	*Phalacrocorax carbo*	**LM**
Little Cormorant -	*Phalacrocorax niger*	**LM**
Indian Shag or Snake bird -	*Phalacrocorax fuscicollis*	**LM**
Darter -	*Anhinga rufa*	**LM**
4. ARDEIDAE - Herons, Egrets		
Grey Heron -	*Ardea cinerea*	**LM**
Purple heron -	*Ardea purpurea*	**LM**
Pond heron / Paddy bird -	*Ardeola grayii*	**Br.**
Cattle egret -	*Bubulcus ibis*	**Br.**
Large Egret -	*Ardea alba*	**LM**
Smaller egret -	*Egretta intermedia*	**LM**
Night heron -	*Nycticorax nycticorax*	**LM**
5. CICONIIDAE - Storks		
Painted stork -	*Mycteria leucocephala*	**LM**
Openbill stork -	*Anastomus oscitans*	**LM**
White necked stork -	*Cioconia episcopus*	**LM**
6. THRESKIORNITHIDAE - Ibises, Spoonbills		
White Ibis -	*Threskiornis aethiopica*	**LM**
Black Ibis -	*Pseudibis papillosa*	**LM**
Spoon bill -	*Platalea leucorodia*	**LM**
7. ANATIDAE - Ducks, Geese		
Lesser Whistling Teal -	*Dendrocygna javanica*	**LM**
Large Whistling teal -	*Dendrocygna bicolor*	**LM**
Pintail -	*Anas acuta*	**M**
Common teal -	*Anas crecca*	**M**
Spotbill duck -	*Anas poecilorhyncha*	**LM**
Common Pochard -	*Aythya ferina*	**M**
Cotton teal -	*Nettapus coromandelianus*	**Br.**

8. ACCIPITRIDAE - Hawks, Vultures

Black winged Kite -	*Elanus careuleus*	
Pariah Kite -	*Milvus migrans govinda*	**Br.**
Brahminy kite -	*Haliastur badius*	**Br.**
Shikra -	*Accipter badius*	
Indian Long billed Vulture -	*Gyps indicus*	
Indian White backed Vulture -	*Gyps bengalensis*	
Egyptian or Scavenger Vulture -	*Neophron percnopterus*	
Marsh harrier -	*Circus aeruginosus*	**M**
Crested Serpent Eagle -	*Spilornis cheela*	
Osprey -	*Pandion haliaetus*	**M**

9. PHASIANIDAE - Quails, Partridges

Grey Partridge -	*Francolinus pondicerianus*	

10. RALLIDAE - Coots

White breasted waterhen -	*Amaurornis phoenicurus*	**Br.**
Indian Moorhen -	*Gallinula chloropus*	**Br.**
Purple Moorhen -	*Porphyrio porphyrio*	**Br.**
Coot -	*Fulica atra*	**Br.**

11. JACANIDAE - Jacanas

Pheasant tailed Jacana -	*Hydrophasianus chirurgus*	**Br.**
Bronze winged Jacana -	*Metopidius indicus*	**Br.**

12. RECURVIROSTRIDAE - Stilts

Black wing stilt -	*Himantopus himantopus*	**M**

13. CHARADRIIDAE - Lapwings, Plovers, Sandpipers

Red wattled Lapwing -	*Vanellus indicus*	**Br.**
Little Ringed plover -	*Charadrius dubius*	**M**
Wood sandpiper -	*Tringa glareola*	**M**
Common sandpiper -	*Tringa hypoleucos*	**M**
Little stint -	*Calidris minuta*	**M**

14. LARIDAE - Gulls, Terns

Indian River Tern -	*Sterna aurantia*	**LM**

15. COLUMBIDAE - Doves, pigeons

Blue Rock Pigeon -	*Columba livia*	**Br.**
Indian Ring Dove / Collared Turtle Dove -	*Streptopelia decaocta*	
Little Brown Dove -	*Streptopelia senegalensis*	

16. PSITTACIDAE - Parakeets

Rose ringed Parakeet -	*Psittacula krameri*	**Br.**

17. CUCULIDAE - Cuckoos

Pied Crested Cuckoo -	*Clamator jacobinus*	**LM**
Crow Pheasant / Coucal -	*Centropus sinensis*	

Brain fever bird -	*Cuculus varius*	
Koel -	*Eudynamys scolapacea*	**Br.**

18. STRIGIDAE - Owls

Barn Owl -	*Tyto alba*	
Spotted Owlet -	Athene brama	**Br.**

19. APODIDAE - Swifts

House Swift -	Apus affinis	**LM**
Palm Swift -	Cypsiurus parvus	**LM**

20. ALCENIDAE - Kingfishers

Lesser Pied Kingfisher -	Ceryle rudis	**Br.**
Small blue / Common kingfisher -	Alcedo athis	**Br.**
White breasted Kingfisher -	Halcyon smyrnensis	**Br.**

21. MEROPIDAE - Bee - Eaters

Blue tailed Bee-eater -	Merops philippinus	**LM**
Green Bee-eater -	Merops orientalis	**Br.**

22. CORACIIDAE - ROLLERS

Indian Roller -	Coracias benghalensis

23. UPUPIDAE - Hoopoes

Hoopoe -	Upupa epops	**Br.**

24. CAPITONIDAE - Barbets

Small green barbet -	Megalaima viridis	**Br.**
Coppersmith / Crimson breasted barbet -	Megalaima haemacephala	

25.PICIDAE - Woodpeckers

Larger golden backed woodpecker -	Chrysocolaptes lucidus

26. ALAUDIDAE - Larks

Red winged bush-lark -	Mirafra erythroptera
Ashy crowned finch-lark -	Eremopterik grisea

27. HIRUNDINIDAE - Swallows

Dusky crag martin -	Hirundo concolor	
Wire tailed swallow -	Hirundo smithii	**M**
Red rumped swallow -	Hirundo daurica	**M**

28. LANIDAE – Shrikes

Bay backed shrike -	Lanius vittatus

29. ORIOLIDAE - Oribles

Golden Oriole -	Oriolus oriolus	**LM**

30. DICRURIDAE – Drongos

Black Drongo or King Crow -	Dicrurus adsimilis	**Br.**
Grey / Ashy Drongo -	Dicururs leucophaeus	**LM**

31. ARTAMIDAE - Swallow-shrikes

Ashy swallow-shrike - Artamus fuscus

32. STURNIDAE - Mynas

Grey headed Myna - Sturnus malabaricus blythi
Brahminy myna - Sturnus pagodarum **Br.**
Common Myna - Acridotheres tristis **Br.**
Jungle Myna - Acridotheres fuscus

33. CORVIDAE - Crows

House Crow - Corvus splendens **Br.**
Jungle Crow - Corvus macrorhynchos **Br.**

34. CAMPEPHAGIDAE - Cuckoo - shrikes

Common wood shrike - Tephrodornis pondicerianus

35. IRENIDAKE - Leafbirds, Ioras

Common iora - Aegithina tiphia

36. PYCNONOTIDAE - Bulbuls

Red whiskered bulbul - Pycnonotus jocosus **Br.**
Red vented bulbul - Pycnonotus cafer **Br.**
White browed bulbul - Pycnonotus luteolus

37. MUSCICAPIDAE

Subfamily - TIMALIINAE - Babblers

Jungle Babbler - Turdoides striatus
White headed Babbler - Turdoides affinis

Subfamily -MUSCICAPINAE - Flycatchers

Brown flycatcher - Muscicapa latirostris **LM**

Subfamily - SYLVINAE - Warblers

Plain wren warbler - Prinia subflava **Br.**
Ashy wren warbler - Prinia socialis **Br.**
Tailor Bird - Orthotomus sutorius **Br.**
Blyth's Reed Warbler- Acrocephalus dumetorum **M**
Lesser white throat - Sylvia curruca **LM**

Subfamily- Robins

Magpie Robin - Copsychus saularis **Br.**
Black Redstart - Phoenicurus ochruros **M**
Pied Bush Chat - Saxicola caprata
Indian Robin - Saxicoloides fulicata

38. PARIDAE - Tits

Grey tit	-	Parus major

39. MOTACILLIDAE - Pipits & Wagtails

Paddyfield pipit	-	Anthus novaeseelandiae **M**
Yellow Headed Wagtail	-	Motacilla citreola **M**
Grey Wagtail	-	Motocilla cinerea **M**
Large Pied Wagtail	-	Motocilla maderaspatensis **M**

40. DICAEIDAE - Flower peckers

Tickell's Flower Pecker	-	Dicaeum erythrorhynchos **Br.**

41. NECTARINIIDAE - Sunbirds

Purple rumped sunbird	-	Nectarinia zeylonica **Br.**
Purple sunbird	-	Nectarinia asiatica **Br.**

42. ZOESTORIDAE - White eyes

White Eye	-	Zoesterops palpebrosa

43. PLOCIDAE

Subfamily - PASSERINAE - Sparrows

House sparrow	-	Passer domesticus **Br.**

Subfamily - PLOCINAE

Baya	-	Ploceus philippinus **Br.**

Subfamily - ESTRILDINAE

Red Munia	-	Estrilda amanadava **Br.**
White backed Munia	-	Lonchura striata **Br.**
White throated Munia	-	Lonchura malabarica **Br.**
Spotted Munia	-	Lonchura punctulata **Br.**
Blackheaded Munia	-	Lonchura malacca **Br.**

LM - Local Migrants from nearby districts /states.
M - Migrants from other countries
Br - Birds breeding within the lake or in the trees/man made structures adjoining lake boundaries

Checklist 2: BUTTERFLIES

Common Name	**Scientific Name**

Danaidae

Blue Tiger - *Tirumala limniace exoticus*
Common Crow - *Euploea core core*
Plain Tiger - *Danaus chrysippus chrysippus*
Striped Tiger - *Danas genutia genutia*

Lycaendae

Common Cerulean - *Jamides celeno aelianus*
Common Pierrot - *Castalius rosimon rosimon*
Pale Grass Blue - *Zizeeria maha ossa*

Nymphalidae

Baron - *Euthalia aconthea meridionalis*
Baronet - *Symphaedra nais*
Blue Pancy - *Precis orithya*
Common Castor - *Ariadne merione merione*
Common Leopard - *Phalanta phalantha phalantha*
Common sailor - *Neptis hylas varmona*
Danaid Eggfly - *Hypolimnas misippus*
Lemon Pansy - *Precis lemonias lemonias*
Yellow Pansy - *Precis hiertia hierta*

Papilonidae

Common Blue Bottle - *Graphium sarpedon teredon*
Common Mormon - *Papilio polytes polytes*
Common Rose - *Pachliopta aristolochiae aristolochiae*
Lime Butterfly - *Papilio demoleus*
Tailed Jay - *Graphium agamemnon menides*.

Pieridae

Common Emigrant - *Catopsilla crocale*
Common Grass Yellow - *Eurema hecabe simulate*

Satyridae

Common Evening Brown - *Melantis leda leda*

Checklist 3: SPIDERS **Checklist 3: SPIDERS**

No.	Common Name	**Scientific Name**
1	Speckled Band – Four leg	Argiope anasuja
2	Banded Four leg	*Argiope pulchella*
3	Long – Horned orb	*Gasteracantha dalyi*
4	Tri banded Spiky orb	*Gasteracantha geminata*
5	Green Lynx	*Peucetia viridane*
6	Box longlegs	*Crosspriza lyoni*
7	Common Big – Jaw	Tetra gnatha mandibulata
8 & 9	Social Spiders	*Eresidae* (2 species)
10, 11 & 12		3 unidentified species

Reference:
Preston Ahimaz, Vijayalakshmi. K., ***Spiders: An Introduction***.

Checklist 4: MAMMALS

Common Name	Scientific Name
Primates	
Bonnet Macaque	*Macaca radiata*
Mangooses	
Common Mongoose	*Herpestes edwardsi*
Rodents	
Three stripped Palm Squirrel	*Funambulus palmarum*
Indian Field Mouse	*Mus booduga*
Common House Rat	*Rattus rattus*
Bandicoot Rat	*Bandicota indica*

Checklist 5: AMPHIBIANS

Frogs:
Green Pond Frog
Indian Bull Frog
Baloon Frog
Funny Looking Frog
Rana cyanopllyctie

Toads
Common Indian Toad
Marbled Toad

Checklist 6: REPTILES

Snakes:

11 species of snakes have been recorded in and around the lake. Most of the snakes, particularly the ***Rat snake*** help to control the rat population.

No.	Common name	Scientific name
1	Common worm snake or Blind snake	Typhlina bramina
2	John's Earth Boa	*Eryk johni*
3	Trinket Snake	*Elaphe helena*
4	Common Rat Snake or Dhaman	*Ptyas mucosus*
5	Common Kukri Snake	*Oligodon arnensis*
6	Common Wolf Snake	*Lycodon aulicus*
7	Checkered Keel back	*Xenochrophis piscator*

8	Olivaceous Keel back	*Atretium schistosum*
9	Green Keel back	*Macropisthodon plumbicolor*
10	Common Green Whip Snake	*Ahaetulla nasutus*
11	Indian Cobra	*Naja naja*

Tortoises/Turtles -

Fresh water or Mud Turtles

Peninsular Mud Turtle or Flap Shell - *Lissemys punctata granasa*

Fresh water Tortoises or Terrapins

Indian Pond Terrapin - *Melanochelys trijuga trijuga*

Land Tortoises

Starred Tortoise - *Geochelone elegans*

Lizards

Geckos

Southern Hill Gecko - *Hemidactylus frenatus*

Termite Hill Gecko - *Hemidactylus triedus*

Agamids

Common Garden Lizard or Blood sucker - *Calotes versicolor*

Skinks

Common or Brahminy Skink - *Mabuya carinata*

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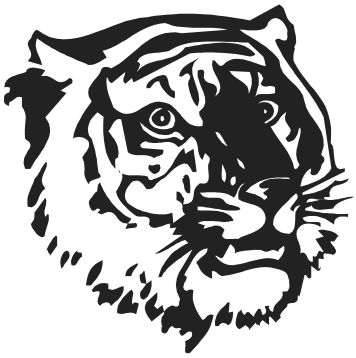
> Lopez.A and Mundkur.T (eds) 1997, "***The Asian Waterfowl census 1994 – 1996, Results of the coordinated water bird census and an overview of the status of wetlands in Asia***", Wetlands International, Kuala Lumpur

> *The Naturalist*, Volume 7, Issue 2, March - April 1997, News letter of Wildlife Aware Nature Club

BHADRA TIGER RESERVE – A CASE STUDY*



**** Conducted as a part of Karnataka bio-diversity Strategy and Action Plan (KBSAP)***

WILDLIFE AWARE NATURE CLUB
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TUMKUR- 572103

OCTOBER 2001

WANC MEMBERS WHO CONTRIBUTED TO THIS PROJECT

The following members comprised of the WANC team who conducted this project

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11. Mallikarjun

THIS REPORT HAS BEEN EDITED BY: Ameen Ahmed

CONTENTS

6e) Findings/Data Collected

> Number of villages to which questionnaires were sent

> Number of villages from which questionnaires were received

> Number of villages visited by WANC members

> Excerpts / Comments of interviews

> Man- Animal conflict

> Threats to Flora and Fauna

7. RECOMMENDATIONS FOR STRATEGY TO CONSERVE BHADRA TIGER RESERVE

8. RECOMMENDATIONS FOR ACTION PLAN TO CONSERVE BHADRA TIGER RESERVE

9. REFERENCES

10. Note on Acquisition and Rehabilitation in Bhadra Wildlife Sanctuary

1. PREFACE

Wildlife Aware Nature Club: WANC - **as it is popularly known, was established in 1990 by a few young nature lovers. It was the first organization to be formed in Tumkur district for the cause of nature and wildlife conservation. WANC today is considered as the most active & dedicated environmental NGO in this region. Among its activities, WANC has been involved in many surveys of important wildlife areas of Karnataka, to help in their better management. This case study on Bhadra Tiger Reserve is an extension of its activities and its commitment to conservation. WANC is proud to be associated with the KBSAP under the agesis of the prestigious Centre for Ecological Sciences of Indian Institute of Science (IISc), Bangalore and the Karnataka Forest Department.**

2. ACKNOWLEDGEMENTS

This report is the outcome of the faith reposed in WANC by Prof. Madhav Gadgil of CES, for which WANC is grateful to him. The wildlife wing of the Karnataka Forest Department led by Sri. S.K.Chakrabarthy, Chief Wildlife Warden and Principal Chief Conservator of Forests (Wildlife) and his subordinates Sri.Yatish Kumar, Deputy Conservator of Forests (Bhadra Wildlife Division), Mr.Thimmaiah, Assistant Conservator of Forests (Chikmagalur wildlife Sub-division), Mr. Nagaraj, Assistant Conservator of Forests (Lakvalli wildlife Sub-division) and all concerned officials of the Forest Department lent all possible support to the smooth functioning of this study. Mr.Kenchappa and Mr.Chandrashekaraiah Chief Secretaries of Chikmagalur Zilla Panchayat and Shimoga Zilla Panchayat were extremely helpful in the WANC members to approach the concerned Gram Panchayats. Also the data collection would not have been possible but for the reliable information given by the respective Mandal and Gram Pradhans.

3. LIST OF PHOTOGRAPHS AND MAPS

4. BHADRA TIGER RESERVE

Nestled amidst the scenic ranges of the Western Ghats is India's youngest Tiger Reserve – Bhadra Wildlife Sanctuary. It is spread across the Malnad districts of Chikmagalur and Shimoga

4a) LOCATION:

Geographical co-ordinates:

N: 13 25' to 13 50'

E: 75 15' to 75 50'

4b) AREA: 492.46 sq. km

Core Zone: 133 sq. km

Tourism Zone: 100.83 sq. km

Buffer zone: 258.63 sq. km

The entire sanctuary is divided into three parts. While the Aldera state forest is divided from the main body to south by the expansive Bhadra reservoir (200 Sq. km), private coffee estates surround the Baba budain giri reserve forest.

4 c) TERRAIN:

The saucer shaped Jagara Valley lies within the Horseshoe shaped Bababudan hills. The terrain within the valley undulates gradually while the surrounding peaks are of towering height. The lowest point in the sanctuary is 2267 feet at the junction of Thadabehalla and Somavahini halla. The highest point is Bidddigiri, about 4636 feet above sea level. The nearby Mullainagiri peak is 1900 metres (6317 feet), the highest in Karnataka.

4d) CLIMATE:

Temperatures in the Jagara valley range from 8 C to 35 C, while the surrounding peaks are even colder during winter. Southwest monsoons drain the Jagara valley with about 2500 mm of rain, chiefly between early June and late September. But the plains in the northern part of the sanctuary receive less than a thousand mm of rainfall.

4e) FLORA:

Bhadra is mosaic of different habitats with Bamboo being very common. In northern part of the sanctuary the habitat is mainly dry deciduous. Towards south the trees are much taller and are of moist deciduous type. Baba budain giri state forest, which is in the eastern part of the sanctuary, consists of Shola evergreen forests. Plantations of teak and eucalyptus are present in parts of the sanctuary. Jagara giant is a huge teak tree, considered to be the biggest in Karnataka. The girth of this 300-year-old tree is 5.21 metres.

4f) FAUNA:

The sanctuary is extremely rich in wildlife, due to its proximity to Western Ghats and the diverse habitat. These forests have always been known for the big wild cats. Until the formation of the sanctuary these forests were a happy hunting ground for hunters, considered by many of them as a Paradise on earth. Well-known hunter Kenneth Anderson claimed to have shot many tigers here, including the `Lakvalli man-eater' fearing whom, construction work of the huge Bhadra reservoir had to be briefly abandoned. The sanctuary even today has a very healthy tiger population, the reason for which it was recently declared as a tiger reserve. Leopards, wild dogs, jungle cats, jackal, striped hyena and Indian fox are the main predators found here. Elephants have made Bhadra as their home since long. Bhadra is known for its large population of Gaur. A severe outbreak of rinderpest or `foot and mouth' epidemic during late eighties, led to the death of many gaurs. The strict protection being afforded by the forest department has once again raised their numbers considerably. Chital or spotted deer is the commonest deer here. Sambar and barking deer are also found here. Among the smaller mammals are: Slender loris, Porcupine, Black napped hare and mouse deer. Giant malabar squirrels, typical of the Western Ghats, can be seen in plenty in Muthodi area. Along the many streams and Bhadra reservoir, Otters and Marsh crocodiles can be seen. The southern part of Bhadra, particularly the area around Muthodi is extremely rich in birds, butterflies and reptiles. The sanctuary is home to over 250 species of birds, many of which like the malabar pied hornbill, malabar Trogon, blue winged parakeet are endemic to the Western Ghats. Some of India's most beautiful and big butterflies like southern birdwing and blue mormon are found here. Rare and unique reptiles like the flying lizard can be seen gliding amidst the huge trees here. Apart from King Cobra- the largest poisonous snake on earth, Malabar pit vipers and rare coral snakes are found here.

The 300-year-old Jagara giant tree is the biggest ***teak tree in Karnataka, with girth of 5.21 metres***

Due to the presence of a viable population of tigers the sanctuary was declared as a tiger reserve in 1999

4g) WATER RESOURCES:

Numerous streams most of which feed the Bhadra River flow through these pristine forests, forming an abundant source of water for the wildlife here. Among them is the Somavahini halla, which flows through the tourist complex of Muthodi. During summer many animals can be found along the banks of Bhadra reservoir.

4h) LEGAL STATUS:

This forest was first given the status of a protected area in 1952 when 252 sq. km (77.45 Sq. miles) of it was declared as Jagara Valley Wildlife Sanctuary, in 1952, named after the hamlet of Jagara, vide Govt. notification No: A & F 6175 /90 (1) FT 112-40-2 dated 21st February 1951. The area was enlarged to the present 492 sq. km in September 1974 and renamed as Bhadra, vide notification AFD 25 FWL 74 dated 25th September 1974. The final notification was issued in 1998 vide G.O.No.FEE 58 FWL 96 dated 9th March 1998. Due to the healthy tiger population and the prospects of the area as a long-term habitat for the tiger and related species to thrive, the Govt. of India upgraded it into a tiger reserve on 19th November 1998.

4i) VILLAGES / SETTLEMENTS WITHIN THE SANCTUARY:

There are 16 villages within the sanctuary with few basic amenities supporting 736 families.

The 200 Sq. Km. Bhadra Reservoir divides the Aldera state forest in the north from the main body of the sanctuary.

There are about 16 villages within the sanctuary, supporting a 736 families.

4j) APPROACH:

There are two approaches to the sanctuary from Bangalore. The one from north is from Tarikere. Muthodi in the south can be approached via Chikmagalur (33 km by road). The nearest railhead in south is Kadur, which is 40 km from Chikmagalur. To north, Tarikere is the nearest Railhead

4k) TOURISM:

Muthodi is the main place for tourists to stay in Bhadra. There are a number of cottages here along with a couple of dormitories and rest houses. There are excellent facilities to organise nature camps. During rainy season, chances of sighting wildlife decrease due to misty conditions and the dense vegetation cover. But the scenery within and around the sanctuary with the backdrop of the Bababudan giri hills, during this period is spectacular. Sigekhan, a couple of kilometres from Muthodi, is one such place. Standing atop the isolated forest bungalow one can enjoy entire landscape of the horseshoe shaped Bababudan giris and the Jagara valley within it. A walk around this place early morning or late evening can reveal interesting wildlife. Kemmanagundi and Bababudan giri are the two hill stations near Muthodi. The Salim Ali Nature centre has a few trophies of wild animals along with a good library. Also there are facilities to screen wildlife movies on video. The best time to visit the park is from October to March. It is not advisable to visit the park during peak summer or from July to August when the monsoons are at their fury.

5. INTRODUCTION TO KBSAP (Karnataka state Biodiversity Strategy and Action Plan)

India is a land rich in diverse forms of life. But unfortunately much of this is under threat due to a host of reasons. Serious attempts are being made from various quarters to save this precious natural wealth. The Government of India under the Ministry of Environment and Forests (MoEF) has initiated a project for the preparation of a National Bio-diversity Strategy and Action plan (NBSAP). This project, which is participatory in nature with inputs from a broad spectrum of the society, aims at conservation of biological diversity, its sustainable utilization and equal sharing of benefits.

The Centre for Ecological Sciences at the Indian Institute of Science is co-ordinating at state level the preparation of Karnataka state Bio-diversity Strategy and Action plan (KBSAP). This attempt in Karnataka will broadly include the following six themes:

(a) Management of protected areas

(b) Medicinal plants

(c) Freshwater fishes

(d) Wetlands

(e) Cultural traditions of conservation, and

(f) Land races of cultivated plants.

To harness the ideas of the common man and expertise of technical people in Karnataka, a 4-way approach is being adopted. Among these are case studies of selected areas by leading NGOs. Wildlife Aware Nature Club (WANC) has been identified by the CES to take up case studies on Bhadra Tiger Reserve and Tumkur Amanikere.

6. THE CASE STUDY

6 a) AIMS OF THE STUDY:

India is a land extremely rich in natural wealth. But much of this is under threat due to many factors. Of the 17 % of land mass under forest cover in our country, only 3.3% has been set apart for wildlife sanctuaries and a mere 1.1% has been reserved for National Parks. Karnataka has 21 wildlife sanctuaries and 5 national parks. Like other states of the nation, even here the sanctuaries are facing varying degree of pressure. There are various lines of thoughts on how to protect these areas. While some would like wildlife to be given priority over humans in these areas, others advocate equal rights for both wildlife and forest dwelling humans.

This KBSAP initiated case study on Bhadra wildlife sanctuary aims to thoroughly review the current status and difficulties associated with the management of Protected Areas. This study aims to come out with relevant measures for the successful management of Protected Areas through the KBSAP.

6 b) METHODS OF STUDY:

As mentioned, earlier (see chapter 4, ***About Bhadra Wildlife Sanctuary***), there are 16 villages / hamlets inside the sanctuary. Apart from the residents of these 16 villages, there are more than 30 villages along the periphery of the sanctuary, many of whose residents are in one way or the other associated with the sanctuary and its wildlife. In order to get fair views from all these villages, WANC adopted two methods to under take the study:

1.) Direct and **2.) Indirect**

1) Indirect:

To complete the case study under the given period of time and at the same time for the WANC members to personally visit all the villages in and around the sanctuary was a very difficult task. Hence a novel idea to send questionnaires to each of these villages was adopted (Questionnaire included below). WANC took the help of the Chief Secretaries of Chikmagalur and Shimoga Zilla Panchayats in approaching the respective Gram Panchayats to make it sure that the questionnaires reach all the villages. While many of the Gram

Panchayats returned the questionnaires by post, some were personally collected by WANC members at the respective Gram Panchayat offices.

2) Direct:

i) Field Visits: Apart from the villages to which the questionnaires were sent, WANC members paid field visits to all the 16 villages coming within the sanctuary area. Apart from this 25 Villages along the sanctuary periphery were visited. This was done to collect the views and information from villagers and forest officials who work at the field/grass root level, apart from getting a first hand experience of the relevant things. By doing this, a fair representation of views through out the sanctuary could be elicited.

ii) Group Discussions: Two Group discussions were held along with the villagers during the Village Fairs of Siruvase and Mallandur in June 2001. Posters on wildlife and Bhadra sanctuary were displayed during the fairs first at Siruvase then at Mallandur. This attracted a number of Villagers and also coffee planters. Questions were posed to the visiting villagers taking care that people were in groups of same villages. This would reduce the margin for errors for the data provided. This way some extremely important and otherwise unknown data was collected like that of the cattle lifting at Bogase village.

6 c) RESOURCES / BASE LINE DATA:

Before initiating the actual fieldwork, attempts were made to collect the updated information on the sanctuary. The following documents were referred:

i) Gazetteer: Year 1930 Mysore State

ii) Topo Sheets: The following Survey of India Sheets were used to get
a picture of the topography, location of the villages,
approaches etc.
No: 48 O/7(1979),
No: 48 O/9(1980)
No: 48 O/10(1979)
No: 48 O/11(1978)
No: 48 O/14(1979)

FSI No. 480 (1986)…

iii) Books / Literature: The following literature proved very helpful in getting reliable data of the Sanctuary particularly its flora and fauna.

a) Shekar Singh, Ashish Kothari et al., ***Directory of National Parks and Wildlife Sanctuaries of Karnataka***. Published by Indian Institute of Public Administration, New Delhi.

b) G.N.Srikantaiah, I.F.S, (DCF, Chikmagalur Division), Dr.S.Subramanya, I.A.S, (Deputy Commissioner, Chikmagalur District), ***Bhadra Wildlife Sanctuary, Acquisition, Rehabilitation and Resettlement Project.*** Government of Karnataka, February 1992.

c) Karanth, Ullas K (1982): ***Bhadra Wildlife Sanctuary and its endangered ecosystem***, Journal of Bombay Natural History Society, Vol.79(1), Pages 79 – 86.

iv) Field visits by WANC members: Since its formation in 1990 WANC members have been regularly visiting the various forests and Wildlife habitats. As a part of this, on several occasions members have visited Bhadra sanctuary and its surrounding forests and villages. Most of the observations particularly those pertaining to the flora and the fauna have been documented by members. Apart from this WANC had organised two nature camps at Muthodi in the heart of the sanctuary for 8 days during the Wildlife Week (I week of October) of 1997. All this has placed WANC in a better position to carry out the case study in a fair manner and do justice to the faith reposed in it.

WANC members visited all the villages within the sanctuary and 25 villages along the periphery of the sanctuary.

A photo of WANCers during one of their visits to the villages.

After the visits to the villages, two group interactions were held during the weekly village fairs at Siruvase and Mallandur in mid June

Posters were displayed at the village fairs to attract them to the group discussions.

6 d) CONSTRAINTS:

Time was probably the only constraint during the case study. If the project was for a period more than the present 5 months then more villages could have been visited, making the data collected even more reliable and accurate.

6 e) FINDINGS / DATA COLLECTED FROM STUDY:

i) Findings of Indirect survey

I. Villages inside the Sanctuary:

Name of Village	Taluk	Total population (apprx)	Cattle population (apprx)	Families	Forest encroachment	Main problems		Remarks
					Y/N	To man		
						Cattle lifting (apprx)	Crop raid (apprx)	
Hebbe	Chk	400	500	97	Y	Y(T,L) 80	Y(WB,E)	
Madla	Chk	350	2000	159	Y	Y(T,L) 10	Y(WB,E)	
Hipla	Chk	300	500	98	Y	Y(T,L) 10	Y(WB,E)	Eshwara temple (400 yrs)
Keseve	Chk	300	150	60	Y	Y(T,L) 15	Y(WB,E)	Brahma temple
Muthodi	Chk	120	120	36	Y	Y(T,L) 5	Y(WB,E)	
Karuvane	Chk	150	150	52	Y	Y(T,L) 4	Y(WB,E)	
Waddihatti	Chk	200	200	51	Y	Y(T,L) 5	Y(WB,E)	
Hebbekurkul mane	NRP	30	50	7	Y	Y(T,L)	Y(WB,E)	
Bidare	NRP	50	50	12	Y	Y(T,L)	Y(WB,E)	

Shiragola	NRP	150	200	40	Y	Y(T,L) 20	Y(WB,E)	Rama,chennakeshava,mallikarjuna temples
Balegadde	NRP	50	50	20	Y	Y(T,L)	Y(WB,E)	
Mutt	NRP	75	100	24	Y	Y(T,L)	Y(WB,E)	
Hunasekatte	NRP	40	50	15	Y	Y(T,L)	Y(WB,E)	
Heggarmattuvane	NRP	110	150	68	Y	Y(T,L)	Y(WB,E)	
Kancugar	NRP	25	35	7	Y	Y(T,L)	Y(WB,E)	
Madhuguni	NRP	100	150	28	Y	Y(T,L) 20	Y(WB,E)	

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NOTE:

CHK – Chikmagalur taluk

NRP - N.R.Pura taluk

II. Villages outside the Sanctuary:

Name of Village	Total population (apprx)	Cattle population (apprx)	Families (apprx)	Forest encroachment	Main problems	
					To man	
				Y/N	Cattle lifting	Crop raiding
Khandya	150	300	30	Y	Y(T,L) 5	Y(WB,E)
Suguduvani	200	500	50	Y	N	Y(WB,E)
Bidare gundi hambala	72	50	30	Y	Y(T,L)	Y(WB,E)
Kodihirebylu	350	500	80	Y	Y(T,L)	Y(WB,E)
Trasamutta	100	150	35	Y	Y(T,L)	Y(WB,E)
Kara Gadde	122	60	35	Y	Y(T,L)	Y(WB,E)
Kundur	150	300	40	Y	Y(T,L) 20	Y(WB,E)
Kenchi Koppa	600	700	350	Y	Y(T,L) 10	Y(WB,E)
Honne Koppa	300	110	63	Y	Y(T,L) 6	Y(WB,E)
Byre makki	160	50	36	Y	N	N
Magalu	280	200	55	Y	N	N
Chandra valli dapti	500	150	93	Y	N	N
Bale koppa	150	80	30	Y	Y(T,L)	Y(WB,E)
Bidare Patna	50	40	15	Y	Y(T,L)	Y(WB,E)
Karadi Khana	350	40	80	Y	Y(T,L)	Y(WB,E)
Badigere	400	300	150	Y	Y(T,L)	Y(WB,E)

Siravase	500	400	200	Y	Y(T,L) 15	Y(WB,E)
Bogase	150	250	50	Y	Y(T,L) 40	Y(WB,E)
Kodi	250	300	70	Y	Y(T,L) 20	Y(WB,E)
Kodi coffee estate	100	130	35	Y	Y(T,L)	Y(WB,E)
Dabbare	110	125	40	Y	Y(T,L)	Y(WB,E)

ii) Findings of Direct survey

Number of villages visited by WANC members.

a) ***Within the Sanctuary****……..*

Name of Village

1. Hebbe
2. Madla
3. Hipla
4. Keseve
5. Muthodi
6. Karuvane
7. Madla – Waddihatti
8. Hebbe Kurkulmane
9. Bidare
10. Shiragola
11. Balegadde
12. Mutt
13. Hunasekatte
14. Heggarmattuvane
15. Kancugar
16. Madhuguni

b) ***Outside / Periphery of the Sanctuary…….***

Name of Village

1. Khandya
2. Sugudavani
3. Bidare Gundi Hombala

4. Kodi Hire beelu
5. Trasamutta
6. Kara Gadde
7. Lakkavalli – Kunduru
8. Kenchi Koppa
9. Honne Koppa
10. Bire Makki
11. Magalu
12. Chandara Valli
13. Harana Kore
14. Chandara Valli dapthi
15. Bale koppa
16. Bidare Patna
17. Karidi Khana
18. Badigere
19. Siravase
20. Kundur *
21. Bagase
22. Musgilli
23. Kodi
24. Kodi Coffee Estate
25. Dabbare.

iii) Man-Animal conflict:

Loss of Human lives:

*An elephant killed a 35-year-old man 3 years back at Siruvase.

*One more case in 1987 in Muthodi village of a 16-year-old boy being killed by an Elephant has been recorded.

Loss of livestock: (Part of this information collected during the weekly village fair at Siruvase and Mallandur in June 2001) In Bogase village, villagers informed WANC surveyors that approximately 80 cattle have been killed in one year on an average. In one house of Mr.Manjappa Shetty and cattle lifted by carnivores in a single night during the monsoons in June 2000. The villagers did not lodge compensation claims with the Forest

Department, as they were afraid that they would be rehabilitated. There are claims that even the elected representatives of Grama Panchayat advise villagers against claiming compensation. Last year the villagers of Bogase claimed to have seen a Tigress with her cubs for at least 20 days, some of them claim it be one month. The Tigers, the villagers say kill the cattle without fear.

#Crop loss: There are regular raids by wild animals into the human habitations particularly into those villages that are within the sanctuary. The total compensation paid by the Forest department from 1st April 1997 till 31st March 1998 is Rs.42, 500

#Loss to Wildlife:

*The straying outside the sanctuary of wild animals, particularly the big cats-Tigers and Leopards, is rarely tolerated by the surrounding villagers. On April 1, 2001 a fully-grown tigress was killed by a group of farmers after it strayed out of the sanctuary. The incident occurred in Karkuchchi colony near Lakkavalli village on the northern outskirts of the sanctuary. The killing was sparked by the alleged attack by the tigress on one Mr.Rammappa, a farmer who incidentally survived the attack.

**Cases of cattle poisoning:* There have not any been any cases of revenge killings of big cats by poisoning dead cattle.

**Case of Electrocution of Wild animals:* There are claims of wild boars being electrocuted near estates.

iv) Threats to the Sanctuary:

Forest Fires: Considerable portions of the Sanctuary are affected, as villagers set afire to the forests. Particularly the teak plantations along the periphery are affected the most. This is supposedly done to facilitate the growth of fresh grass for grazing.

Illegal grazing: There are a large number of livestock belonging to the villagers residing in the sanctuary. They are supplying milk to the diaries in Chikmagalur. Some of them even lend their cattle to other villages to graze. Apart from grazing within the villages, the cattle enter even to the core zone. Most of them are not vaccinated. The grazing is unguarded, during rainy season the cattle are not expected to be back. The vaccination programme by the Karnataka Forest Department has to be intensified.

Collection of fire wood: Most of these villagers depend on the sanctuary for their daily needs of fuel wood.

Poaching / hunting: There have not been many cases of bigger mammals like Tiger, Leopards, Gaur, Chital, Sambar or elephants being poached. The poaching of small game like Wild boar Blacknaped Hare still persists, particularly along the periphery.

Smuggling of timber: The timber smuggling lobby is active in parts of the sanctuary particularly towards those parts of the sanctuary that adjoin Koppa territorial Division. The Press has carried extensive coverage of the havoc that timber smuggling lobby has wrecked in Chikmagalur district.

#SEVERING OF WILDLIFE CORRIDORS:

The wildlife corridors connecting Bhadra Tiger reserve to its neighbouring sanctuaries have been severely threatened. The wildlife corridor to the north-west connecting the sanctuary to Shettihalli sanctuary has been totally cut off both by the Bhadra Reservoir and also the Gajanur anicut. Although to south the corridor connecting to Kudremukh National Park is relatively intact, it is being threatened by factors like encroachments into the neighbouring forests. Develpoment projects in the long term will create islands of wildlife populations, which will break the transfer of gene pool resulting in inbreeding.

a.) Upper Bhadra Project: This project aimed to provide water to the parts of the dry Chitradurga, Tumkur and Kolar districts. Accordingly there were plans to construct a dam at Magundi in Koppa taluk to impound waters in Bhadra reservoir. This would have drowned many hectares of Bhadra Wildlife Sanctuary. But this was dropped, as it was financially and technically unviable.

Now there are reports that a revised plan proposed by Retired Superintending Engineer Sri. G.S.Paramasivaiah will be implemented. The draft plan is to build two dams. One is across the measure Nullah at Kesave (within Bhadra Sanctuary) or Siddarmath. The other dam is across Kanura Halla at Kanuru in Koppa taluk of Chikmagalur district. If this plan is implemented then large forests of the core of Bhadra wildlife sanctuary will be drowned and destroyed forever.

b) Mining of Iron Ore: The Visvesvaraya Iron and Steel Limited (VISL) a subsidiary of Steel Authority of India (SAIL) started mining 738 hectares of land in Kemmanagundi in 1923. Due to unviable production costs, the company stopped mining in 1983. Crippling financial losses forced SAIL to take over the plant in 1989. The SAIL commissioned a Blast Furnance at VISL in 1995, which prompted the state Government to recommend the handing over of 78.9 hectares including 47 hectares of forest land for renewing the mining. Of this, 16.25 hectares of forest had mineral deposits, which was expected to produce 4.2 million tones of iron

The Assistant Commissioner of Tarikere sub division issued a final notification in March 1998 to include 16.25 ha of this forest land belonging to the Chikmagalur territorial division in to the Bhadra wildlife division. But since then some influential politicians of the area have been lobbying to renew mining in this part of the Sanctuary

Netravathi Diversion Scheme: This project again proposed by Sri.Paramasivaiah aims at building a network of 37 small dams and two canals 300 km long starting from Lingadahole in Pushpagiri wildlife sanctuary till Kudremukh national park. One of the main canals to transport water from this canal dam-network will cut through the heart of the Bhadra Wildlife Sanctuary. This will massively affect the corridors for movement of the wildlife. This project proposal is still in the preliminary stage but very much under consideration

7. RECOMMENDATIONS FOR STRATEGY TO CONSERVE BHADRA TIGER RESERVE

1. Rehabilitation of the villages within the sanctuary should be carried out as planned by all the concerned authorities. There should be no compromise on this issue.

2. Forest fires should be prevented

3. The three zones within the sanctuary i.e. Core, buffer and tourism should be clearly marked and their sanctity maintained.

4. Encroachments should be prevented at any cost.

5. The lower hierarchy of the forest department should be strengthened

6. The compensation procedure for loss to villagers by wildlife should be simplified.

7. There should be better co-ordination between the higher and the lower officials of the forest department.

8. Wildlife census has to be conducted in the sanctuary twice a year by involving interested nature lovers and local NGOs.

9. There should be incentives to those who have served the forest department beyond the call of the duty.

10. Collection of firewood should be strictly controlled.

11. Poaching should be strictly dealt with.

12. The checklists of the flora and fauna should be regularly and scientifically updated.

13. Pollution of Water sources should be prevented.

14. Illegal power fencing should be checked.

15. Developmental projects should be critically reviwed

16. Common man should be encouraged to visit, learn and love the sanctuary.

#Many of the coffee estates pollute the sanctuary's water sources by pumping the untreated water flowing in their vicinity.

8. RECOMMENDATIONS FOR ACTION PLAN TO CONSERVE BHADRA TIGER RESERVE

1. The number of lower strung staff particularly the Forest guards should be increased, and local youth should be given preference.

2. The surrounding villagers should be relentlessly targeted to educate them to know about the harms caused by forest fires to wildlife. Punishment for abetting forest fires should be strict and severe.

3. The lower cadre staffs particularly Foresters and others below their rank should be transferred within the sanctuary, unless any adverse comments pertain to them.

4. Powers should be given to the forest staff on par with the Police to effectively protect the sanctuary.

5. The Sanctuary boundaries should be demarcated prominently. Punishment to the encroachers should be strict and no mercy should be shown to them.

6. The higher-level officers of the Sanctuary should reside in the Head quarters of the sanctuary. They should be available during any emergency to guide their sub-ordinates.

7. Those who have outstandingly served the sanctuary should be awarded.

8. Alternative fuel sources should be made available to the villages to stop the collection of firewood.

9. Vaccination programme of the cattle within and along the sanctuary periphery has to be intensified.

10. More anti-poaching patrols and camps should be established.

11. To update the checklists of the flora and fauna, researchers should be invited and encouraged and work in the sanctuary regularly. There is every chance that there will be extension of the species' range, particularly as most of this area falls in the

Western Ghats. Also there are chances that new species might be discovered, the example of a new toad discovered recently in the nearby Kudremukh National Park is worthy of being mentioned.

12. Coffee pulp from the surrounding coffee estates should be prevented from being pumped in to the Sanctuaries water sources. Also the massive use of pesticides should be dealt with.

13. The feasibility committee of the developmental projects affecting any Protected Area like Upper Bhadra project or Nethravathi diversion scheme should also consist of forest department officials not only engineers.

14. Nature camps should be regularly conducted for school students and the youth by the forest department. Help may be taken from interested NGOs to do so.

15. The accommodation rates of the forest rest houses should be reduced to suit budget of common man. There should be discounts to students and those involved in scientific projects.

9. Note on Acquisition and Rehabilitation in Bhadra Wildlife Sanctuary

1. The Bhadra Wildlife Sanctuary extends over an area of 492.6 Sq.Kms, in the Districts of Chickmagalur and Shimoga. The initial Notification declaring Bhadra Wildlife Sanctuary was issued by State Government vide G.O.No.AFD 25 FWL 74 dated 06-09-1974 read at (1) above and the final Notification was issued in the year 1998 vide G.O.No.FEE 58 FWL 96 dated 09-03-1998 Realising the ecological Importance and the Potential to support high density faunal populations, this sanctuary has been upgraded to the status of Project Tiger Reserve by the Government of India on November 19. 1998. There are 16 villages inside the Bhadra Wildlife Sanctuary, comprising of 736 families. A project was prepared by the Deputy Commissioner of Chickmagalur in the year 1992 to acquire 861.00 acres of Revenue Land of these villagers and rehabilitate them outside the sanctuary at an estimated cost of Rs.12.76 Crores (Rs.7.02 for Acquisition and Rs.5.74 Crores for Rehabilitation). This project was submitted to the Government for approval.

2. The Deputy Commissioner, Chickmagalur was directed by the Government to calculate the acquisition and rehabilitation cost as per the current rates. As per the directions of the Government, the Deputy Commissioner, Chickmagalur has revised the acquisition cost to Rs. 13.00 Crores and the Rehabilitation cost to Rs.4.65 crores and has submitted to the Government for approval in the letter read at (3) above.

Cost of Rehabilitation as per the proposed New Rehabilitation Package.

Sl.No.	Details	Amount (Rs.in lakhs) 152.30 Expected Budget.
1.	Exgratia payment for displaced families (736 families)	(Tentative)
2.	Cost of Infrastructure for displaced families a. Construction of SchoolBuilding b. Road network including drainage c. Burial grounds and recreation park. d. Shopping complex e. Bus Shelter f. Temple g. Water supply	 10.00 51.00 6.00 5.00 1.00 3.00 33.00
3.	Providing Electricity	100.00
4.	Transportation cost at Rs.5000/- per displaced family (736 families)	36.80
5.	Dispensary and Veterinary Dispensary	25.00
	Total:	423.10
6.	Contingency and Administrative Overheads at 10% of total.	42.31
	Grand Total:	465.41 (Tentative)

3.The 16 Villages coming under this project are

Villages	No. of families for the purpose of rehabilitation benefits.	Extent of land to be acquired (in Acres)
Hebbe	97	99.7
Madla	159	250.15
Hipla	98	143.46
Keseve	60	85.25
Muthodi	36	34.23
Karuvane	52	106.00
Madla – Waddihatti	51	17.62
Hebbe Kurkulmane	7	5.00
Bidare	12	7.20
Shiragola	2	-
Balegadde	20	33.22
Mutt	24	17.49
Hunasekatte	15	-
Heggarmattuvane	68	1.1
Kancugar	7	-
Madhuguni	28	60.87
Total:	736	861.29

4) The State Government has written a letter to the Government of India that the cost of the acquisition would be met by the Government of India and the cost of rehabilitation will be met by Government of Karnataka. Already the Government of India has released Rs.1.68 Crores on March 1999 for acquisition of lands and the Government of Karnataka has released Rs. 0.50 Crores for rehabilitation. An amount of Rs. 2.18 Crores has been

deposited with the Deputy Commissioner, Chickmagalur on 31-03-1999. Again the Government of India has released Rs. 2.00 Crores in January 2001 for acquisition of lands.

5) Out of these already 4(1) Notification under Land Acquisition Act has been issued for Hebbe, Madla and Hebbe-kurkulmane villages on
24-05-1999. The 6(1) Notification has been issued on 19-08-2000 and 22-06-2000. The Deputy Commissioner, Chikmagalur has informed that the acquisition of Hebbe village can be completed with the available money.

6) The Forest, Ecology and Environment Department has to obtain a written consent of Government of India about the acquisition cost. The cost of rehabilitation will be met by the State Government subject to maximum ceiling of Rs.5.00 crores (Rupees Five Crores Only

8) The Government of Karnataka has sanctioned rehabilitation and resettlement package benefits and facilities to the families affected by the acquisition of land for the project Bhadra Wildlife Sanctuary in Chickmagalur District.

GOVERNMENT ORDER NO.RD 69 REH 97

BANGALORE DATED MARCH 28TH 2001

1. Government are pleased to sanction following Rehabilitation and Resettlement Package benefits and facilities to the families affected by the acquisition of land for the project Bhadra Wildlife Sanctuary in Chickmagalur District.

A) Land Acquisition and Compensation.

a. Coffee lands
b. Other lands
c. Malki
d. Buildings
e. Solatium and additional market value as admissible under land Acquisition act.
f. Encroachers on if the encroachers are eligible as per state Government Land. Government orders for regularisation of their unauthorised cultivation, and if regularisation orders are issued as per rules, compensation may be determined as per land Acquisition act.

B) Rehabilitation Scheme.

a. Land Grants

Families holding own lands plus extent regularised wherever applicable.

Maximum extent proposed for grant.
……

Wetland/Plantation Land

1. 5 Acres and above -
   5 Acres t upset price of Rs.1000/-per acre.

2. 1-5 Acres and above -
   3 Acres at upset price of Rs.1,000/- per acre.

3. Less than 1 Acre/Landless -

1 Acre at upset price of Rs 1,000/- per acre

……

b. House site at free of cost.

Land holdings inclusive of Extent o fencroachment Regularised	*Area of the site
1. 1.5 Acres and above 2. 1-5 Acres 3. Less that 1 Acre/landless	90' * 60' 80' * 50' 50' * 40'

c. Transportation cost,
Lump sum grant of Rs 5000/- each family.

d. Dismantled building material can be utilised by occupants.

e. Amenities

Civic amenities in rehabilitation colony, M.C.Halli viz..,
site formation, roads, Drains, Sanitation, Drinking
water, Electricity, School, Post Office, Hospital,
Playground, Shopping Complex, Place for worship etc.

f. Each family to be treated as a unit for the purpose of rehabilitation grant and distribution of site and number of families is limited to 736 including landless persons and encroachers.

g. Rehabilitation Grant

As per standard rehabilitation package to be approved by the Government in due course.

2. Sanction is accorded:

    1) to release the amount of Rs.4.65 crores (Rupees Four Crores Sixty Five Lakhs only) as and when required for rehabilitating 736 families of 16 villages.
    2) For acquisition of lands (861.29 Acres) pertaining to the Bhadra Wildlife Sanctuary:
    3) For grant of lands at an upset price of Rs.1000.00 (Rupees One Thousand Only)

3. The Forest Ecology and Environment Department to obtain a written consent of Government of India about the acquisition cost of Rs. 13.00 crores (Rupees Thirteen Crores Only):

4. This order issues with the concurrence of the Finance Department vide its note No.FD/140/Exp/VH/2001 Dated 7.2.2001.

BY ORDER AND IN THE NAME OF THE GOVERNMENT OF KARNATAKA

(K.S.JAIPRAKASH REDDY)
Deputy Seceratary to Government
(Revenue Department(Rehabilitation and Coordination)

10. REFERENCES

1. Shekar Singh, Ashish Kothari et al., ***Directory of National Parks and Wildlife Sanctuaries of Karnataka***. Published by Indian Institute of Public Administration, New Delhi.

2. G.N.Srikantaiah, I.F.S, (DCF, Chikmagalur Division), Dr.S.Subramanya, I.A.S, (Deputy Commissioner, Chikmagalur District), ***Bhadra Wildlife Sanctuary, Acquisition, Rehabilitation and Resettlement Project.*** Government of Karnataka, February 1992.

3. Karanth, Ullas K (1982): ***Bhadra Wildlife Sanctuary and its endangered ecosystem***, Journal of Bombay Natural History Society, Vol.79(1), Pages 79 – 86.

4. The Hindu, Monday, October 5, 1998
5. The Hindu, Sunday, February 25, 2001
6. Deccan Herald, Monday, April 2, 2001
7. Deccan Herald, Sunday, 1st July 2001

WETLAND BIO-DIVERSITY-CASE STUDY-

SULEKERE

(SHANTHISAGAR TANK)

CHANNAGIRI TALUK, DAVANAGERE DISTRICT

H.N. CHANDRASEKHARAIAH, M.F. RAHMAN AND S.L.RAGHAVAN

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WETLAND BIO-DIVERSITY-CASE STUDY-SULEKERE (SHANTHISAGAR TANK) CHANNAGIRI TALUK, DAVANAGERE DISTRICT

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WETLAND BIO-DIVERSITY-CASE STUDY-SULEKERE (SHANTHISAGAR TANK) CHANNAGIRI TALUK, DAVANAGERE DISTRICT

by

H.N. CHANDRASEKHARAIAH, M.F. RAHMAN AND S.L. RAGHAVAN
Society for Advancement of Aquaculture, Bangalore - 560018.

INTRODUCTION

Humans depend for their food, medicines and industrial products from bio-diversity in the wild as well as domesticated components. Conserving bio-diversity, be it terrestrial or aquatic, can provide safety net for human survival, allowing the option for future access to species and associated ecosystems necessary for sustaining life. Bio-diversity conservation is beyond the goals of traditional nature conservation and it also includes protection of nature from the adverse impacts of human activities with a challenge of meeting peoples needs from planned and sustainable utilisation of its components.

Karnataka has more than 44,000 man-made wetlands which are seasonal, long-seasonal and perennial, constructed over a period of time for multipurpose utilisation like irrigation, drinking water, washing, bathing, etc., These resources are important habitats for different kinds of aquatic flora and fauna. Majority of the wetlands in the State, oflate, are encroached upon, silted, weed infested as a result of which the water holding capacity is greatly reduced affecting the aquatic life. Entry of untreated effluents and domestic sewage has made certain tanks highly polluted which also has affected the quality of water and the aquatic life.

These resources used to harbour varities of indigenous fish life which was a source of nutritious food for the rural population, besides providing livelihood for the fishermen.

OBJECTIVES OF THE PROJECT

To assess the present status of quality of water, soil, flora and fauna, a case study of Sulekere (Shantisagar tank) in Channagiri taluk of Davanagere district was undertaken. The purpose of the study, in general, is to evolve strategies for the protection and development of such wetlands bio-diversity in the State.

The case study of the wetland Sulekere was undertaken by the Society for Advancement of Aquaculture, Bangalore - 560018 atthe instance of Prof. Madhav Gadgil, Project Co-ordinator, Centre for Ecological Sciences, Indian Institute of Science, Bangalore - 560012.

SULEKERE (SHANTISAGAR TANK)

Sulekere (Shantisagar tank) is one of the oldest and largest perennial tanks next only to Kambam tank of Andhra Pradesh. The tank was constructed by Princes Shantavva some 600 years age by creating a bund in between two hillocks across Hirehalla and Soppinahalla streams in Channagiri taluk, Davanagere district. The waterspread area of the tank is 2466 ha, maximum depth being 9 M with an average of 5 M. The longitudinal length of the tank is 16 km and has the circumference of 40 km. The catchment area of the tank is around 84,416 ha and it commands an irrigated area of 2876 ha. The annual rainfall in the region is about 646mm. The tank is situated at longitude 75°55' and latitude 14° 8' and is in semi-malnad area of the State. The length of the bund is 38 M.

Formerly, water level of the tank used to recede. Now, the Bhadra reservoir canal, located close-by, is connected to it, as much, it maintains, almost, constant water leverl throughout the year. The depth of the tank is said to have been reduced by about 1.0 to 1.2 M by way of siltation. The marginal areas of the tank, to an extent of 15% of the total waterspread, is encroached and is utilised for cultivation of agricultural crops. The tank, to an extent of 30% of the total waterspread area, is infested with different types of aquatic plants. There are no industries located in the catchment area of the tank. There is a Fishseed Production Farm of the Department of Fisheries, Government of Karnataka, located below the tank which has an area of 4.15 ha. Majority of the ponds in the farm are in dilapidated condition and are weed infested. Very few ponds, presently, are in use.

METHODOLOGY

Four sampling stations were fixed for conducting comprehensive observations on physico-chemical and biological features of water, soil, plankton, benthos, aquatic weeds and fishes.

Station - 1 : Near the bund
Station - 2 : Near Ittige village
Station - 3 : Near Somalapur village and
Station - 4 : Near Kerebilchi village

Samples of water, soil, plankton, benthos, aquatic weeds and fishes were collected from each station and were subjected to detailed physico-chemical and biological analysis.

The water samples, by employing standard methods, were analysed for temperature, turbidty, pH, dissolved oxygen, alkalinity, free ammonia, phosphate, nitrate and nitrite.

The productive potentially of the water was assessed by using light and dark bottles technique.

The soil samples were analysed for pH, organic carbon and total nitrogen.

For plankton, a total volume of 100 L of surface water was strained through a plankton net made of nylobolt silk cloth corresponding to 21XXX. The samples thus collected were preserved in 5% formalin and subjected to qualitative and quantitative analysis.

Samples of littoral biota were collected by operating `D' type net having a mouth opening of 0.44 M and towed for a length of 10 M and preserved in 5% formalin and analysed.

Different types of aquatic weeds observed in the tank were collected and identified.

Various types of fishing gears were operated and fish specimens collected were identified. Visited fish landing centres and fish markets for recording the catch composition and fish fauna as well.

The fishermen of the area and the citizens, as also officers of the Department of Fisheries were contacted to ascertain the past and the present status of the fishery of the tank.

OBSERVATION

The physico-chemical conditions of water and soil collected from four stations are presented in Table - 1.

Water:

The air temperature was found to range from 27.0 to 33.2°C and was higher than the water temperature. The water temperature was lower than the air temperature and ranged between 23.5 and 30.5°C. Lower values were recorded during July, 2001. The water was clear, odourless even during rainy season and turbidity was less than 100 mg/l. The water was alkaline in nature with pH ranging between 8.4 and 8.6.

Dissolved oxygen concentration varied from 5.5 to 7.4 mg/1 and was in optimum level. Total alkalinity was in moderate concentrations and ranged between 80 and 112 mg/l. Lower values recorded during July is on account of incursion of rain water. The water was free from pollution and free ammonia was absent in all the stations.

Phosphata was found in trace quantities as also nitrites. Nitrate was in low concentration and ranged from 0.142 to 0.146 mg/l.

The primary productivity values ranged between 322.8 and 348.4 mgC/m3/hr indicating the productive potential of the tank.

In general, the water was alkaline in nature with moderate hardness, optimum level of dissolved oxygen and low levels of nutrients and was free from any form of pollution.

Soil :

The soil is alkaline in nature with pH ranging from 8.0 to 8.2. Low organic carbon was recorded (0.08 to 0.12%) while total nitrogen content, exhibiting low concentrations, ranged from 0.06 to 0.08%.

Table – 1

Physico – chemical conditions of water and soil

Parameters	**Station – 1**	**Station – 2**	**Station – 3**	**Station – 4**
WATER :				
Air Temperature °C	27-27.5	27-27.5	27-27.5	27.0-33.2
Water Temperature °C	23.5-27.0	23.5-27.1	24.0-27.0	24.0-30.5
Colour	Colourless	Colourless	Colourless	Colourless
Odour	Odourless	Odourless	Odourless	Odourless
Turbidity-mg/1	Clear<100	Clear<100	Clear<100	Clear<100
Dissolved Oxygen-mg/1	6.0-7.2	5.75-7.2	5.5-6.8	6.5-7.4
pH	8.4-8.6	8.4-8.6	8.4-8.5	8.4-8.6
Total Alkalinity-mg/1	80.0-112.0	80.0-112.0	80.0-108.0	80.0-112.0
Free Ammonia-mg/1	Nil	Nil	Nil	Nil
Phosphate-mg/1	Tr.	Tr.	Tr.	Tr.
Nitrate-mg/1	0.146	0.142	0.146	0.144
Nitrite-mg/1	Tr	Tr	Tr	Tr
Primary Productivity				
-mg $C/m^3/hr.$	348.4-322.8			

Parameters	**Station - 1**	**Station - 2**	**Station - 3**	**Station – 4**
SOIL:				
pH	8.0-8.1	8.0-8.2	8.0-8.2	8.0-8.2
Organic Carbon %	0.09-0.12	0.09-0.14	0.08-0.12	0.08-0.12
Total Nitrogen %	0.06-0.08	0.06-0.08	0.06-0.08	0.06-0.08

Plankton :

The qualitative and quantitative planktonic groups are presented in Table - 2. in general, plankton density was moderate. It was found to range from 1 - 42 u/l. Zooplankton dominated over phytoplankton when total planktonic forms were taken into account. Qualitatively, planktonic species were in poor representations in all the stations.

Among Phytoplankton, Myxophyceae was represented by *Oscillatoria*, Chlorophyceae by *Eudorina, Mougeotia, Pediastrum, Ulothrix* and *Clowterium* and Bacillariophyceae by *Fragillaria* and *Synedra*.

Among Zooplankton, Protozoa was represented by *Arcilla* and *Difflugia*, Copepoda by Cyclops and *Nauplius*, Rotifers by *Filinia* and *Keratella*, Cladocera, incidentally the largest group, by *Ceriodaphnia, Diaphnosoma, Daphnia, Simocephalus* and Ostracoda by *Cypris*.

Table - 2

Qualitative and Quantitative Composition of Planktonic Groups

Groups/Family/Species	**Station -1**	**Station -2**	**Station -3**	**Station -4**
PHYTOPLANKTON:				
MYXOPHYCEAE:				
Oscillatoria	--	01	01	--
CHLOROPHYCEAE:				
Eudorina	10	04	17	02
Mougeotia	01	--	01	--
Pediastrum	02	01	03	02
Ulothrix	05	--	03	--
Closterium	02	--	02	--
BACILLARIOPHYCEAE:				
Fragillaria	02	07	11	03
Synedra	02	17	25	06

Groups/Family/Species	Station -1	Station -2	Station -3	Station –4
ZOOPLANKTON:				
PROTOZOA				
Arcella	05	07	12	03
Diffugia	02	--	03	--
COPEPODA:				
Cyclops	20	42	02	05
Nauplius	01	09	04	01
ROTIFERS:				
Filinia	01	01	--	--
Keratella	02	02	12	01
CLADOCERA:				
Ceriodaphnia	02	--	02	--
Diaphnosoma	01	02	--	--
Daphnia	01	20	01	--
Simocephalus	01	--	01	--
OSTRACODA:				
Cypris	03	--	--	02

Littoral fauna :

Organisms listed in Table -3, occurred variously in the shallow areas of the tank in different stations were sampling was done. The rich aquatic vegetation offers favourable conditions for their shelter and multiplication.

Nine species of insects belonging to seven families coming under four Orders; molluscs, where gastropods dominated over bivalves, had nine forms belonging to six families under four Orders, fishes, eight species belonging to five families and two Orders and crustanceans, two species belonging to one family and an Order were recorded from the

tank. Incidentally, the rich molluscan fauna could be utilised as food by the non-predatory catfish - *pangasius pangasius.*

The tank presented optimum level of various biotic components for sustaining fish life in the tank.

Table - 3

Littoral fauna constituents of Sulekere Tank

Insect :			
	Order	:	Ephemeroptera
	Family	:	BAETIDAE
		1.	*Caenis* spp.
		2.	*Cloeon* spp.
	Order	:	Odonata
	Suborder	:	Anisoptera
	Family	:	COENAGRIONIDAE
		3.	*Enallagma* spp.
	Order	:	Hemiptera
	Family	:	PLEIDAE
		4.	*Plea* spp.
	Family	:	NEPIDAE
		5.	*Hydrometra elongata* Fabricius
	Family	:	BELOSTOMATIDAE
		6.	*Diplonychus annulatum* Fabricius
	Order	:	Coleoptera
	Family	:	DYTISCIDAE
		7.	*Dytiscus limbatus* Fabricius
		8.	*Cybister* larvae
	Family	:	HYDROPHILIDAE
		9.	*Berosus indicus* Mets.
Molluscs:			
	Class	:	Gastropoda
	Subclass	:	Prosobranchia
	Family	:	VIVIPARIDAE
	Subfamily	:	Bellamyinae
	Genus	:	*Bellamya* Jousseaune
		1.	*Bellamya bengalensis* (Lamarck)
		2.	*Bellamya heliciformis* (Mueller)

	Family	:	THIARIDAE
	Subfamily	:	*Thiarinae* s.str.
	Genus	:	*Thiara* Roeding
	Subgenus	:	*Thiara* s.str.
		3.	*Thiara (Thiara) scabra* Mueller
	Subgenus	:	*Melanoides* Olivier
		4.	*Thiara (Melanoides) tuberculata* (Mueller)
	Subclause	:	Pulmonata
	Order	:	Basommatophora
	Family	:	LYMNAEIDAE
	Genus	:	*Lymnaea* Lamarck
	Subgenus	:	**Pseudocuccinea**
		5.	*Lymnaea luteola* Lamarck
	Family	:	PLANORBIDAE
	Subfamily	:	Planorbinae s.str.
	Genus	:	**Gyraulus Charpentier**
		6.	*Gyraulus convexiusculus* (Hutton)
	Class	:	Bivalvia
	Subclass	:	Paleoheterodonta
	Order	:	Unionoida
	Family	:	UNIONIDAE
	Subfamily	:	Unioninae
	Genus	:	*Lamellidens* Simpson
		7.	*Lamellidens corianus* Lea
		8.	*Lamellidens marginalis* (Lamarck)
	Subclause	:	Heterodonta
	Order	:	Veneroida
	Family	:	CORBIDULIDAE
	Genus	:	*Corbicula* Megerle von Muehlfeld
		9.	*Corbicula striatus* Deshayes
Fish:			
	Order	:	Cypriniformes
	Family	:	CYPRINIDAE
	Subfamily	:	Danioninae (Rasborinae)

	Genus	:	*Rasbora* Bleeker
		1.	*Rasbora daniconius* (Hamilton - Buchanan)
	Order	:	Cyprinodontiformes
	Family	:	APLOCHEILIDAE
	Subfamily	:	Aplocheilinae

	Genus	:	*Aplocheilus* McClelland
		2.	*Aplocheilus lineatus* (Valenciennes)
	Family	:	POECILIDAE
	Subfamily	:	Poecilinae
	Genus	:	*Poecilia* Bloch & Schneider
		3.	*Poecilia (Lebistes) reticulata* (Peters)
	Order	:	Perciforms
	Suborder	:	Percoidei
	Family	:	CHANDIDAE (=AMBASSIDAE)
	Genus	:	*Chanda* Hamilton - Buchanan
		4.	*Chanda nama* Hamilton - Buchanan
	Genus	:	Parambassis Bleeker
		5.	*Parambassis ranga* (Hamilton - Buchanan)
	Suborder	:	Labroidei
	Family	:	CICHLIDAE
	Genus	:	*Etroplus* Cuvier
		6.	*Etroplus maculatus* (Bloch)
	Genus	:	Oreochromis Gunther
		7.	*Oreochromis mossambica* (Peters)
	Suborder	:	Gobioidei
	Family	:	GOBIIDAE
	Subfamily	:	Gobiinae
	Genus	:	*Glossogobius* Gill
		8.	*Glossogobius giuris giuris* (Hamilton - Buchanan)
Crustacea:			
	Class	:	Crustacea
	Subclass	:	Malacostraca
	ORder	:	Decapoda
	Family	:	PALAEMONIDAE
		1.	*Macrobrachium* spp.
		2.	*Caridina* spp.

Table - 4

Occurrence of Littoral Organisms in different stations of the Tank

Fauna	**Station -1**	**Station -2**	**Station -3**	**Station -4**
	Dam site	**Ittige**	**Somalpur**	**Kerebilchi**

Insects:				
Caenis spp.	--	P	P	--
Cloeon spp.	--	P	P	P
Enallagma spp.	P	P	P	--
Plea spp.	--	P	--	P
Hydrometra elongata	--	P	P	P
Diplonychus annulatum	--	P	P	P
Dytiscus limbatus	--	P	P	P
Fauna	**Station -1**	**Station -2**	**Station -3**	**Station -4**
	Dam site	**Ittige**	**Somalpur**	**Kerebilchi**
Molluscs:				
Bellamya bengalensis	--	P	P	P
Bellamya heliciformis	--	P	P	--
Thiara (Thiara scabra	--	P	P	P
Thiara (Melanoides) tuberculata	--	P	P	P
Lymnaea luteola	--	P	P	P
Gyraulus convexiusculus	--	P	P	P
Lamellidens corianus	--	P	P	P
Lamellidens marginalis	--	P	P	--
Corbicula stria tella	--	P	P	--
Fish:				
Rasbora daniconius	--	P	P	P
Aplocheilus lineatus	P	P	P	P
Poecilia (Lebistes) reticulata	--	P	P	P
Chanda nama	--	P	P	P
Parambassis ranga	--	P	P	P
Etroplus maculatus	--	P	P	P
Oreochromis mossmbica	P	P	P	P
Glossogobius giuris giuris	--	--	--	P
Crustacea:				
Macrobrachium spp.	P	P	P	P
Caridina spp.	--	P	P	P

Macro-Vegetation :

Barring the dam/bund zone, the aquatic vegetation was quite rich in the other stations Ten (10) species belonging to six (6) families were recorded from the tank (Table - 5). Some of the aquatic weeds like *Vallisneria, Hydrilla, Aponogeton* and *Potamogeton* could be profitably utilised as food component by introducing the indigenous and exotic herbivorous fish species like *Puntius pulchellus* and *Ctenopharyngodon idella* respectively.

Table - 5

	Family	:	GENTIANACEAE
	Genus	:	**Limnanthemum**
		1.	*Limnanthemum indicum* Thwaites
	Family	:	CONVOLVULACEAE
	Genus	:	**Ipomoea**
		2.	*Ipomoea aquatica* Forsk.
	Family	:	HYDROCHARITACEAE
	Genus	:	**Hydrilla**
		3.	*Hydrilla verticillata* Casp.
	Genus	:	**Vallisneria**
		4.	*Vallisneria spiralis* Linn.
	Family	:	NAIADACEAE
	Genus	:	**Aponogeton**
		5.	*Aponogeton monostrachyon* Linn.
		6.	*Aponogeton crispum* Thumb.
	Genus	:	**Potamogeton**
		7.	*Potamogeton crispus* Linn.
	Family	:	CYPERACEAE
	Genus	:	**Cyperus**
		8.	*Cyperus distans* Linn.
	Genus	:	**Eleocharis**
		9.	*Eleocharis plantaginea* R.Br.
	Family	:	CHARACEAE
	Genus	:	**Chara**
		10.	*Chara brachypus* Braun.

Fishes :

During the period of study, twenty five species of fishes belonging to eleven families and six Orders were recorded. Apart from the Indian major carp - *Catla catla, Labeo rohita* and the cichlid - *Oreochromis mossambica*, rest of the species are indigenous to the system. By weight, *Cyprinus carpio* dominates in the fish catch of the tank followed by *L. rohita, Puntius* spp., *Cirrhinus* spp., *Mystus* spp., *O.mossambica*, and Murrels. Reports indicate that the rich indigenous fish fauna of the tank is greatly reduced; hence measures should be taken to restore the earlier situation so as to maintain `bio-diversity of the fish genetic resources' ofthe tank in its enterity. Systematic list of the fishes observed in the tank is presented in Table - 6.

Table - 6

Systematic list of the fish fauna of Sulekere Tank			
	Super Class	:	Gnathostomata
	Class	:	Actinopterygii
	Subclass	:	Neopterygii
	Division	:	Teleostei
	Sub-Division	:	Osteoglossomorpha
	Order	:	Osteglossiformes
	Suborder	:	Notopteroidei
	Family	:	NOTOPTERIDAE
	Genus	:	*Notopterus* Lacepede
		1.	*Notopterus notopterus* (Pallas)
	Sub-division	:	Euteleostei
	Super order	:	Ostariophysi
	Order	:	Cypriniformes
	Family	:	CYPRINIDAE
	Subfamily	:	Danioninae (=Rasborinae)
	Tribe	:	Oxygasterini
	Genus	:	*Salmostoma* Swainson
		2.	*Salmostoma clupeoides* (Bloch)
	Tribe	:	Danionini
	Genus	:	*Rasbora* Bleeker
		3.	*Rasbora daniconius* (Hamilton - Buchanan)
	Subfamily	:	Cyprininae

	Tribe	:	Cyprinini
	Subtribe	:	Cyprini
	Genus	:	*Cyprinus* Linnaeus
		4.	*Cyprinus carpio* var *communis* Linnaeus
		5.	*Cyprinus carpio* var *specularis* Lacepede
	Tribe	:	Systomini
	Subtribe	:	Systomi
	Genus	:	*Puntius* Hamilton - Buchanan
		6.	*Puntius chola* (Hamilton - Buchanan)
		7.	*Puntius sarana sarana* (Hamilton – Buchanan)
		8.	*Puntius sophore* (Hamilton - Buchanan)
		9.	*Puntius ticto* (Hamilton - Buchanan)
	Tribe	:	Labeonini
	Subtribe	:	Labeones
	Genus	:	*Cirrhinus* Oken
		10.	*Cirrhinus reba* (Hamilton - Buchanan)
	Genus	:	*Catla* Valenciennes
		11.	*Catla catla* (Hamilton - Buchanan)
	Genus	:	*Labeo* Cuvier
		12.	*Labeo* rohita (Hamilton - Buchanan)
	Order	:	Siluliformes
	Family	:	BAGRIDAE
	Subfamily	:	Bagrinae
	Genus	:	*Mystus* Scopoli
		13.	*Mystus cavasius* (Hamilton - Buchanan)
	Family	:	CLARIDAE
	Genus	:	*Clarias* Scopoli
		14.	*Clarias batrachus* (Linnaeus)

	Superorder	:	Acanthopterygii
	Series	:	Atherinomorpha
	Order	:	Cyprinodontiformes
	Family	:	APLOCHEILIDAE
	Subfamily	:	Aplocheilinae
	Genus	:	*Aplocheilus* McClelland
		15.	*Aplocheilus lineatus* (Valenciennes)
	Family	:	POECILIDAE
	Subfamily	:	Poecilinae
	Genus	:	*Poecilia* Block & Schneider

		16.	*Poecilia (Lebistes) reticulara* (Peters)
	Order	:	Synbrachiformes
	Suborder	:	Mastacembelodei
	Family	:	MASTACEMBELIDAE
	Subfamily	:	Mastacembelinae
	Genus	:	*Mastacembelus* Scopoli
		17.	*Mastacembelus armatus* (Lacepede)
	Order	:	Perciformes
	Suborder	:	Percoidei
	Family	:	CHANDIDAE (=AMBASSIDAE)
	Genus	:	*Chanda* Hamilton - Buchanan
		18.	*Chanda nama* Hamilton - Buchanan
	Genus	:	Parambassis Bleeker
		19.	Parambassis ranga (Hamilton - Buchanan)
	Suborder	:	Labroidei
	Family	:	CICHLIDAE
	Genus	:	*Etroplus* Cuvier
		20.	*Etroplus maculatus* (Bloch)

	Genus	:	*Oreochromis* Gunther
		21.	*Oreochromis mossambica* (Peters)
	Suborder	:	Gobioidei
	Family	:	GOBIIDAE
	Subfamily	:	Gobinae
	Genus	:	*Glossogobius* Gill
		22.	**Glossogobius giuris giuris**
			(Hamilton - Buchanan)
	Suborder	:	Channoidei
	Family	:	CHANNIDAE
	Genus	:	*Channa* Scopoli
		23.	*Channa marulius* (Hamilton - Buchanan)
		24.	*Channa orientalis* Bloch & Schneider
		25.	*Channa striatus* (Bloch)

Fish species which are no more available in the tank

Few decades back, before undertaking the introduction of fast-growing Indian major carp, *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*, fish species indigenous to the tank were dominating. Butm presently, the composition of indigenous fish is very much reduced and even the introduced carp, except *L.rohita* and stray cases of *C.catla, C.migala* is not being recorded at all. The fish species indigenous to the waterbody which were once contributing considerably to the fishery of the tank were *Tor khudree, Puntius pulchellus, Labeo fimbriatus, Gonoproktopterus kolus, Ompok, bimaculatus* and *Wallago attu*. These species are no more available in the tank. In addition, the population of Murrels-*Channa marulius, C.striatus* and *C.orientalis* has also come down considerably. The accidental entry of exotic Tilapia - *Oreochromis mossambica* appears to be taking a dominating role in the fishery of the tank; hence efforts are to be made to eliminate the species to the extent possible from this tank to maintain biodiversity of the fish species indigenous to the tank.

The fishermen of the area prefers introduction of the gangetic carps annually and, here, the Department of Fisheries has to shoulder the responsibility.

Table - 7

Fish species which are no more available in the tank

	Order	:	Cypriniformes
	Family	:	CYPRINIDAE
	Subfamily	:	Cyprininae
	Tribe	:	Cyprinini
	Subtribe	:	Cypini
	Genus	:	**Tor Gray**
		1.	*Tor khudree* (Sykes)
	Genus	:	*Puntius* Hamilton - Buchanan
		2.	*Puntius pulchellus* (Day)
	Genus	:	*Gonoproktopterus* Bleeker
		3.	*Gonoproktopterus kolus* (Sykes)
	Genus	:	*Labeo* Cuvier
		4.	*Labeo fimbriatus* (Bloch)
	Order	:	Siluriformes
	Family	:	SILURIDAE
	Genus	:	*Ompok* Lacepede
		5.	*Ompok bimaculatus* (Bloch)
	Genus	:	*Wallago* Bleeker
		6.	*Wallago attu* (Schneider)

PRESENT STATUS OF SULEKERE

The fishery of the tank is managed by the Department of Fisheries and is organising stocking of fast growing species of fishes annually and is also issuing licences for the exploitation of fishery. There are about 400 fishermen actively engaged in fishing throughout the year. They operate castnets, gillnets, prawn nets, long-lines, rod and line for fishing. Though the Department of Fisheries issues fishing permits for using gillnets with mest size of 2.5 inches and above only, the fishermen seldom practice these conditions.

The Department of Fisheries, in order to augment fish production, is stocking the tank with fast-growing gangetic carps. The number of fish seed stocked in the tank for the last five years is as in Table - 8.

Table - 8

Fish seed introduced in the Sulekere

Period	Number stocked (in lakhs)				Total
	Rohu	Catla	Mrigal	Common carp	
1996-97	17.48	1.00	7.68	3.60	29.68
1997-98	22.89			7.05	29.94
1998-99	7.73	2.00	--	12.90	22.83
1999-2000	6.50	0.50	0.8	5.85	13.65
2000-2001	11.72	--	--	3.40	15.12
Total	66.32	3.50	8.48	32.80	111.12

The statement indicates that the fish seed stocked in the tank is 111.12 lakhs spread over five years. Out of this, 66.32 lakhs is Rohu and 32.80 lakhs common carp. The quantity of Catla and Mrigal introduced into the tank is very low. It is reported that Catla, Rohu and Common carp records good growth.

Table - 9, denotes the number of licences issued to the fishermen and the revenue realised for the period from 1996-97 to 2000-2001.

Table – 9

Licences issued and the realised

Period	No.of licences issued	Revenue realised
1996-97	201	73300.00
1997-98	276	108620.00
1998-99	418	187600.00
1999-2000	347	185500.00
2000-2001	255	164200.00

Licences issued include fishing with castnets, gillnets, (2.5 in. mesh size and above), long-lines and rod and line. The fishing permit holders also operate small-meshed gillnets, castnets and prawn nets. Gillnet fishing is conducted by a fishing unit (2 fishermen) with the help of a coracle and required nets. Licences are issued to the fishermen for fishing all through the year and no `close-season' is being observed by the parties.

The present fish production is estimated to be 140 M. tonnes valued at Rs. 35.00 lakhs @ Rs. 25/- per kg. The fishermen land their fish catches at Ittige, Somalapura, Kerebilchi, Kagathur, Basavarajapura and Dam-site. The average fish catch per day ranges from 150 - 400 kg, the peak fish production is being during the monsoon months. The indigenous fish fauna account to 20% only. The average annual fish catch for a fishing unit works-out to about 3.5 M. tonnes. The fish harvested, to an extent of 20% is sold locally and rest is supplied to fish merchants which they normally market at Davanagere, Harihar, Channagiri, Santhebennur, etc., The fish is transported in baskets / gunny bags without ice. The fisher women are generally engaged in the marketing of fish locally. The approximate composition of fish harvested presently is as follows:

Rohu	:	30%
Common carp	:	40%
Murrels	:	05%
Catfishes	:	05%
Tilapia	:	10%
Others	:	10%

The selling price of fish depends, generally, on the quantity of fish landed, size, weight and the species. Normally, carp, murrels, and catfishes fetch about Rs. 25/- to 30/- per kg at the spot. Thus, a fishing unit earns Rs. 87,500/- to Rs. 1,05,000/- annually. The fishermen are able to earn substantially compared with the average per capita income in the State.

INLAND FISHERMEN COOPERATIVE SOCIETY

There are 14 fishing villages in and around the tank with 5000 fishermen population of which, 80 from Ittige, 250 from Somalapura, 40 from Kerebilchi and 30 from Basavarajapura are actively engaged in the fishing profession.

There is one Fishermen Cooperative Society functioning in Sulekere area which has a membership of 2500. They have a share capital of Rs. 37,875/- (Rs.7,000/- from the Government and Rs.30,875/- from the members). Formerly, the Society used to provide fishery requisites to its members. Presently, the Society is interested to avail the National Welfare Housing Scheme to its members. In all, 148 houses under this scheme have been constructed for the members of the Society. (48 houses in Somalapura and 100 houses in Basavarajapura). These houses are constructed and provided to the fishermen free of cost of Rs. 30,000/- each.

The society is not involved in the development of fisheries in the tank or in the processing and marketing of the fish harvested. The members of the Society belongs to Ganga matha, Bestha, Scs, Sts., Kumbara, and Muslim communities.

It was reported that the children of the fishermen of the area are studying in Schools and Colleges and the educated, for want to employment opportunities elsewhere, are actively engaged in the fishing activities. The fishermen also own cattle, sheep, poultry etc., to augment additional income.

The locally available target fish species have reduced in their population and efforts, hence, are to be made to restore the earlier position. The aquatic weeds are predominantly present in the shallower areas of the tank. The weeds in the tank, presently, are not posing any problem in the normal fishing activity.

According to knowledgeable sources over the last 10 years, species like *Puntius pulchellus.*
Gonoproktopterus kolus, Labeo fimbriatus, Ompok bimaculatus, Wallago attu and *Tor khudree* present in large numbers and contributing towards considerable fishery of the tank, have disappeared and are no more recorded. Fish species like *Puntius sophore, P.ticto, Danio aequipinnatus, Salmostoma* spp., *Channa marulius, C.striatus, C.orientalis, Clarias batrachus* and *Mastacembelus armatus* are said to have decreased in their population.

As stated earlier, the indigenous fish fauna has drastically reduced. The income of fishermen, however, has not come down on account of the stocking of carps and increased fish production. However, following reasons could be assigned for the elimination of certain endemic fish species and in the reduction of others.

1. Indiscriminate fishing :

Though the fishermen are expected to operate nets of 2.5 inches mesh size and above only, the operation of small-meshed nets throughout the year has resulted in the decline of endemic fish species.

2. Non-observance of `closed-season' :

The breeding season of majority of fish species coincides with the onset of monsoon. During this season, fishes are caught in large scale. The fishes are not allowed to breed resulting in the depletion of their stock.

3. Stocking of Common carp :

Department of Fisheries is organising stocking of fast-growing fish species every year in the tank to augment fish production. From the statement of stocking carried out in the

tank, it may be made out that common carp has been introduced in large quantities followed by Rohu. Common carp, being an omnivore, also has the habit of browsing in the shallower regions of the tank damaging the eggs released by the indigenous fish. This has affected the indigenous fish fauna in the tank to a great extent. This species attains early maturity and breed thoughout the year; thus its population increases and compete for food and space.

4. Inadvertent introduction of Tilapia:

The inadvertent introduction of T.ilapia has also affected the endemic fish species as they are prolific breeders and are omnivorous. They also compete for food and space.

The fish production has increased on account of stocking of fast-growing gangetic carp and the exotic common carp. The catches of the fishermen have also increased although, as reported, there is marked decrease in the indigenous fish fauna.

Because of the large scale fish landings during monsoon, price per kg of fish, comparatively, is less. During other seasons, the fish fetch a higher price. The prices now prevailing are higher compared with the ones what they used to get in the past. The consumer, in general, prefers, murrels, catfishes major carps and common carp.

Fishermen or local citizens of the area not concerned about the conservation of the targetted fish species. They are interested only in increasing the stocking density of the cultivable species of fishes so as to enable them to have good catches and to increase their earnings. If systematic development of the fishery by stocking compatible species of proper size, number and composition is undertaken, the production of fish proportionately increases; when fish landing is in large scale, then the need arises to preserve the produce either in cold storage or by using ice. Therefore, it is suggested that an ice plant and cold storage of suitable capacity may be established to prevent spoilage of fish and to market the fish in good condition and at a higher price.

The fishermen are of the opinion that the management, conservation and exploitation strategy should be the responsibility of the Department of Fisheries as their Co-operative Society. Zilla Panchayat, Taluk Panchayats are not conversant with this type of

developmental programmes. The Department of Fisheries may also organise fish pooling centres in present fish landing places with proper facilities for hygeinic handling of fish.

The fishermen and the local people are of the opinion that the fish seed farm, which is in dilapidated condition, to be renovated and put to use for the purpose it was established and be provided with necessary man-power for its effective management.

There was no instance of mortality of fish encountered any time on account of flow of untreated effluents as there are no industries located close-by and the entry of domestic sewage into the tank is also not there. Use of pesticides for agricultural practices in the catchment area also has not affected the fishery in any form. No dynamiting or poisoning has ever been reported.

DISCUSSION

The Sulekere (Shantisagar tank) water, in general, in alkaline in nature with moderate hardness, optimum level of dissolved oxygen and low levels of nutrients and is unpolluted. The productive potentially is good as revealed by the primary productivity values. The plankton was moderate, both qualitatively and quantitatively. The benthic fauna was rich, with molluscs dominating followed by insects, fishes and crustaceans. The aquatic vegetation of desirable species were present in the medium. The indigenous fish faun diversity was also adequately represented.

According to the officials of the Department of Fisheries and the fishermen, it was indicated that the tank held quite a good number of fish species. During the period of study, 25 fish species were recorded. Information gathered indicates species like *Puntius pulchellus, Labeo fimbriatus, Gonoproktopterus kolus, Ompok bimaculatus, Wallago attu* and *Tor khudree* are no more available from the tank. It was also pointed that species like *Puntius sophore, C. orientalis, Clarias batrachus* and *Mastacembelus armatus* have drastically reduced in their population.

The tank fishery is managed by the Department of Fisheries. Annually fast-growing Indian major carp and exotic common carp are stocked for improving the fish productivity.

But only Rohu and Common carp are stocked in large numbers when compared with Mrigal and Catla. Exotic Tilapia-*Oreochromis mossambica* has established in the tank and they form a sizeable fishery. To rehabilitate the disappeared fish species, it is necessary to collect them from the sources available and breed them in captivity and stock them into the tank besides, collecting the young ones of these fishes and introduce them for their growth and perpetuation. In the interest of safe-guarding the fishes, it is essential for strict observance of mesh regulation and `close season'. The fishermen who mainly depend on fishing profession may be identified and be provided with sustenance allowance during the **`closed season'**. These efforts will result in enriching the indigenous fishery besides augmenting fish production.

Though the fishing licences are issued for conducting fishing by gillnets with 2.5 inches mesh-size and above, there is no strict supervision on the operation of fishing nets, as such, smaller meshed nets are operated throughout the year. There is no `close-season' for fishing being observed to protect catching the brood stock during the breeding season.

The fishermen, presently, are getting better catches and equally good price compared to earlier times, 20% of the fish harvested is being sold locally and the rest is handed over to fish merchants for marketing in urban areas.

Fishermen or the local populace are not concerned about the conservation of the fishery of the tank in general and indigenous fishes in particular.

If the tank is scientifically developed by stocking catla, rohu, mrigal, grass carp and pulchellus at the rate of 1000 fingerings of 70 - 100 mm per ha (total fish seed required for the tank is 24.66 lakhs), the fish production could be increased to 1450 M tonnes valued at Rs. 3.7 crores considering the average growth of fish as 1.0 Kg. per year with 60% survival. But the common carp and tilapia population should be reduced besides stopping stocking of common carp totally.

The Fishermen Cooperative Society, which is dormant at present, should be revived and it should undertake supply of fishery requisites and organise fish marketing and other allied activities beneficial to fishermen. When the fish production is likely to increase, it is necessary to provide preservation facilities by establishing ice-plants and cold storages. It

may be considered to organise a NGO with all concerned departmental officers, fishermen and public to manage the fishery of the tank.

STRATEGY FOR CONSERVATION OF INDIGENOUS FISH FAUNA AND TO AUGMENT FISH PRODUCTION

1. Indigenous fishes which are endemic to the area and which have reached a stage of rare, endangered and threatened, condition, may be initially collected and stocked into the tank for growth and perpetuation of their generation.

2. The National Bureau of Fish Genetic Resources, Lucknow (UP) may be entrusted with the responsibility of establishing **`gene bank'** of the economically important fish species like *Puntius pulchellus, Labee fimbriatus, L.calbasu, Gonoproktopterus kolus, Tor khudree*, etc. which will help in conserving the valuable fish genetic resources of the area.

Some of these fishes may be maintained at the fish farm located close-by after attending to the repairs of the ponds and to make them breed in captivity. Bhadra fish farm could also be utilised for the purpose and the progeny so obtained could be stocked into the Sulekere tank. Care should be taken to stock fingerlings between 70 and 100 mm in length for better survival. This shall be providing scope for the in-site conservation of the rate, endangered and threatened fish species.

3. In the interest of protecting the indigenous fish population, the stocking of common carp in to the tank should be stopped. Efforts may also be made to reduce their population by intensive exploitation.

4. Tilapia is also not a desirable fish which starts multiplying in its early age and compete for food and space with other fishes in the tank. Intensive exploitation fishes to thrive well.

5 Though the licences are issued for fishing with 2 1/2 in. mesh size and above in the gillnets, the fishermen are not strictly following this condition and they are operating smaller meshed nets and are exploiting juveniles and adults, thus preventing them from attaining appropriate size of maturity and breeding. Therefore strict measures should be imposed to protect the brood stock.

6. Majority of the fishes breed during monsoon. During this season, fishermen exploit fishery in large scale. This will prevent the fishes to breed and perpetuate their generation. In the interest of protecting the brood stock and to allow them to breed, fishing during monsoon months may be prohibited. The fishermen shall be deprived of their earnings during the **`closed season'**. To enable them to maintain their families, suitable sustanence allowance may be provided after identifying such persons who are exlusively depending on fishing.

7. Washing of pesticides containers and sprayers used for spraying pesticides should not be washed in the tank water.

8. The use of pesticides in agricultural practices in the catchment area of the tank may, in the long run, affect the fish stocks of the tank. Therefore, the agriculturists should be educated to use bio-fertilizers and bio-pesticides only. Proper literature in this regard in local languages may be prepared, printed and made available to agrocultural and others too.

9. No industries discharging harmful effluents into the tank should be established in the catchment area of the tank.

10. Compatible species of fishes may be stocked for augmenting fish production and to while the food available in different niches of the tank.

11. For effective utilisation and control of aquatic vegetatio in the tank, herbivorous fishes like indigenous *Puntius pulchellus* and the exotic Grass carp - *Ctenopharyngodon idella* may be introduced in adequate numbers.

12. If scientific methods are adopted in stocking, development of fisheries and exploitation, fish production may be increased to an extent of about 10 times from the present level.

13. Instead of depending on the supply of fish fingerlings from the fish farms, it may be considered to receive only the fry of different varieties of fishes and rear them in especially erected `pens' in the suitable shallover areas of the tank. The seed should be provided with supplementary feed and other required care while rearing and when they attains 70 to 100

mm in size, may be released into the tank. This will ensure proper stocking and give scope for better survival and growth.

14. To prevent soil erosion and siltation of the tank, suitable afforestation measures may be undertaken on the Government land. Even agriculturists may be encouraged to raise useful trees.

15. At present, the exploited fishery is landed at four places in the vicinity of the tank. They are not provided with any facility, pack, etc, for transportation to other places for marketing of the produce. Therefore, it may be considered to establish suitable fish landing-cum-packing sheds at these four with necessary equipments.

16. At contemplated, if fisheries development is undertaken, the fish production shall increase. This increased fish production should be properly preserved and marketed. Therefore, there is a need to establish a cold storage and an ice plant of appropriate capacity to take care of the situation.

17. The Fishermen Cooperative Society is neither in a sound financial position nor has the ability and expertise to manage the tank fisheries. The area of the tank is spread over and covers number of village panchayats. As such, it may be difficult for one panchayat to shoulder the responsibility. The Taluk Panchayats and Zilla Parishads may not give adequate attention on account of their logistics. Therefore, it may be considered to organise an autonomous Institution with representative from fishermen, village panchayats, taluk panchayats zilla parishats, local MLSa and officers of the Fisheris, Irrigation and Forest Department to manage the fisheries development, exploitation and marketing. This Institution should be provided with necessary powers to impose suitable measures (mesh regulation, observance of `close-season' etc.,) to conserve the fishery of the tank. The routine issue of licences permits for fishing may be discontinued and royalty system of fishing may be enforced to generate required funds for future development of the tank fishery, besides, providing scope for fishermen to improve their catches, receipts and economic condtions. The institution may be initially provided with adequate funds for this purpose.

18. Importance of conservation fishes and maintenance of bio-diversity should be made known to fisheren and general public. Suitable awareness literature in Kannada may be prepared and distributed in all the villges, schools, fishermen cooperative society etc.

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FISH SANCTUARY, RIVER CAUVERY-CASE STUDY

RAMANATHAPURA, ARKALGUD TALUK, HASSAN DISTRICT

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by

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INTRODUCTION

Karnataka, with vast riverine stretches of about 6000 kms, boasts of harbouring a rich and varied fish fauna. It is on record that there are around 200 fish species in these resources. Some of the riverine stretches near the temples are the abodes for certain protected fish species and are called`sanctuaries' and they are to be protected. Sanctuaries for the protection of fishes have been established from early times. Government of Karnataka has declared following fish congregation centres as fish sanctuaries.

Sl.	Name of the Sanctuaries	River	Taluk	District
1.	Ranganathittu	Cauvery	Srirangapatna	Mandya
2.	Ramanathapura	Cauvery	Arakalagudu	Hassan
3.	Shishila	Kumaradhara	Belthangadi	Dakshina Kannada

There are some more riverine stretches in the state where congegation of fishes are protected by religious and other institutions and they are :

Sl.	Name of the Sanctuaries	River	Taluk	District
1.	Sringeri	Tunga	Sringeri	Chikmagalore
2.	Jammatigi	Tunga	Koppal	Chikmagalore

3.	Chippalagudda	Tunga	Thirthahalli	Shimoga
4.	Bachanayakanahalli	Kumaradhara	Sulya	Dakshina Kannada
5.	Todkhana	Chandragiri	Sulya	Dakshina Kannada
6.	Payaswini	Payaswini	Sulya	Dakshina Kannada
7.	Thingale	Seethanadi	Karkala	Dakshina Kannada
8.	Nisargadhama	Cauvery	Kushalnagar	Coorg

A declining trend in fish species, population and size have been noticed over the past few decades in these sanctuaries. The reason attributed is to the fast changing `eco-systems' brought about by environmental alterations consequent to construction of several barrages, weirs, anicuts etc., along the riverine course and the establishment of various industries, factories, increased agricultural activities and human habitation.

In such a scenarios, these three sanctuaries serve as areas of safe habitation for fishes as these are protected zones under Wildlife Act of 1972. However, data on the existing fish species and their populations in the sanctuaries and their status are not available. No measures are adopted for the protection and propagation of endemic fish species, as also, ecological monitoring has received very little attention over the past few decades.

OBJECTIVES OF THE STUDY

To assess the present **`status'** of a fish sanctuary including its area, depth, physico-chemical conditions of water, soil, plankton, benthos, aquatic vegetation and fish fauna and to evolve strategies for the protection and development as also to safeguard the bio-diversity.

Ramanathapura Fish Sanctuary :

Ramanathapura fish sanctuary situated in river Cauvery near Rameshwara Temple in Ramanathapura, Arakalgudu taluk, Hassan District also known as Vanhi Pushkarani. It was declared as sanctuary as per G.O. No. G. 1627 / Ft. 296.35.2 of 11/17.06.1935 by the Government of Mysore under the provisions of Section 5 (1) of Mysore Game and Fish Preservation Regn. II of 1901 which states that fishing for one furlong on either side of the pond known as **`Vanhi Pushkarani'** in the Cauvery river by the side of the Rameshwara

temple at Ramanathapura, Arakalgud taluk be prohibited" The sanctuary lies between 12(degree)37' latitude and 76(degree)5' longitude.

According to legends, the fishes in the **`Vanhi Pushkarani'** are the incarnations of noble souls around Lord Shiva. It has been observed that the fishes sheltering in the area never gets dislocated inspite of heavy floods in the river. Once when Maharaja of Mysore visited this fish sanctuary, he was pleased to decorate some fishes with snout rings.

METHODOLOGY

Three stations, one at sanctuary proper and one each at 1 km above and below on either side of the sanctuary were fixed for comprehensive observations on physico-chemical and biological features of water, soil, plankton, benthos, aquatic weeds and fishes.

Station - 1 1 km upstream of the sanctuary.
Station - 2 Sanctuary
Station - 3 1 km downstream of the sanctuary.

Samples of water, soil, plankton, benthos, aquatic vegetation and fishes were collected from each station and were analysed for physico-chemical and biological parameters employing standard methods.

After recording the temperature, the water, samples were analysed for turbidity, pH, dissolved oxygen, alkalinity, free ammonia, phosphate, nitrate and nitrite.

Light and dark bottle technique was employed for assessing the primary productivity.

The soil samples were analysed for pH, organic carbon and total nitrogen.

For plankton, 100 litres of surface water was strained through a plankton net made of nylobolt silk cloth corresponding to 21XXX. The samples collected were preserved in 5% formalin and subjected to both qualitative and quantitative analysis.

`D' type of net having a mouth opening of 0.44 M was towed to a length of 10 M to collect littoral biota. The samples were preserved in 5% formalin and analysed.

Different types of aquatic weeds observed in the areas were collected and identified.

Fishing gears of different types were operated and fish specimens collected were identified. Visited fish markers also to record fish fauna from the riverine stretch sampled.

The fishermen of the locality, elder citizens of the area and Officers of the Department of Fisheries, were contacted to ascertain the past and present status of the fish sanctuary.

OBSERVATIONS

The river stretch in the area studied is rocky with some pools. One such pool by the side of the Rameshwara temple is **Vanhi Pushkarani**. The pool is about 1.00 ha in area with an average depth of 1.5 M. The pool is silted up to some extent and the stone steps from the temple to **Vanhi Pushkarani** is in dilapidated condition. Although this pool is devoid of aquatic vegetation, on either side of the pool in the river stretch and in the middle of the river, thick grassy patches were observed. It has been also noticed that vehicles are being washed near the sanctuary and is also used for washing and bathing.

A small sign board of the size 1.5 X 1.5 feet is fixed near the sanctuary indicating its existence.

Presently, the sanctuary has famous game-fish of India - Mahseer - Tor khudree and the Katli/Chocolate Mahseer-Neolissoclilus hexagonolepis. The latter species is observed to be in large numbers.

No organised feeding of fishes in the sanctuary is being done. Pilgrims and tourists, however, feed the fishes with groundnut, fried rice, biscuits, bread pieces etc. during festive seasons and on other days. There is no strict watch and ward by the Department of Fisheries or any other agencies (NGO's). The temple authorities said to be having vigil against poaching in sanctuary area. However, there are reports of dynamiting and poisoning in the sanctuary area during the lean season.

There is a fish nursery of the Department of Fisheries situated nearby the sanctuary, but is not in much use on account of leaky ponds.

Water :

The physico-chemical conditions of water and soil are presented in Table - 1.

Air temperature was found to range from 33.0 to 33.3°C. It was higher than the water temperature which was between 30.0 and 32.5°C. The water was clear, odourless and turbidity was less than 100 mg/l and it exhibited alkaline character with pH of 8.4. No variations in pH was noticed from different stations.

The dissolved oxygen ranged from 5.0 to 5.1 mg/l with no significant variations from different stations and was in moderate levels.

Total alkalinity at 104.0 mg/l was in moderate concentrations.

The water was free from pollution and free ammonia was absent in all the stations.

Nutrients like phosphates and nitrites were found in trace quantities while nitrate was in low concentration and found to range from 0.146 to 0.148 mg/l

The primary productivity value was recorded at 166.42 mgC/m3/hr indicating moderate productive potentially.

In general, the water was alkaline in nature with moderate hardness, satisfactory level of dissolved oxygen with low levels of nutrients and free from any pollution. Due to fluviatile conditions, no significant variations in the parameters from station to station could be observed.

The soil exhibited an alkaline character with pH of 8.1, low organic carbon content of 0.120 to 0.122% and total nitrogen of 0.06%.

Table - 1

Physico - Chemical conditions of water and soil

Parameters	**Station –1**	**Station -2**	**Station -3**
WATER:			
Air Temperature °C	33.0	33.3	33.0

Water Temperature °C	30.0	305	32.0
Colour	Colourless	Colourless	Colourless
Odour	Odourless	Odourless	Odourless
Turbidity -mg/1	Clear<100	Clear<100	Clear<100
Dissolved Oxygen - mg/l	5.0	5.1	5.0
PH	8.4	8.4	8.4
Total Alkalinity - mg/l	104.0	104	104.0
Free Ammonia - mg/l	Nil	Nil	Nil
Phosphate - mg/l	Tr.	Tr.	Tr.
Nitrate - mg/l	0.148	0.148	0.146
Nitrite - mg/l	Tr.	Tr.	Tr.
Primary Productivity			
mg $C/m^3/hr.$	166.42		

Parameters	**Station -1**	**Station -2**	**Station -3**
SOIL:			
PH	8.1	8.1	8.1
Organic Carbon %	0.122	0.120	0.122
Total Nitrogen %	0.06	0.06	0.06

PLANKTON :

Qualitative and quantitative planktonic groups are as in Table -2. Phytoplankton was found to dominate over zooplankton in all the stations where studies were conducted. Their

numbers ranged between 1 and 23 u / litre. Qualitatively, phytoplankton, was contributed by Myxo phyceae, Chlorophyceae and Bacillariophyceae.

Myxophyceae was represented by Oscillatoria and Spiruline, Chlorophyceae by Spirogyra, Ulothrix, Pediastrum, Closterium and Mougeotia. Synedra, Asterionella, Cyclotella and Fragillaria constituted Bacillariophyceae.

Zooplankton was constituted by Protozoa, Copepoda, Rotifera, Cladocera and Ostracoda. Their numbers ranged from 1 to 8 u /l.

Protozoa was represented by Difflugia. Copepoda by Cyclops and Diaptomus, Rotifera by Keratella and Diaphnosoma, Cladocera by Ceriodaphnia and Ostracoda by Cypris.

The miscellaneous group was represented by insect remains, vegetative parts and nematodes.

Table - 2

Qualitative and Quantitative composition of Planktonic groups				
Groups		**Station -1**	**Station -2**	**Station –3**
PHYTOPLANKTON			7	
MYXOPHYCEAE	**Oscillatoria**	2	1	11
	Spirulina	-		-
CHLOROPHYCEAE	Pediastrum	2	3	5
	Closterium	-	-	1
	Mougeotia	2	-	1
	Spirogyra	7	11	7
	Ulothrix	5	13	2

Groups		**Station -1**	**Station -2**	**Station -3**
BACILLARIOPHYCEAE				
	Synedra	11	17	23
	Asterionella	-	3	5
	Cyclotella	1	-	3
ZOOPLANKTON :				
PROTOZOA	Diffugia	2	1	2
COPEPODA	Diaptomus	3	2	1
	Cyclops	8		7
			1	
ROTIFERA	Keratella	3	1	5
	Diaphnosoma			1
			2	
CLADOCERA	Ceriodaphnia	2		1
OSTRACODA	Cypris	1		
			1	
MISCELLANEOUS	Insect remains	2	1	3
	Vegetative parts	2		2
	Nematodes	1		2

LITTORAL FAUNA :

The forms listed were from the shallow weed infested marginal riverine stretches. Their distribution, in the three stations sampled, were almost identical. Amongst Insects, five

species belonging to six Families coming under Four Orders; Molluscs - where Gastropods dominated over Bivalves, had nine species belonging to six Families under two Orders; Fishes - five species coming under four Families and three Orders and Crustacean - one species belonging to a Family and an Order were recorded. The riverine stretch where sampling was done, presented optimum occurrence of various benthic faunistic elements to sustain fish life.

INSECTS :			
	Order	:	Ephemeroptera
	Family	:	BAETIDAE
		1.	Cloeon spp.
	Order	:	Odonata
	Suborder	:	Anisoptera
	Family	:	LIBELLULIDAE
		2.	Urothemis signata (Rambur)
	Family	:	Coenagrionidae
		3.	Enallagma spp.
	Order	:	Hemiptera
	FAmily	:	NEPIDAE
		4.	Laccotrphes maculatus Fabricius
	Family	:	BELOSTOMATIDAE
		5.	Diplonychus annulatum Fabricius
	Order	:	Coleoptera
	Family	:	DYTISCIDAE
		6.	Dytiscus limbatus Fabricius

MOLLUSCS :			
	Class	:	Gastropoda
	Subclass	:	Prosobranchia
	Order	:	Mesogastropoda
	Family	:	VIVIPARIDAE
	Subfamily	:	Bellamyinae
	Genus	:	Bellamya Jousseaune
		1.	Bellamya bengalensis (Lamarck)
	Family	:	BITHYNIIDAE
	Subfamily	:	Bithyniinae S.str.
	Genus	:	Gabbia Tryon
		2.	Gabbia stenothyroides (Dohrn.)
	Family	:	THIARIDAE
	Subfamily	:	Thiarinae s.str.
	Genus	:	Thiara Roeding
	Subgenus	:	Thiara s.str.
		3.	Thiara (Thiara) scabra (Mueller)
	Subgenus	:	Melanoides Olivier
		4.	Thiara (Melanoides) tuberculata (Mueller)
	Subfamily	:	Melanatriinae
	Genus	:	Sulcospira Troschel
		5.	Sulcospira huegeli (Philipi)
	Subclass	:	Pulmonata
	Order	:	Basommatophora
	Family	:	LYMNAEIDAE
	Genus	:	Lymnaea Lamarck
		6.	Lymnaea acuminata Lamarck
		7.	Lymnaea luteola Lamarck

Family	:	PLANORBIDAE
Genus	:	Indoplanorbis Annadale & Prashad
	8.	Indoplanorbis exustus (Deshayes)
Class	:	Bivalvia
Subclass	:	Heterodonta
Order	:	Veneroida
Family	:	CORBICULIDAE
Genus	:	Corbicula Megerle von.Muehfeld
	9.	Corbicula striatella Deshayes

Fishes:			
	Order	:	Cypriniformes
	Family	:	CYPRINIDAE
	Subfamily	:	Danioninae (=Rasborinae)
	Tribe	:	Danionini
	Genus	:	Rasbora Bleeker
		1.	Rasbora caveruu (Jerdon)
	Subfamily	:	Cyprininae
	Tribe	:	Systomini
	Subtribe	:	Systomi
	Genus	:	Puntius Hamilton - Buchanan
		2.	Puntius ticto (Hamilton - Buchanan)
	Order	:	Cyprinodontiformes
	Family	:	APLOCHEILIDAE
	Subfamily	:	Aplocheilinae

	Genus	:	Aplocheilus McClelland
		3.	Apolcheilus lineatus (Valenciennes)
	Family	:	POECILIDAE
	Subfamily	:	Poecilinae
	Genus	:	Gambusia Poey
		4.	Gambusia affinis (Baird & Girard)
	Order	:	Perciformes
	Suborder	:	Percoidei
	Family	:	CHANDIDAE (=AMBASSIDAE)
	Genus	:	Parambassis Bleeker
		5.	Parambassis ranga (Hamilton - Buchanan)
Crustacean:			
	Class	:	Crustacea
	Subclass	:	Malacostraca
	Order	:	Decapoda
	Family	:	PALAEMINIDAE
		1.	Macrobrachium spp.

AQUATIC WEEDS :

The aquatic weeds - Hydrilla verticillata, Potamogeton pectinatus and Chara spp., along with terrestrial grassy vegetation (the latter in the exposed marginal areas of the riverine stretch) were found well distributed in the stations where hydrobiological collections were made. Following is the systematic list of weeds observed.

Family	:	HYDROCHARITACEAE
Genus	:	Hydrilla
	1.	Hydrilla verticillata Casp.
Family	:	NAIADACEAE
Genus	:	Potamogeton
	2.	Potamogeton pectinatus Linn.
Family	:	CHARACEAE
	3.	Chara spp.

The occurrence of particularly Hydrilla spp. and Potamogeton spp. warrants introduction of indigenous herbivorous carp - Puntius pulchellus and the exotic Grass carp – Ctenopharyngodon idella. All the weeds harbour various types of aquatic insects and molluscan fauna which forms the food of many species of fishes.

FISH FAUNA :

Twenty seven fish species belonging to eleven Families and six Orders were collected from the riverine stretch where hydrobiological and fisheries investigations were carried-out. The list, in additiona to the economically important fishes, also recorded the occurrence of the medium and minor carps, weed fishes, catfishes and murrels. Though the distribution of fish species was almost identical, however, carps and weed fishes were the dominant ones by numbers.

Super Class	:	Gnathostomata
Class	:	Actinopterygii
Subclass	:	Neopterygii
Division	:	Teleostei
Subdivision	:	Osteoglossomorpha
Order	:	Osteoglossiformes
Suborder	:	Notopteroide
Family	:	NOTOPTERIDAE
Genus	:	Notopterus Lacepede
	1.	Notopterus notopterus (Pallas)
Subdivision	:	Euteleostei
Superorder	:	Ostariophysi
Order	:	Cypriniformes
Family	:	CYPRINIDAE
Subfamily	:	Danioninae (=Rasborinae)
Tribe	:	Oxygasterini
Genus	:	Salmostoma Swainson
	2.	Salmostoma acinaces (Valenciennes)
Tribe	:	Danioni
Genus	:	Danio Hamilton - Buchanan
	3.	Danio aequipinnatus (McClelland)
Genus	:	Rasbora Bleeker
	4.	Rasbora caverii (Jerdon)
Subfamily	:	Cypininae

Tribe	:	Cypinini
Suybtribe	:	Cypini
Genus	:	Cyprinus Linnaeus
	5.	Cyprinus carpio var communis (Linnaeus)
Subtribe	:	Tores
Genus	:	Tor Gray
	6.	Tor khudree (Sykes)
Genus	:	Neolissochilus Rainboth
	7.	Neolissochilus hexagonolepis (McClelland)
Tribe	:	Systomini
Subtribe	:	Systomi
Genus	:	Puntius Hamilton - Buchanan
	8.	Puntius carnaticus (Jerdon)
	9.	Puntius chola (Hamilton - Buchanan)
	10.	Puntius sophore (Hamilton - Buchanan)
	11.	Puntius ticto (Hamilton - Buchanan)

Tribe	:	Labeonini
Subtribe	:	Labeones
Genus	:	Labeo Cuvier
	12.	Labeo calbasu (Hamilton - Buchanan)
	13.	Labeo rohita (Hamilton - Buchanan)
Subfamily	:	Garrinae
Genus	:	Garra (Hamilton - Buchanan)
	14.	Garra gotyla stenorhynchus (Jerdon)
Order	:	Siluriformes
Family	:	BAGRIDAE
Subfmily	:	Bagrinae
Genus	:	Mystus Scopoli
	15.	Mystus cavasius (Hamilton - Buchanan)
	16.	Mystus montanus (Jerdon)
Family	:	SILURIDAE
Genus	:	Ompok Lacepede
	17.	Ompok bimaculatus (Bloch)
Genus	:	Wallago Bleeker
	18.	Wallago attu (Schneider)
Superorder	:	Acanthopterygii
Series	:	Atherinomorpha
Order	:	Cyprinodontiformes
Family	:	APLOCHEILIDAE
Subfamily	:	Aplocheilinae
Genus	:	Aplocheilus McClelland

	19.	Aplocheilus lineatus (Valenciennes)
Family	:	POECILIDAE
Subfamily	:	Poecilinae
Genus	:	Gambusia Poey
	20.	Gambusia affinis (Baird & Girard)
Order	:	Synbranchiformes
Suborder	:	Mastacembelidei
Family	:	MASTACEMBELIDAE
Subfamily	:	Mastacembelinae
Genus	:	Mastacembelus Scopoli
	21.	Mastacembelus armatus (Lacepede)
Series	:	Percomorpha
Order	:	Perciformes
Suborder	:	Percodei
Family	:	CHANDIDAE (=AMBASSIDAE)
		Chanda Hamilton - Buchanan
	22.	Chanda nama Hamilton - Buchanan
Genus	:	Parambassis Bleeker
	23.	Parambassis ranga (Hamilton - Buchanan)
Suborder	:	Labroidei
Family	:	CICHLIDAE
Genus	:	Oreochromis Gunther
	24.	Oreochromis mossambica (Peters)
Suborder	:	Anabantoidea
Family	:	ANABANTIDAE

Genus	:	Anabas Cuvier
	25.	Anabas testudineus (Bloch)
Suborder	:	Channoidei
Family	:	CHANNIDAE
Genus	:	Channa Scopoli
	26.	Channa marulius (Hamilton - Buchanan)
	27.	Channa striatus (Bloch)

DISCUSSION

The water was alkaline in nature with moderate hardness, satisfactory levels of dissolved oxygen with low levels of nutrients and free from any pollution. Fluviatile conditions of water was observed. The soil was alkaline with low organic carbon and total nitrogen. The primary productive values were in moderate level. The plankton and the benthic fauna was in moderate levels.

Aquatic vegetation was represented by Hydrilla Potomogeton and Chara. Which could profitably be utilised as fish food by introducing herbivorous carps. P.pulchellus and C.idella

27 species of fishes were recorded in and around sanctuary area, of which the dominant forms were N.hexagonolepis, T.khudree, P.carnaticus, L.calbasu, O.marulius and minnows. Though species like L.calbasu, P.carnaticus, T.khudree N.hexagonolepis & C.marulius are listed under `threatened' category, these species however, are found in small numbers. N.hexagonolepis, is the only species available in large numbers in the sanctuary. Therefore, concerted efforts are to be made to protect these fishes by arranging proper watch and ward, feeding, etc.

The temple authorities and general public are of the opinion that the population of fishes, species-wise in the sanctuary, as also their individual size has considerably reduced. It is also stated that Bili Meenu - T.khudree which was once a dominant species, has dwindled in its population and the present species in abundance noted is Ellu meenu - N.hexagonolepis. They further stated that there is no proper watch and ward and no regular feeding for fishes in the sanctuary is being done. There are good number of licenced fishermen engaged in fishing in river Cauvery who are stationed in Konanur, 3 km away from the sanctuary. They operate different type of nets with varied mesh sizes in both upper and lower stretches of the sanctuary and catch fish species of all sizes. Poaching and dynamiting are also resorted-to during summer months. Thus they, to a large extent, are responsible for the redution in the population of the fishes in the sanctuary and also in the riverine stretch of the area.

The fish sanctuaries are important from the point of protecting the fishes of the concerned rivers; but all the fishes of a river may not be a constituent in the fish population of the sanctuary. Efforts, hence, may be made to collect and stock them in the sanctuaries to protect and propagate them.

Though these sanctuaries are, to some extent protected, they have yet been subjected to poisoning, dynamiting overfeeding causing depletion of oxygen during festivals resulting in mass mortality of valuable fish stocks. To quote, at sishila the sanctuary was poisoned causing destruction of hordes of fishes. Thanks to the NGOs who have now taken steps to restore the sanctuary. An instance at Bachanayakanahalli, Enakal sanctuary in Kumaradhara in the recent past, subjected to over-feeding causing depletion of oxygen and mass mortality of fishes. Such instances may be taking place in other sanctuaries also which commands vigil all the time in order to maintain bio-diversity of the valuable fish genetic resources.

STRATEGIES FOR THE IMPROVEMENT OF THE SANCTUARY

1. There may be several other fish congregation centres in the perennial rivers in the State. Besides these, fishes congregate at the foot of the falls and also at anicuts. Therefore, it is necessary to undertake a detailed survey to identify such congregation places and demarcate the areas for declaring them as **"fish sanctuaries"** to protect the endemic fish species.

Proper boundary of the sanctuary should be fixed by installing prominant **"sign boards"** at strategic points incorporated with details such as **`Fish sanctuary'** its extension. Do's and Don'ts to ensure the safety and well being of the fishes.

Do's	**Don'ts**
(a)Feed the fishes with biscuits, bread, fried or cooked rice, rice polish	Throwing stones, cigarettes, cigar beedi stubs, plastic bags, oily stuffs, papers and any other wastes etc and ground nut oil cake.
(b) Maintain respectable Fishing distance to view the fishes in their natural habitat.	Poisoning, dynamiting, washing of clothes, pesticide containers; sprayers used for spraying pesticides etc.

2. As against one furlong on either side of **Vanhi Pushkarani** as sanctuary, a distance of 1.5 Km above and 1-5. Km below may be declared as the new boundary. This is in view of the fact that there are deep pools located within the proposed extended portion of the riverine stretch where also

fishes, during the summer months, take shelter and are vulnerable for fishing. By declaring these areas, proper shelter and safety could be ensured to the fishes endemic to the region which help in multiplication of its stocks and maintain bio-diversity. The Government should take steps to amend the existing limits of **one furlong** on either side of the sanctuary to **1.5 Kms**.

3. The fishes in the sanctuary are likely to migrate for breeding during monsoon and post-monsoon seasons. At present fishing is permitted beyond the sanctuary area during these seasons. To prevent exploitation of brood migrating fishes, it is necessary to prohibit fishing in the riverine stretch of 10 Kms - upstream and downstream, in the interest of protecting the fishery and its propogation.

4. It is observed that the pools in the sanctuary area are silted-up. Efforts to desilt pools with least distuubance to the fishes may hence be undertaken, so as to provide scope for the fishes to have enough space in the sanctuary.

5. Certain marginal areas of the river stretch near the sanctuary where grass / weeds are found, may be cleared manually.

6. It is noticed that vehicles are being washed in the sanctuary area. This may lead to pollution which in turn affect the fishes. As such, cleaning of vehicles in the vicinity of the sanctuary area has to be totally prohibited.

7. A separate ghat may be created beyond the notified sanctuary area for washing of washing cloths and bathing purposes.

8. Some of the stone slabs of the **steps** leading to the Vanhi Purshkarani are dislocated and some of them have fallen into the sanctuary proper obstructing the normal movement of the fishes. Action may be taken to remove these from the sanctuary area, repair steps and prevent further damage.

9. Unless public are involved in maintaining the sanctuary, it is difficult to protect it. Therefore NGO's should be organised to take care of the sanctuary with necessary financial assistance. This is to ensure the safety of the fishes and regular feeding as at present no institution or individuals are involved in the maintenance of the sanctuary.

10. Feeding of fishes should be done as a daily routine and over-feeding during festivals in particular should be controlled by proper supervision as unutilised feed materials may lead to pollution (depletion of oxygen etc.,) and in mass mortality of fishes.

11. Apart from collecting and cooling the existing fish species available in the river stretch in the sanctuary, other endemic species of the river may also be pooled and protected. This shall be institutes conservation of all the endemic species of the river.

12. Government fish nursery near the sanctuary may be got repaired and utilised for raising the endemic fish species collected from the Cauvery river before they are released into the sanctuary.

13. A Mahseer fish hatchery established at Harangi (35 Km from Ramanathapura) in Coorg district may be utilised for breeding T.khudree, N.hexagonolepis. P.carnaticus, L.calbasu etc. and rejuvinate the stocks in this river as also elsewhere in the State by the Department of Fisheries.

14. Departmental Officers may be trained in different aspects of fish culture and breeding and to enforce legal proceedings against those who violate law in maintaining the sanctuary.

15. Mass awareness among the people should be created regarding the importance of fish sanctuary by circulating suitable literature in local languages.

16. Only three areas in the State are officially declared as **`Sanctuaries'** by the Department of Fisheries.

The other 8 fish congregation spots / sanctuaries which, presently, are being managed by religious institutions and others should also be declared as sanctuaries. A detailed study of these 8 sanctuaries may be under taken and suitable measures to improve them on the lines indicated may be followed to protect and maintain the bio-diversity of their fish genetic resources.

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Annexure K: List of Participants

Annexure L: List of Organizations contributing to the Programme

Sl.No.	Organization	Place	Taluk	District
1.	KFD, Aranya Bhavan	Bangalore	Bangalore	Bangalore
2.	KFD, Tumkur	Tumkur	Tumkur	Tumkur
3.	KFD, Mysore	Mysore	Mysore	Mysore
4.	KFD, Kolar	Kolar	Kolar	Kolar
5.	All India Radio	Bangalore	Bangalore	Bangalore
6.	Fisheries Department	Bangalore	Bangalore	Bangalore
7.	Fisheries Department	Mangalore	Mangalore	Mangalore
8.	CES, IISc	Bangalore	Bangalore	Bangalore
9.	Ecology, Env. Forests, GoK	M. S. Building, Bangalore	Bangalore	Bangalore
10.	Agriculture Dept. GoK	M. S. Building, Bangalore	Bangalore	Bangalore
11.	State Pollution Control Board	Bangalore	Bangalore	Bangalore
12.	Karnataka Ayurveda drug Manufacture Association	Bangalore	Bangalore	Bangalore
13.	Natural Remedies	Veerasandra layout, Bangalore	Bangalore	Bangalore
14.	F.R.L.H.T.	Anand Nagar	Bangalore	Bangalore
15.	Wildlife Aware Nature Club	Tumkur	Tumkur	Tumkur
16.	Tumkur Science Centre	Tumkur	Tumkur	Tumkur
17.	Nagarika Seva Trust	Guruvayanakere	Belthangadi	D.K.
18.	Society for Advancement of Aquaculture	Bangalore	Bangalore	Bangalore
19.	B.A.I.F.	Tiptur	Tiptur	Tumkur
20.	I.N.C.E.R.T.	Bangalore	Bangalore	Bangalore
21.	Mathsya Hitha Rakshana Vedike	Shishila	Belthangadi	D.K.
22.	B.G.V.S.	Bangalore	Bangalore	Bangalore
23.	Govt. Ayurvedic Medical College	Bangalore	Bangalore	Bangalore
24.	Forestry College	Ponnampet	Virajpet	Coorg
25.	K.S.C.S.T.	Bangalore	Bangalore	Bangalore
26.	Department of Public Instruction	Bangalore	Bangalore	Bangalore
27.	St. Theresa High School	Belthangadi	Belthangadi	D.K.
28.	Vidhyabodhini High School	Balila, Sullia	Sullia	D.K.
29.	Nehru Memorial High School	Aranthodhu, Sullia	Sullia	D.K.
30.	Govt. High School	Karkala	Karkala	Udupi
31.	Govt. High School	Koodabettu	Karkala	Udupi
32.	Subramanya Junior College	Bhaskeri,Honnavara	Honnavara	U.K.
33.	Vidyodhaya P. U. College	Yadahalli	Sirsi	U.K.
34.	Chennamma Jr. College	Somvarapet		Coorg
35.	Berchman's High School			Shimoga
36.	Govt. High School	Belur	Hassan	Hassan
37.	Hebbalu Govt. High School	Hebbalu, Belur	Hassan	Hassan
38.	S. V. S. High School	Agumbe	Thirthahalli	Shimoga
39.	**organization**	**Place**	**Taluk**	**District**
40.	KFD, Aranya Bhavan	Bangalore	Bangalore	Bangalore
41.	KFD, Tumkur	Tumkur	Tumkur	Tumkur
42.	KFD, Mysore	Mysore	Mysore	Mysore
43.	KFD, Kolar	Kolar	Kolar	Kolar
44.	All India Radio	Bangalore	Bangalore	Bangalore
45.	Fisheries Department	Bangalore	Bangalore	Bangalore

46.	Fisheries Department	Mangalore	Mangalore	Mangalore
47.	CES, IISc	Bangalore	Bangalore	Bangalore
48.	Ecology, Env. Forests, GoK	M. S. Building, Bangalore	Bangalore	Bangalore
49.	Agriculture Dept. GoK	M. S. Building, Bangalore	Bangalore	Bangalore
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52.	Natural Remedies	Veerasandra layout, Bangalore	Bangalore	Bangalore
53.	F.R.L.H.T.	Anand Nagar	Bangalore	Bangalore
54.	Wildlife Aware Nature Club	Tumkur	Tumkur	Tumkur
55.	Tumkur Science Centre	Tumkur	Tumkur	Tumkur
56.	Nagarika Seva Trust	Guruvayanakere	Belthangadi	D.K.
57.	Society for Advancement of Aquaculture	Bangalore	Bangalore	Bangalore
58.	B.A.I.F.	Tiptur	Tiptur	Tumkur
59.	I.N.C.E.R.T.	Bangalore	Bangalore	Bangalore
60.	Mathsya Hitha Rakshana Vedike	Shishila	Belthangadi	D.K.
61.	B.G.V.S.	Bangalore	Bangalore	Bangalore
62.	Govt. Ayurvedic Medical College	Bangalore	Bangalore	Bangalore
63.	Forestry College	Ponnampet	Virajpet	Coorg
64.	K.S.C.S.T.	Bangalore	Bangalore	Bangalore
65.	Department of Public Instruction	Bangalore	Bangalore	Bangalore
66.	St. Theresa High School	Belthangadi	Belthangadi	D.K.
67.	Vidhyabodhini High School	Balila, Sullia	Sullia	D.K.
68.	Nehru Memorial High School	Aranthodhu, Sullia	Sullia	D.K.
69.	Govt. High School	Karkala	Karkala	Udupi
70.	Govt. High School	Koodabettu	Karkala	Udupi
71.	Subramanya Junior College	Bhaskeri,Honnavara	Honnavara	U.K.
72.	Vidyodhaya P. U. College	Yadahalli	Sirsi	U.K.
73.	Chennamma Jr. College	Somvarapet		Coorg
74.	Berchman's High School			Shimoga
75.	Govt. High School	Belur	Hassan	Hassan