

BIODIVERSITY OF ASSAM



Status Strategy & Action Plan for Conservation

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Status Strategy and Action Plan
for Conservation



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M. S. Swaminathan
Chairman

Biodiversity of Assam

Status Strategy and Action Plan for Conservation

FOREWORD

Assam and the northeast region fall under the mega biodiversity group. At the same time the region has become a biodiversity hotspot from the point of view of threats to flora and fauna. Biodiversity is the feedstock of the biotechnology industry. It is also the backbone of food and livelihood security systems. To emphasize the importance of biodiversity in safeguarding health security, the World Health Organisation, called for a movement to save plants to save lives.

The Assam Science Society deserves our gratitude for its efforts to conserve biodiversity and use it in an equitable and sustainable manner. Drs A K Bhagabati, M C Kalita and S Baruah have rendered valuable service by putting together very valuable information on all aspects of biodiversity in Assam. The book brings out clearly that Assam is a genetic paradise. I hope the present book will create widespread awareness of Assam's unique genetic heritage and thereby promote a people's movement for the conservation and sustainable use of biodiversity.

A handwritten signature in black ink, appearing to read 'M. S. Swaminathan'.

M S Swaminathan

PREFACE

An exhaustive book on biodiversity and associated issues pertaining to Assam in North-East India has been a long felt need. A constituent of India's Eastern Himalayan biodiversity hotspot, Assam qualifies for this recognition by virtue of its variegated natural make up that provides a strong basis for sustenance of highly diverse life forms. Equally rich is its cultural patterns which have evolved through spontaneous response to the local natural environment. The scenario of nature-culture interaction, however, had experienced remarkable change with the annexation of the area to British colonial rule as back as 1826. The British introduced commercial tea plantation, coal and mineral oil extraction industries and commercial felling of trees and other forest resources of Assam. Simultaneously the area experienced a rapid population growth compared to many other parts of the country primarily due to in-migration of people from within the country and outside. All these developments have overtly or covertly put a variety of pressures and threats on the available and potential bioresources of the state. Such a sensitive situation with respect to the status and sustainability of biological diversity calls for scientific study and documentation of biodiversity and finally evolving strategies and action plans for its sustainable use and conservation. This book is basically a systematic and collective attempt towards achieving such a positive and indispensable end.

Divided into eight chapters, the book first introduces the background and basic premises of the study and the geo-ecological, socio-economic and administrative profiles of the study area. It then delves into the status of biodiversity in terms of plant, animal and agriculture diversity and documents the wide base of floral and faunal diversity as exhaustively as possible. The proximate and root causes of biodiversity loss, the roles of major actors including the initiatives taken by NGOs are dwelt upon at length subsequently, followed by an analysis of the gaps in information, understanding, policy and legal structure for sustainable use and conservation of biodiversity in the state.

Based on the philosophy and methodology suggested by NBSAP, inputs provided by the government and non-government agencies, the network of local working groups, individual experts and public meetings held at different places of Assam, a set of strategies and action plans for conservation and sustainable use of biodiversity in Assam has been formulated. This is followed by the last chapter on constitutional and statutory protection of ecology, environment and biodiversity in India.

This is, in fact, not a book about method in that blow-by-blow account of how to carry out pieces of research on biodiversity. It is rather about how to expose that which is often suppressed not by deliberate connivance but by the ways in which research is usually presented to its audience. As the book is the result of a collective effort of many minds and institutions /

agencies, it contains the flavour of all inclusiveness without cannelling into the roots of individual subject of interest. This may be a strength or a weakness of the book which we honestly leave to the readers to judge.

Finally, we believe that it is the time to rethink our position in the ecosystem as we are not and can not be apart from nature. Our lives and economy are indispensably dependent on biological diversity provided by our mother Earth. As Oliver S. Owen *et. al* (1998) observed, we also believe that “despite the wonderful accomplishments of human society over many centuries, it is time to realize that humans are not the crowning achievement of nature, but rather members in a club comprised of all of Earth’s living creatures.”

If this effort can help slightest the process of improving the man-nature relationship and the long-cherished biodiversity restoration in this marginal but naturally rich part of the country, the aims of the Assam Science Society and the humble goals set by the editors may be taken to be fulfilled to a large extent.

Lastly, with all humility and sincerity we invite constructive criticism, advice and suggestions from the learned readers and stakeholders so that required improvement of the contents and presentation may be made in the next edition.

Editors

WORDS FROM GENERAL SECRETARY ASSAM SCIENCE SOCIETY

In India, there has been a growing concern among the people on the environmental problems including the loss of biodiversity during the recent years. The rapid shrinkage of biological resources in different parts of the country resulting from overuse and misuse in many cases has prompted the government to take up effective steps towards conservation and sustainable use of the available and potential bioresources. The National Biodiversity Strategy and Action Plan (NBSAP) undertaken by the Ministry of Environment and Forests, Govt. of India in collaboration with UNDP, GEF, Biotech Consortium India Limited and Kalpavriksh during 201-02 was an important step in this direction.

Assam Science Society had the privilege to act as the State Nodal Agency to organize the state machineries, institutions and organizations and directly or indirectly involved in nature conservation towards preparation of the State Biodiversity Strategy and Action Plan. In such a very serious and responsible effort, Dr. M.C. Kalita and Dr. A.K. Bhagabati, former general secretaries of the Society, as the State Co-ordinator and Convenor took the lead to integrate the ideas and information provided by the government departments, institutions, NGOs and individuals to come up ultimately with the final report. Mr. Surajit Boruah, who acted as a research fellow in the project, extended all possible help in preparing the report at the desired level.

Now, I am very happy to announce that the Society has been able to bring out the report in the form of a book after necessary revision and enlargement. I am confident that the book will cater to the need of a reliable information-base on biodiversity of our state, which is an integral part of the eastern Himalayan biodiversity hotspot, for carrying out research and conservation measures in this specially important field. I on behalf of the Assam Science Society, take the opportunity to thank the editors, contributors, members of the local working groups and all others who contributed whole heartedly to make this effort a success.

Lastly, I thank Mr. J.P. Sarma, proprietor of Eastern Book House, Guwahati for coming forward to take the responsibility of publishing such a valuable book on behalf of the Assam Science Society.

S R Patgiri

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This book, which is an outcome of a report of National Biodiversity Strategy and Action Plan (NBSAP) for Assam has been prepared under the guidance and initial sponsorship of the Ministry of Environment and Forests, Government of India and United Nations Development Programme (UNDP) and Global Environment Facility (GEF). The activities for the preparation of the report since the beginning were coordinated and monitored by the Technical and Policy Core Group (TPCG) led by Kalpavriksh and Biotech Consortium India Limited. We are grateful to all the above organizations / agencies for their support and guidance.

We are grateful to Prof. M. S. Swaminathan, Chairman, M.S. Swaminathan Research Foundation and a Scientist of international repute for kindly sparing some of his invaluable time in contributing the forward to this book. The members of Assam Science Society and those who are associated with the preparation of this book feel immensely enthused by the kind words of Prof. Swaminathan.

A large number of organizations, people and individuals are directly or indirectly associated with the preparation of this book. Space does not, however, permit to mention the names of all of them here. Some of the organizations and learned individuals were, however, very kind and enthusiastic to extend their valuable help and guidance. They are – His Excellency Honorable Governor of Assam, Lt. General (Retd) S. K. Sinha, P.K. Bora, Honourable Chief Secretary, Government of Assam, Dr. P.C. Bhattacharjee, Member, TPCG, Dr. P. Mahanta, President, Assam Science Society, Dr. A. K. Goswami, Dr. C.M. Sarma and Dr. K. Pathak, Ex-Presidents, Assam Science Society, Mr. K. N. Deva Goswami, PCCF, Government of Assam, Dr. S. K. Sarma Retd. Professor, Dept of Environmental Science Gauhati University and Dr. S. Sarma, Dept of Biotechnology, Gauhati University.

The members of the State Steering Committee and the Core Committee, SBSAP deserve hearty thanks for their constant help and guidance. The coordinators and members of the Local Working Groups, without whose untiring and selfless contribution, it would not have been possible to bring out the book in the present form, deserve special thanks and gratitude. We are thankful to Mr. N.U. Ahmed, convenor, Environment Sub-Committee, Assam Science Society, for his initiatives in the formative stage of this work.

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nology and Environment Council, Guwahati ; Institute of Advanced Study in Science and Technology, Guwahati ; Tribal Research Institute, Guwahati ; College of Veterinary Sciences, AAU, Khanapara ; College of Fishery, Raha ; Zoological Survey of India, Shillong ; Botanical Survey of India, Shillong ; Regional Meteorological Centre, Guwahati ; Regional Muga Research Centre, Boko ; Horticulture Research Station, Kahikuchi ; National Institute of Rural Development, Guwahati ; Assam Remote Sensing Application Centre, Guwahati ; National Informatic Centre, Guwahati and many others.

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Mr. Jayanta Talukdar, Maherun Nesa and Mr. Pankaj Bora deserve our special thanks for assistance in preparing the manuscript of the book.

Mr. J. P. Sarma, proprietor of EBH Publishers (India), Guwahati deserves our hearty thanks for coming forward to take the responsibility of bring out the book on behalf of the Assam Science Society.

Last but not the least, we gratefully acknowledge the spontaneous response and active cooperation of the village people whom we met in the *raij-mels* organized in different places of the state. We were, in fact, greatly enthused and profoundly benefited by their overwhelming response, experience and perceptions, which they expressed during interaction.

M.C. Kalita
A. K. Bhagabati
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SUMMARY

Biodiversity has currently emerged as an issue of global concern. Almost all the countries of the world irrespective of their locational and socio-political characteristics have now come forward in an organised manner to address the issues relating to biodiversity as there has been increasing threat and pressure on the biosphere. Different nations under the guidance of international bodies like UNO have developed their own plans and programmes for sustainable use and conservation of biodiversity. In India, although there have been large number of studies on biodiversity and related issues, these are not organised enough to formulate a national action plan for conservation of biodiversity.

The Ministry of Environment and Forests, Government of India and United Nations Development Programme (UNDP), Global Environment Facility (GEF) have, therefore, come together to create a scientifically organized base for the study of the status, prospects and problems of biodiversity in the country so as to arrive at a common national policy applicable to all parts of the country with due recognition to the regional realities favourable for sustenance of biodiversity. In Assam, depending upon the physical and cultural variations within the state two areas have been identified for the purpose. The districts of the Brahmaputra and the Barak valleys and NC hills district (22 districts in total) have been considered as the state unit and the Karbi Anglong district as the sub-state unit .

In the background stated above, the present work attempts to provide a detailed picture of the status of almost all forms of biodiversity, threats and pressures on it, initiatives taken so far for sustainable use and conservation and finally a scheme of strategy and action plan for sustainable use and conservation of biodiversity in the state. It also tries to create an environment involving all the people and the administrative machinery to encourage all concerned to contribute positively to the mission of biodiversity conservation in the state.

As the biodiversity strategy and action plan encompasses all the geographical units, ecosystems, population groups and the economy and culture of the state, a wide range of information and data pertaining to biodiversity and related issues have been collected, and also generated wherever possible. This is really a Herculean task, the accomplishment of which requires group effort, utmost sincerity and seriousness. Therefore, since the beginning of the project a well thought-out multi-staged methodology has been chalked out and followed.

Geographical and Socio-Economic Profile

Assam, a constituent state of India, holds a unique position in the country's strategically very important north-eastern region. The present physiographic configuration of Assam is characterised by diverse features such as floodplains, marshes and *beels*, scattered hillocks, folded hill ranges and old plateaus. Assam lies in the regime of monsoon climate with a hot and wet summer and a cool and dry winter. However, the state shows marked variation in its

climatic pattern mainly because of its peculiar location, natural vegetation and presence of waterbodies including rivers. The soils of Assam are generally divided into four groups- alluvial soils, piedmont soils, hill soils and lateritic soils. The alluvial soils are extensively distributed over the Brahmaputra and Barak plains. The hill soils are generally found in the southern hilly terrains of the state. The lateritic soils in the state extensively occur in the N. C. Hills district and some parts of southern Karbi Plateau.

The terrestrial natural ecosystems of Assam are mainly forest ecosystems covering both the hills and the plains, besides the grassland ecosystems. The aquatic ecosystems are of both lotic and lentic types. The lotic ecosystems are confined to the main rivers and their tributaries. The lentic ecosystems are mainly the large stagnant waterbodies locally known as *beels*, ponds, swamps and other waterlogged areas. Moreover, although limited in number and area, the national parks and sanctuaries in the state bear immense significance so far as biodiversity is concerned. The national parks and sanctuaries in Assam cover around 3% of the state's total area as against the country's 4.3%.

Assam is the homeland of several population groups such as the tribals, the indigenous non-tribals, the Bengali Hindu immigrants, the Muslim immigrants, the Nepali immigrants, the tea labourers and several other groups from within the country. Although the process of assimilation among different populations is still going on, the groups maintain considerably their traditions and cultures in the territories under their occupation. Thus the composition of population in the state exhibits great diversity. So far the scheduled castes and tribes are concerned, there are altogether 16 scheduled caste communities constituting 7.4% of the state's total population, while the scheduled tribes (ST) accounts for 12.82% (1991 census). Demographically, Assam is characterized by a very high rate of population growth throughout the last century. At the beginning of the 20th century the state had a population of 3.29 million. It increased to 8.03 million in 1951 and to 22.41 million in 1991 witnessing an average annual exponential growth rate of 1.80% during 1901-51 and 2.60% during 1951-91 as against the country's corresponding growth rates of 0.83% and 2.15%. The present population (as per 2001 census) of the state stands at 26.63 million.

Status of Biodiversity

Plant Diversity

The vegetation of Assam is primarily of tropical type covering areas of evergreen, semi-evergreen, deciduous forests and grasslands. Stretches of riparian forest found along the river banks are also very important. Due to incomplete reporting from certain areas like North Cachar hills, parts of Tinsukia district that contains patches of tropical rain forest and parts of Kokrajhar district, the exact number of plant species in Assam still remains uncertain. However, the available records and enumeration lists suggest that there are 3017 species of flowering plants.

Assam houses quite a good number of medicinal plants including several rare, endangered and endemic species. A comprehensive list prepared on the basis of existing literatures

contributed by various workers has been presented in the report. The list includes indigenous and wild plants, which have certain medicinal uses. The state is also rich in bamboo diversity, where 10 genera and 42 species can be found. In the case of cane, the total number of species reported stands at 14.

Orchids belonging to the family Orchidaceae are one of the largest groups of flowering plants. N. E. India claims the largest share in the world with about 72% species that covers around 825 species under 145 genera. Most of the epiphytic orchids are lost due to mass clearance of forests for other developmental activities. Besides the problem of grazing, some unplanned human activities and interference through collection of ornamental and medicinal plants for commercial purposes, many terrestrial and saprophytic orchids are now on the verge of extinction. In Assam, about 192 species of orchids are distributed in the plains and hilly areas.

A large part of Assam is covered by wetlands rich in both flowering and non-flowering plants. The rural communities rely upon the wetlands for various purposes and harvest a variety of products like fish, fodder, food items etc. The aquatic plant species of Assam belong to diverse habitats and have distinctive characteristics. Many wetlands of the state are in a process of eutrophication, indicating loss of productivity due to both natural and human factors. The extensive growth of water hyacinth (*Eichhornia crassipes*), one of the most cumbersome aquatic weeds of the region, is becoming a constant threat to the productive wetlands.

Although there is no exhaustive list of the endemic flora of Assam, a search on the basis of the exploration of BSI and other workers reveals the occurrence of as many as 102 endemic species belonging to 75 genera. Due to lack of adequate information, it is difficult to ascertain the number of rare, endangered or threatened taxa of Assam. However, a list of 60 rare, endangered and threatened species from the state has been compiled.

Animal Diversity

The North-East including the state of Assam represents the transitional zone between the Indian, Indo-Malayan and Indo-Chinese biogeographical regions. It is, therefore, considered as one of the biologically most diverse areas in the whole of South Asia. Here, the forests are extremely rich and diverse with wide varieties of primate, carnivore, herbivore and birds. About 193 species of mammals and more than 958 species and subspecies of birds are so far reported from Assam. The state possesses 16 important protected wildlife areas, which house nearly 44 types of endangered and rare species of mammals and 14 types of reptiles and amphibia. Altogether 230 forms of mammals (species and sub-species) have been recorded so far from Assam. There are 14 species of primates in Assam, which constitute 1/6th of the total primate species of the world. As many as 19 cat families are reported to be found in the state. Moreover, Assam holds the entire known world population of Pigmy hog, 75% of the world population of the Indian rhinoceros and Wild water buffaloes and a sizable population of Asian elephants and tigers.

Diversified habitats and various ecological associations have significantly enriched the avian diversity in Assam with more than 950 species belonging to 302 genera and 68 families. The largest family being Sylviidae followed by Muscicapidae, Accipitridae, Corvidae, Anatidae, Scolopacidae, etc. The state represents 53.5% of the total birds species of Indian sub-continent.

Reptiles constitute an important vertebrate group. Assam with its varied topography and habitat types support a species rich reptilian fauna. Members of three living Orders namely Crocodylia (Crocodyles & Gharials), Chelonia (Turtles & Tortoises) and Squamata (Snakes & Lizards) are found in the state. The records of reptilian resource of Assam show the presence of 1 species of Crocodylia, 19 species of Chelonia and 77 species of Squamatas.

North-East India supports a well-diversified amphibian fauna and so far 70 species are reported from the region. The amphibian fauna of Assam is very poorly evaluated and most of the records are that of undivided Assam. In the state, so far 185 species belonging to 98 genera under 34 families have been recorded. This group has 33 representatives endemic to the region. So far fish is concerned, 25 species have been identified as threatened.

The fresh water molluscs constitute an important part of the ecosystem. The Brahmaputra and the Barak river systems of Assam with their large number of perennial tributaries, hill streams, swamps, beels, man-made ponds, reservoirs, floodplains etc. are the main habitats for the snails. In Assam, 10 species of freshwater snails are used as food by different tribal communities. The family Thiariidae has the highest number of species (10) but the family Planorbidae, Achatinidae, Bithyniidae, Cyclophoridae, Ariophantidae and Unionidae have the lowest number of species (1).

Butterflies and moths are the living jewels of the landscape. In India, about 1500 species of butterflies have been identified so far and among these about 50% species are reported from Assam. The large and beautiful Swallowtail butterflies like Great windmill, Rose windmill, Golden birdwing, Common birdwing, Batwing, Tailed redbreast, Sword tail, Dragon tails etc. are very rare and restricted to some small areas only.

Much work has not been done so far to assess the microbial diversity of the region. The cultivated lands of Assam harbor large varieties of useful microbes. The nitrogen-fixing bacteria and blue-green algae are abundant in the soils of the state. Already some works have been done on Rhizobial species from soil wherein leguminous crops like *black and green gram, lentil, cowpea, chickpea*, etc. are cultivated. These rice fields contain a large variety of nitrogen-fixing blue-green algae along with *Aspergillus fumigatus, Chaetomium thermophile*, etc.

Agricultural Diversity

North-East India including Assam is in the core of the widely recognized centers of diversity of several field, horticultural and cash crops. The geographical location, physical

features and historical factors have made the state an area of unique ethnic and cultural diversity. Variations among different ethnic groups in their traditional knowledge of uses, quality preferences and farming practices are the additional factors adding to the diversity of the plant species.

Assam is a part of the broad region widely recognized as the center of diversity of rice. The indigenous rice germplasm of the region is endowed with wide genetic diversity and represents a wealth of valuable gene systems. The rice germplasm stock maintained at the Central Rice Research Institute (CRRI), Cuttack includes 2054 from Assam alone out of 12256 collections from all over India which explains the extent of diversity of rice in the region. The present stock of rice germplasm in Assam Agriculture University amounts to around 4000 accessions, including local varieties and improved strains.

North East India including Assam possesses reasonably rich diversity in several grain legumes. Altogether 61 lines of green gram, 59 lines of black gram, 44 lines of lentil, 12 lines of *arhar* and 29 lines of fieldpea are being maintained at the Regional Agricultural Research Station (RARS), Shillongani. Sugarcane has been in cultivation in Assam since long past. Out of 24 wild species of sugarcane in the country, 12 are found in north-eastern region including Assam.

Assam is known for its tea plantation. The gene pool of tea consists of cultivated species, wild species, weedy relatives, old seed *jats* or land races, improved clones and breeding lines/hybrids. It is noteworthy that the collection of diverse tea germplasm at Toklai Experimental Station, Jorhat was started in the early part of the last century. The station so far has collected 1074 germplasms which indicate the broad base of genetic diversity in the state.

The diversified ecology of Assam is unique for growing a large number of fruits and vegetables of tropical, sub-tropical and temperate origin. Assam is exceptionally rich in citrus and banana germplasm. Another unique feature of the state is the occurrence of aquatic fruits like *makhana* or gorgon fruit (*Eurale ferox*). Besides, large number of minor fruits of medicinal and therapeutic values are grown all over the state either in backyard gardens or in the forests. Vegetables grown in the state include tropical vegetables like cucurbits, various kinds of bean, some varieties of leafy vegetable, lady's finger, etc. and temperate vegetables like cole crops, tomato, pea, carrot, beet, etc. Almost all temperate, topical and sub-topical commercial vegetables are being grown in Assam. The state is exceptionally rich in genetic resource of cucurbits, non-tuberiferous solanums, and beans and tuber crops.

The state is endowed with rich germplasm of different livestock and poultry species. The indigenous livestock and poultry constitute the major chunk of the state's population. Over the years the population of livestock and poultry species viz., cattle, buffalo, goat, pig, sheep, fowl and duck have shown a steady increase with varying annual growth rate at different periods. However, there have been growing threats and pressures on domesticated livestock diversity

both from natural and human factors. Among others, the process of urbanization and industrialization and the resultant change in the lifestyle of the people on the one hand, and the problems of flood and bank erosion etc. on the other, have put increasing pressure on the domesticated livestock diversity.

Sericulture and weaving are parts of the cultural heritage of the people of this region. It exists in the Brahmaputra valley from time immemorial. It was practised by the tribal of the North-East even before the Arayan migrated to this region. The indigenous people of the North-East were well acquainted with the product of wild worms such as Doyang muga, Deo muga, Kotkari muga, Eri etc. All types of native food plants of silkworm grow abundantly throughout North-East, especially in the Brahmaputra and the Barak valley and the foothills of Naga, Khasi and Garo hills. Muga silkworm is a polyphagus insect, which feed on several food plants, of which the primary ones are Som (*Machilus bombycina* K) and Soalu (*Litsea polyantha*, Juss).

Causes of Biodiversity Loss

The causes of biodiversity loss may be grouped into two : proximate causes and root causes. The proximate causes include (i) population growth and density, (ii) habitat destruction caused by anthropogenic factors, (iii) overgrazing, (iv) poaching, (v) flood and bank erosion, (vi) application of agrochemecals, (vii) biopiracy and (viii) political problems. The root causes of biodiversity loss in the state on the other hand have been perceived as stated below :

1. The development activities adopted so far in the state in most cases have not paid required attention to the delicate aspects of the environmental systems. This has obviously resulted in a growing unconformity between the natural and the human systems. A general lack of scientific understanding and negligence of the attributes of nature and their functioning in various ecosystems in the state is commonly observed in the process of formulating development plans and programmes.
2. The traditional modes of agricultural and household industrial production which more or less maintain a harmonic relation with nature are being increasingly replaced by the modern modes, many of which are, however, exotic in nature. The exotic modes of production such as tea farming, coal mining and oil exploration, paper manufacturing, etc generally care little for sustainability of the local resources.
3. The economic developments attained by the state in different production sectors are not properly oriented to the diversity of the available and potential natural resource base. In many cases, the development process and generation of employment are being diverted to such sectors which have very little to do with the rich natural resource base of the state. Overwhelming and unmanageable concentration of working force in the government service sector is the best example in this regard.

4. The rich natural diversity of the state in wilderness was exposed in the early part of nineteenth century to an economy basically colonial and exploitative in character. The virgin lands with rich biodiversity were extensively used for capitalistic production of tea, coal, oil and timber which was quite unfriendly to the local natural environment. The legacy of such an exploitative system is still found to continue in some forms, direct or indirect.
5. The streams of migration of people to the state in different periods from within and outside the country having different traditions and economic backgrounds are found, in most cases, to be not conducive for long-term sustenance of the biodiversity. The uncontrolled migration of people particularly to the delicate ecosystems covering the foothills and river banks is no less responsible for causing substantial erosion of the very broad base of the state's biodiversity.

Major Actors : Roles and Initiatives

It is encouraging to note that there has been a growing awareness among the people during the recent period on the vital roles played by biological diversity on the survival of natural system and human culture. It is further encouraging that a section of the people have, at least, voluntarily come forward under the initiatives of some NGOs to understand the importance of biodiversity and act accordingly for its conservation. The growing initiatives and positive activities of the people and the NGOs in this regard have been able to draw attention of the government and to initiate something in this direction. Parallely, insurgency and political uprising of certain communities for their identity and right have also played some role, negative or positive, in regard to biodiversity conservation. The roles and initiatives of the people, various departments of the government and the NGOs for conservation of biodiversity have been discussed and the policies and programmes currently adopted by the departments of forest, agriculture, sericulture and fisheries are mentioned. The diverse activities performed mainly by different NGOs in the state may be summarized as follows :

- i. environmental education and awareness;
- ii. people's participation in forest and wildlife conservation;
- iii. sustainable use of biological resources;
- iv. promotion of traditional values relating to environment and biodiversity conservation;
- v. integration of departmental activities of the government and bridging the gaps between the people and the government in the fields of environment and biodiversity conservation.

Gap Analysis

Gap analysis has been made in terms of understanding, sustainable use and conservation of biodiversity. This includes analysis of gaps in information, gaps in vision, gaps in policy and

legal structure and gaps in institutional and human capacity.

Strategy and Action Plan

Based on the philosophy and methodology as suggested by NBSAP, the inputs provided by the government / non-government agencies, the network of local working groups created for the purpose, public meetings (*raij mel*) held at different places of the state, opinions derived from individual experts, a conceptual framework has been developed to formulate strategy and action plan for conservation and sustainable use of biodiversity in Assam. The strategies formulated cover almost all the issues and problems concerning biodiversity as visualised by the project group to be important, relevant and workable. In some cases, however, the suggested actions could not be pin pointed to the expected level owing to paucity of authentic data and concrete picture of the concerned themes and issues. It is not that there is no scope for further incorporation of strategies and actions, if someone goes for the finer details of the issues and problems. The set of strategy and action plan stated below tries to prioritise the themes and issues relevant to sustainable use and conservation of biodiversity in the state :

- Strategy**
1. Dissemination of education and awareness among all sections of people including those in political, administrative and legal fields.
 2. Revitalization of traditional perception, knowledge and skills which have significant positive values in the rational use and conservation of biodiversity resources.
 3. Expansion of scientific studies on various facets of biodiversity and integration of them to strengthen the total understanding of biodiversity and to explore measures for its sustainable use and conservation.
 4. Reorientation of the economy towards sustainable use of biological resources and generation of employment opportunities for the weaker sections and women in ecofriendly occupations.
 5. Integration of the existing conservation efforts to strengthen their efficiency and evolving new measures for conservation of biodiversity in view of the emerging problems and prospects.
 6. Identification and management of the threats and pressures on biodiversity.
 7. Maintenance of agricultural biodiversity and planning for sustainable management of the farming system.
 8. Conservation of the aquatic environment and safeguarding their rich biodiversity for sustainable use and development.
 9. Formulation of policy and laws for conservation and sustainable use of biodiversity.

Under these nine strategies as many as 48 actions have been suggested for implementation. It is desired that transparency, people's involvement, NGO's help and co-operation, guidance from experts and more importantly sincere efforts from the government departments should be ensured within the existing and changing administrative framework of the state for successful implementation of the actions suggested.

Chapter 1

INTRODUCTION

1.1 Background

Biodiversity has currently emerged as an issue of global concern. The world bodies concerning environment have now come forward in an organised way to address the issues relating to biodiversity as there has been increasing threat and pressure on the biosphere. The global evolutionary processes have produced an amazing range of flora and fauna including microorganisms, which are intrinsically related with myriad survival and livelihood needs of human society. The alarming rise of human population particularly during the last 200 years on the one hand and the rapid advancement of science and technology on the other, have presently placed the man-environment relationship in such a state that many of the problems causing concern have already gone beyond human control. Recognizing this fact the advanced nations and subsequently the less advanced nations too, have expressed serious concern on the matter and started adopting planned measures towards mitigating the problems. The resolutions adopted in the earth summit of 1992 and subsequent international commissions bear testimony of such concern and global co-operation.

In India also, there has been a growing concern among the people on the environmental problems and issues including biodiversity during the recent years. The rapid loss of biological resources experienced in different parts of the country resulting from overuse and misuse in some cases, has prompted the people and the government machineries to do something positive for their conservation and sustainability. The National Biodiversity Strategy and Action Plan (NBSAP) is, in fact, an integrated massive effort in this direction.

The term biodiversity is often defined as the total variety and variability among living organisms and the ecological complexes they inhabit. It also includes the diversity of forms right from the molecular level through individual organisms, populations, communities, ecosystems, landscapes and biosphere.

It encompasses viruses, bacteria, fungi and other microorganisms as well as plants and animals, which exist on the earth. Human beings are an integral part of it. Thus, biodiversity is the sum total of the species of animals, plants and microorganisms occurring in a given habitat.

In India, although there have been large number of studies on biodiversity and related issues, these are not organised enough to help formulation of a national plan to arrive at a common national goal. Achieving a common national goal of sustainable use and conservation of biodiversity is really a difficult task. It is more so in a vast country like India where the dimension of both biological and cultural diversity is extremely wide. A national plan for the development of such a very diverse and sensitive field has to do justice to the physical and cultural realities prevalent in every nook and corner of the country. The Ministry of Environment and Forests, Government of India and United Nations Development Programme (UNDP),

Global Environment Facility (GEF) have, therefore, come together to create a scientifically organized framework of the status, prospects and problems of biodiversity in the country so as to arrive at a common national policy applicable to all parts of the country giving due recognition to the regional realities. The vastness of the country both in terms of natural and cultural diversity has, however, directed to classify it into states and sub-states coinciding the political boundaries so that a real picture of biodiversity emerges in due course. In Assam, depending upon the physical and cultural variations two areas have been identified for the purpose. The districts of the Brahmaputra and the Barak valleys and NC hills district (22 districts in total) have been considered as the state unit and the Karbi Anglong district as the sub-state unit (Fig-1). It would, however, have been more appropriate if both the hill districts of Karbi Anglong and North Cachar hills could be put together as a sub-state unit. It is not that the sub-state unit (Karbi Anglong) is completely distinct from other parts of Assam, rather there are enough spatial interlinkages as all the areas in the state belong to either the Brahmaputra or the Barak basin.

On the background stated above and the scope, objectives and methodology mentioned below, this study attempts to provide a detailed picture of the status of almost all forms of biodiversity, threats and pressures on it, initiatives taken so far for sustainable use and conservation and finally a scheme of strategy and action plan for sustainable use and conservation of biodiversity. Further, it tries to create an environment involving all the people and the administrative machinery, which will encourage all concerned to contribute positively to the mission of biodiversity conservation in the state.

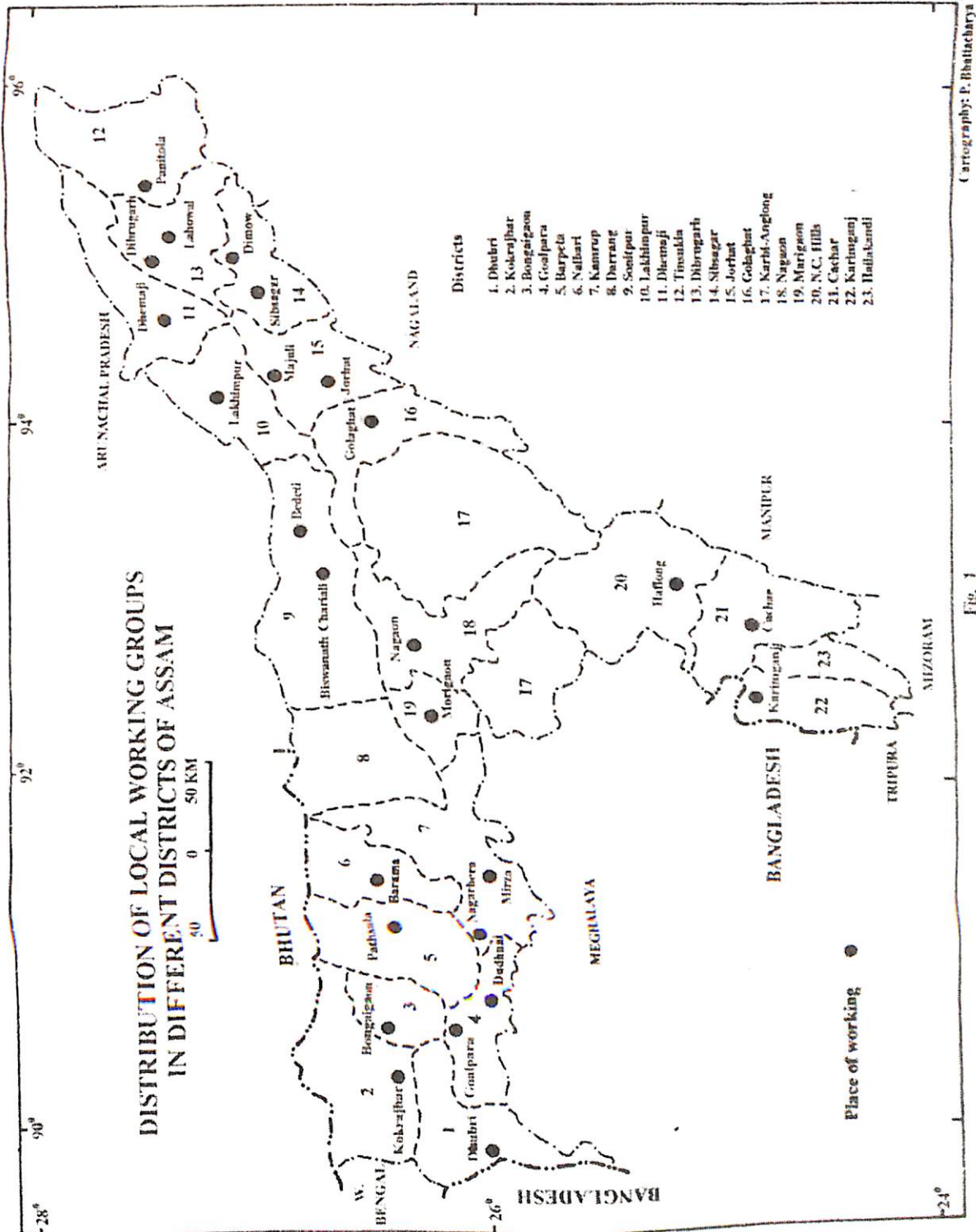
1.2 Scope

Biodiversity in its holistic sense encompasses all levels of biological diversity, ecological and evolutionary processes including natural ecosystems, wild species and varieties, agricultural ecosystems, domesticated species and varieties. It has several other facets when concerned with sustainable use and conservation of biological resources. Even, its ethical, cultural, economic and scientific dimensions are also no less significant particularly while preparing plans for biodiversity conservation. The present work considers biodiversity in its holistic sense and tries to incorporate almost all the themes, issues and problems concerning biodiversity of the state and to identify ways and means for its conservation and sustainable use. However, some of the important aspects like evolution and historical change of different kinds of uses of biological resources and changing human perception of biodiversity could not be dealt with adequately mainly because of time constraint. The scope of the work, however, remains open to accommodate future works concerning the biodiversity of Assam as has been indicated in the strategy and action plan formulated in Chapter 7.

1.3 Objectives

The main objectives of the work are –

- i. to determine the present status of biodiversity in the state with the participation of the people, government, experts and NGOs;
- ii. to identify the threats and pressures on biodiversity in different spatial and social contexts of the state and their proximate and root causes;



- iii. to evolve workable strategies for sustainable use and conservation of biological resources and formulate actions accordingly involving people, government machinery and NGOs;
- iv. to highlight the role of the people, NGOs and the government on biodiversity use and conservation and the initiatives taken by them in this regard;
- v. to analyse the gaps in information, institutional and legal structure relating to biodiversity and to suggest measures to bridge the identified gaps;
- vi. to promote peoples' awareness and active participation in understanding various aspects of biodiversity ensuring its sustainable use and conservation; and
- vii. to create a conducive environment in which the people belonging to different economic classes and communities can share their ideas, views and actions in conservation and sustainable use of biodiversity, especially to safeguard its already threatened components.

1.4 Methodology

As the biodiversity strategy and action plan encompasses all the geographical units, ecosystems, population groups and the economy and culture of the state, a wide range of information and data pertaining to biodiversity and related issues have been collected, and also generated wherever possible. This is really a Herculean task; the accomplishment of which requires utmost sincerity and seriousness. Therefore, since the beginning of the project efforts were made to evolve a well thought-out multi-staged methodology as stated below.

Stage 1 : The first stage includes constitution of different committees and organizational networking. The State Steering Committee has been constituted with as many as 41 members drawn from the Government of Assam and its various departments; academic institutions, NGOs and individual experts in order to guide and monitor the whole course of the work. A core committee consisting of experts from various relevant fields has also been formed to carry on the work in right direction within the time stipulated. Moreover, a full time Joint Coordinator and a research fellow have been engaged to coordinate and streamline the network of activities carried out in different parts of the state.

In view of the wide diversity of nature and culture in the state and to do necessary justice in representing the reality, a local level network covering all the districts (excluding Karbi Anglong) has been formed under the existing organizational set up of the Assam Science Society, the nodal agency for the project (Fig 1). This network, which is expected to function even after the given tenure of NBSAP is over, is christened as Assam Science Society Biodiversity Network (ASSBN). This network not only includes the members of the society, but also local NGOs and individual experts. As many as 18 local working groups (LWG) thus constituted have been entrusted with collection of relevant information from secondary sources and through primary survey wherever required. The LWGs accordingly prepared reports of their own area (district or any major area thereof) on the basis of data and information collected during the period from March to July, 2001. Parallely a mobile team consisting of a few

members from the core committee travelled from one area to the other within the state to coordinate the activities of the local working groups on the one hand and to record the outcomes of the public hearings (*raij mel*) organized in different parts of the state on the other. In order to streamline the works of the LWGs particularly in respect of collecting information and prioritization of the conservation measures, an exhaustive data format has been prepared keeping in view all relevant aspects of biodiversity.

Stage 2 : It includes collection of information from secondary sources such as government departments, directorates, research institutes, universities and NGOs primarily by the core committee members. This is closely followed by the activities like :

- i. acquisition of the reports prepared by the LWGs and the inputs provided by individual experts primarily on the status of flora and fauna and associated problems.
- ii. compilation and editing of the secondary data and information, reports of the LWGs and the inputs of the NGOs and individual experts;
- iii. holding of workshops, meetings to discuss the outputs of the LWGs and the secondary information collected;
- iv. reviewing and upgrading of the status of biodiversity reported by the LWGs and the core committee members.

Stage 3 : This stage includes the steps for drafting the report and giving it a final shape. The steps are :

- i. organisation of a two-day workshop inviting the core committee members, selected members from the LWGs, experts and few members from NGOs to prepare the format of the report, especially the section on strategy and action plan;
- ii. preparation of the draft report by the core committee members;
- iii. presentation of the draft in the NBSAP regional meeting covering the north-eastern states held at Guwahati during 18-19 December, 2001 for review;
- iv. modification/alteration of the draft on the basis of the deliberations in the regional meeting for presentation before the State Steering Committee held on January 11th, 2002 for finalization and approval;
- v. production of the final report.



BIODIVERSITY OF ASSAM

Status Strategy & Action Plan for Conservation

Main Focus

- ☞ Plant Diversity: medicinal plants, bamboo & cane, orchids, endemic flora, food plants
- ☞ Animal Diversity: mammals, aves, reptiles, amphibia, fish, butterfly, mosquito
- ☞ Agricultural Diversity: crops, horticulture, livestock, sericulture
- ☞ Biodiversity Loss
- ☞ Major Actors of Biodiversity Conservation
- ☞ Strategy and Action Plan for Conservation and Sustainable Use of Biodiversity
- ☞ Constitutional and Statutory Protection
- ☞ Documentation: maps and photographs



Assam Science Society

Founded in 1953, Assam Science Society (ASS) is one of the oldest and most vibrant voluntary organizations of the country dedicated to the cause of popularizing science among the masses. Today, with a network of more than one hundred branches throughout the state and a membership strength of over five thousand, the society has accomplished new heights in its mission to create public awareness in the fields of science education, environment and health, biodiversity, agriculture and livestock, conservation of nature and natural resources.



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