



Chapter - 3

THEME: BIODIVERSITY

Biodiversity is the degree of variation of life forms within a given ecosystem and is a measure of the health of an ecosystem. Life on Earth today consists of many millions of distinct biological species and India is one of the 17 identified mega biodiverse countries of the world. With only 2.4 per cent of the total land area of the world, the known biodiversity of India contributes 8 per cent to the known global biodiversity. It has been estimated that at least 10 per cent of the country's recorded wild flora, and possibly the same percentage of its wild fauna, are on the threatened list, many of them on the verge of extinction.

3.1 Regulation of Biodiversity in India

National Biodiversity Authority (NBA) was established in 2003 by the Government of India for the regulation, conservation and sustainable use of bio-resources of India. Even six years after its formation, NBA could not notify important regulations like access to biodiversity, transfer of results of research and intellectual property rights etc. Lists of endangered medicinal plants in India and measures for their conservation were not drawn up. NBA's efforts in identifying threatened, endangered and endemic species and recommending guidelines for their conservation were inadequate as list of endangered species was prepared for only seven out of 28 states. It also failed to get the Peoples' Biodiversity Registers and database of biological resources prepared, both of which were vital for efforts at protection and conservation of biological resources. It had no information on grant of Intellectual Property Rights outside India on any biological resource obtained from India or knowledge associated with such biological resources which is derived from India.

3.1.1 Introduction

(i) Biodiversity in India

The term 'biodiversity' is used to refer to all aspects of variability in the living world, including diversity within and between individuals, populations, species, communities and ecosystems. Often, the term 'biodiversity' is used to refer to all species and habitats in a given area for the variety of life and includes plants, animals and micro-organisms, their genes and the systems they inhabit. India is one of the 17 identified mega biodiverse countries of the world. From about 70 *per cent* of the total geographical



Biodiversity in India

area surveyed so far, 45500 plant species²⁴ and 91000 animal species representing about seven *per cent* of the world's flora and 6.5 *per cent* of the world's fauna, respectively, have been identified. From the biodiversity standpoint, India has 59353 insect species, 2546 fish species, 240 amphibian species, 460 reptile species, 1232 bird species and 397 mammal species, of which 18.4 *per cent* are endemic²⁵ and 10.8 *per cent* are threatened. With only 2.4 *per cent* of the total land area of the world, the known biological diversity of India contributes 8 *per cent* to the known global biological diversity. It has been estimated that at least 10 *per cent* of the country's recorded wild flora, and possibly the same percentage of its wild fauna, are on the threatened list, many of them on the verge of extinction.

(ii) Threats to Biodiversity in India

Traditional and substantial dependence on biodiversity resources for fodder, fuel wood, timber and minor forest produce has been an accepted way of life for the rural population that accounts for nearly 74 *per cent* of India's population²⁶. With radical demographic changes, the land to man ratio and forest to man ratio has rapidly declined.



Aconitum ferox-a critically endangered species

Lifestyles and biomass resource needs having remained unchanged, the remaining forests have come under relentless pressure of encroachment for cultivation and unsustainable resource extraction, rendering the very resource base unproductive and depleted of its biodiversity. Coupled with these incongruities and aberrations in land use, unsound development strategies have led to increasing threats to biodiversity resources by way of illegal encroachment of forests and clearing of forests for purposes like agriculture, construction of industries and townships etc. Human activities are directly and indirectly responsible for current high rates of biodiversity loss.

²⁴ Including fungi and lower plants.

²⁵ Endemic, in a broad sense, can mean 'belonging' or 'native to', 'characteristic of', or 'prevalent in' a particular geography, group, field, area, or environment; native to an area or scope.

²⁶ State of Environment Report 2009, Ministry of Environment and Forests.

(iii) Global and Indian response to threats to biodiversity

To encourage the protection of biodiversity by national governments, Convention on Biological Diversity (CBD), an international legally binding treaty, was adopted by the United Nations Conference on Environment and Development, Rio de Janeiro in 1992.



Cutting down of forests

CBD has three main objectives, (i) conserving biological diversity, (ii) using biological diversity in a sustainable fashion and (iii) sharing the benefits of biological diversity fairly and equitably. India became a party to this treaty in 1994.

CBD committed India to the protection of its biodiversity and to provide for conservation, sustainable utilisation and equitable sharing of the benefits arising out of utilisation of its genetic resources. To give effect to CBD, the Biological Diversity Act (Act) was enacted in 2002. The Act listed provisions for regulated access to biological resources by bonafide end-users for various purposes including scientific research, commercial activities and sustainable use of non-timber forest produce. The Act was to be



Non timber forest products

implemented through three functional bodies, viz., the National Biodiversity Authority at the national level, State Biodiversity Boards (SBBs) in different states and Biodiversity Management Committees (BMCs) at the level of local communities.

As provided in the Act, the Central Government established a National Biodiversity Authority (NBA) in October 2003 in Chennai for implementing the provisions of the Act. NBA is under the administrative control of the Ministry of Environment and Forests (MoEF) and consists of a Chairman as the Chief Executive and 10 ex-officio members appointed by the Central Government and five non-official members to be appointed from amongst specialists and scientists, representatives of industry, conservers, etc. MoEF sanctioned 19 regular posts including Chairman and Secretary to carry out day to day functioning of the Authority of which NBA could fill up 13 regular posts as of April 2009. During 2004-05 to 2008-09, NBA received grants worth ₹9.43 crore from MoEF and incurred an expenditure of ₹8.07 crore.

In March 2009, Audit reviewed the functioning of NBA with respect to its role in regulation of biodiversity, covering the period from 2004 to 2009. The important audit findings noticed during the review are detailed in the succeeding paragraphs.

Audit Findings

3.1.2 Protection and Conservation of biodiversity

(a) State Biodiversity Boards

The Act provided for establishment of State Biodiversity Boards (SBB) for advising State Governments on conservation of biodiversity, sustainable use of its components, equitable sharing of benefits, regulating grant of approvals etc. In terms of the Biodiversity Rules 2004, NBA was to coordinate the activities of SBBs and provide them technical assistance and guidance and also issue directions to SBBs and Biodiversity Management Committees in writing, for effective implementation of the Act.



Berberis Aristata- an endangered species

While 21 states had established SBBs, seven states (Maharashtra, Rajasthan, Bihar, Orissa, Meghalaya, Jammu & Kashmir and Assam) had not established SBBs as of April 2009. NBA informed Audit that it neither had reasons for non establishment of SBBs in the seven States nor did it have information on how the functions outlined in the Act were carried out in the states in the absence of SBBs.

NBA stated in October 2009 that they, along with MoEF, had taken several steps for persuading the states to set up SBBs through letters & reminders by Minister, Secretary etc. MoEF stated in March 2010 that Government of Orissa had since constituted its Biodiversity Board in November 2009 and efforts were being made to persuade the remaining states to constitute Biodiversity Boards.

Recommendation - 5

Being a statutory body responsible for conservation of biodiversity all over the country, NBA may make proactive efforts to persuade the remaining states to constitute State Biodiversity Boards.

(b) Functioning of State Biodiversity Boards and creation of Peoples Biodiversity Registers

The Act empowered SBBs to grant approval to Indian citizens, in consultation with local bodies, for commercial utilisation of biological resources. SBBs may also prohibit/restrict use of such resources for practicing indigenous medicines by local people who were growers and cultivators of biodiversity and who were otherwise exempted from obtaining such approval from SBBs. It was observed in audit that only seven out of 22 SBBs established so far, had notified its Biological Diversity Rules as of March 2009. It was further observed that there was no mechanism available in NBA to monitor effectively the functioning of SBBs.



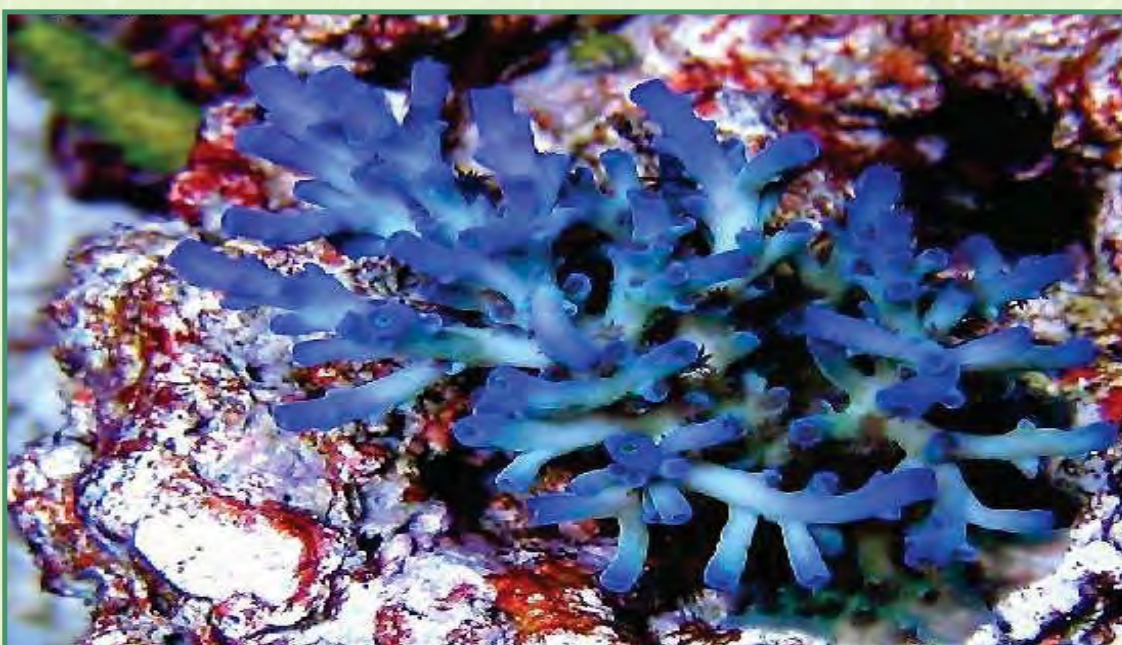
Podophyllum hexamdram-- a critically endangered species

Biodiversity Management Committees (BMCs) were to be constituted in all local bodies for promoting conservation, sustainable use and documentation of biodiversity resources. It was observed that BMCs were constituted in only 29125 (12 per cent) out of more than 2.4 lakh local bodies in the states. The main function of the BMCs was the preparation of Peoples Biodiversity Registers²⁷ (PBRs) in consultation with the local people. PBR was to contain comprehensive information on availability and knowledge of

²⁷ Containing comprehensive information of availability and knowledge of local biological resources, their medicinal or any other use or any traditional knowledge associated with them.

local biological resources or any other traditional knowledge associated with them. The establishment of comprehensive PBRs would not only help to inventorise and document the local biological and genetic resources, it would also help to conserve and sustainably use the biological resources. It was observed that these PBRs were not maintained by a majority of BMCs. Thus, information on biodiversity remained undocumented though NBA was expected to consult BMCs before granting approvals for commercial utilization of biological resources under the Act.

NBA instructed SBBs in September 2008 to compile information on use of biological resources by bio-industries and complete the work before March 2009 and also assured them financial assistance of ₹2 lakh to ₹3 lakh for this work. However, it was observed that SBBs did not furnish the required information as of March 2009.



Acropora Echinata—a vulnerable species

NBA initially replied in April 2009 that it did not have information with regard to the work entrusted to SBBs and pointed out again in October 2009 that a task force would be constituted for assessing the requirements of finance, manpower and infrastructure in SBBs/BMCs. Regarding PBRs, MoEF stated in March 2010 that a simplified model had been finalised and circulated among SBBs and action ultimately had to be completed by the State level functionaries and NBA had been pursuing the matter with SBBs/BMCs. As regards project on compiling of information on the use of biological resources by the industries, MoEF replied that it had been discussed recently and results presented were being fortified and augmented by including additional information.

The fact remains that a large percentage of the biodiversity existing in India remains undocumented and their conservation and sustainable use cannot be effectively promoted in the absence of such documentation.

Recommendation - 6

For effective conservation and documentation of biodiversity at the field level, it is important that NBA makes added efforts to get the states to constitute BMCs in all local bodies for promoting conservation, sustainable use and documentation of biodiversity resources. It is also vital that comprehensive PBRs to inventorise and document the local biological and genetic resources are prepared urgently and updated regularly.

(c) Database of biological resources

The Biological Diversity Rules²⁸ stipulated that NBA should take steps to build up a database and create information and documentation systems for biological resources and associated traditional knowledge through biodiversity registers and electronic databases. NBA initially decided in November 2003 to have an exclusive database containing the information required. Later, in August 2004, it decided to get the gaps filled in the database already available on the subject and also to establish a Biodiversity Resource Centre.

In January 2006, NBA constituted an Expert Committee to develop guidelines for the purpose. In June 2006, the Expert Committee recommended a pilot project proposal for Indian Biodiversity Information System (IBIS). NBA included the proposal to create IBIS in the Eleventh Five Year Plan period (2007-12) document and sent it to MoEF in August 2006 for approval. However, the proposal was yet to receive the approval of MoEF.



Heliopora Coerulea- an endangered blue coral

²⁸ Came into force in 2004 and stipulated the roles and responsibilities of NBA and its members.

In March 2006, MoEF instructed NBA to provide information on rare and endangered biological material being utilised by ayurvedic companies to make products and the source of such material and reminded NBA for this information in May 2007. In the absence of the database, NBA could not furnish information even as of March 2009 and the possibility of ayurvedic companies using rare and endangered species cannot be ruled out. MoEF, in April 2010, stated that IBIS was still in a very elementary form needing substantive further work and NBA had recently constituted an Expert Committee on the subject.

Reply of MoEF indicated that no concrete decision could be taken by MoEF on the issue even after a lapse of seven years of decision taken to have a database.

Recommendation - 7

NBA needs to put in place a database of biological resources for creating information and documentation systems for biological resources and associated traditional knowledge through electronic databases. MoEF may expedite the approval for creation of IBIS and also release the required funds.

(d) Grant of Intellectual Property Rights outside India

The Act empowered NBA to oppose, on behalf of the Central Government, the grant of IPR in any country outside India on any biological resource obtained from India or knowledge associated with such biological resources which is derived from India. For this purpose, the Biological Diversity Rules envisaged appointment of legal experts by NBA.

It was observed that though NBA appointed a legal consultant in November 2005, it did not take effective action to contest questionable IPRs. It also did not set up a monitoring cell within NBA to keep track of IPRs granted outside the country. It was also observed that though NBA had assured²⁹ Parliament in February 2006 that it would set up a monitoring cell to identify and contest IPRs granted outside the country and that steps would be taken to protect IPR for neem, basmati rice and turmeric, NBA had neither set up the monitoring cell nor did it obtain legal opinion on neem, basmati rice and turmeric IPRs.

NBA stated in April 2009 that it was in the process of establishing a legal cell based on instructions of MoEF. MoEF replied in March 2010 that constitution of legal cell had taken time since few legal professionals had expertise in biodiversity and, therefore, it had to be very careful in selecting the competent expert in the field. MoEF further stated that NBA would have a monitoring cell shortly.

Recommendation - 8

NBA may urgently set up a monitoring cell to keep track of Intellectual Property Rights granted outside India.

(e) Protection of knowledge of locals on biological diversity

With a view to protecting the knowledge of local people on biological diversity, the Act envisaged that NBA should make recommendations to Central Government on such unique measures that include registration of such knowledge at local, state and national levels.

After a lapse of four years of establishment of NBA, an Expert Committee was constituted in November 2007 for developing guidelines within 90 days for documentation of local biodiversity, bio-resources

²⁹ In response to Rajya Sabha Question Dy.No.S3021 regarding steps proposed to be taken for appropriate and expeditious action to file patent claims on geographical indicators like Neem, Basmati rice and turmeric etc.

and associated traditional knowledge and to develop ways and means for documentation of a few selected areas of traditional knowledge for commercial exploitation. It was observed in audit that this Committee did not meet even once as of March 2009. Consequently, no recommendations on this vital area dealing with livelihood of tribal and other communities that depended on biodiversity were available.

NBA stated in October 2009 that draft rules finalised in consultation with leading lawyers was under circulation amongst SBBs and other stakeholders. It added that national consultation would also be held to finalise these rules. MoEF also reiterated in March 2010 that outcomes finalised by leading lawyers were circulated among stakeholders and India had hosted an Expert group meeting on traditional knowledge in June 2009. MoEF also added that a national consultation involving stakeholders would also be held in April 2010.

In the absence of documentation of biodiversity, bio-resources and associated traditional knowledge, effective efforts at protection and conservation were not possible.

Recommendation - 9

NBA may develop guidelines for documentation of local biodiversity, bio-resources and associated traditional knowledge and document a few selected areas/fields of 'traditional knowledge' for commercial exploitation.

3.1.3 Regulatory and advisory functions

Section 64 of the Act stipulated that NBA should make regulations for implementing provisions of the Act, with prior approval of the Central Government and by notifying these regulations in the Gazette of India. Further, according to the Section 3 (1) of the Act, no person, without approval of NBA, was to obtain any biological resource occurring in India or knowledge associated thereto for research, commercial utilisation, bio-survey and bio-utilisation.

It was observed in audit that during six years of its existence, NBA had notified only three regulations viz., Guidelines on (i) Enforcement of the Act, (ii) Collaborative research, and (iii) Establishment of repositories. Other important regulations on matters such as access to biological resources, sharing of benefits arising out of the use of accessed biological resources, advice to Government on conservation of biodiversity etc., had not been notified as of March 2009.

NBA stated in October 2009 that it was pursuing the matter vigorously with various committees and added that finalisation of regulations was a continuous process requiring several deliberations and consultation at national level. MoEF also added in March 2010 that framing guidelines was a time consuming and long drawn, lengthy process. The replies of NBA and MoEF needed to be viewed in light of the fact that delay in finalisation of guidelines resulted in delays in effective implementation of the Act and posed a risk to the protection and conservation of biodiversity in India.

Non-finalisation of regulations hampered critical functions expected to be carried out by NBA as detailed in the following paragraphs.

(a) Regulation of access to biodiversity, transfer of results of research and intellectual property rights

It is the mandate of NBA to regulate activities regarding access to biodiversity in order to ensure equitable sharing of benefits arising out of the use of accessed biological resources among persons applying for license, local bodies concerned and benefit claimers. The relevant sections of the Act are as follows:

- Section 3 of the Act prohibits Non-Resident Indians, foreigners and bodies not incorporated in India from having any access to biological resources occurring in India or knowledge associated thereto for research or for commercial utilisation, without previous approval of NBA.
- Section 4 prohibits any person from transferring results of any research to aforesaid persons without the prior approval of NBA.
- Section 6 stipulates that no person should apply for Intellectual Property Rights (IPR) in or outside India for any invention based on any research or information on biological resources obtained from India, without obtaining previous approval of NBA.

Regulations on access to biodiversity and transfer of results of research

It was observed in audit that for finalising regulations on access and benefit sharing and material transfer agreement (relating to Section 3), NBA constituted an Expert Committee in October 2005. The draft regulations prepared by the Expert Committee were approved in June 2007. In November 2007, NBA also approved the guidelines on results of research (relating to Section 4) finalised by another Expert Committee which was constituted in May 2009 for preparation of these guidelines. Though both of these were referred to MoEF in July 2007 and January 2008 respectively, MoEF did not notify them as of March 2010 despite reminders from NBA in August 2008, February and March 2009.

Regulations on IPR

It was further observed in audit that NBA constituted another Expert Committee headed by an Assistant Director General, Indian Council of Agricultural Research in November 2007 for developing regulations for approval of applications for IPRs and for benefits sharing (relating to Section 6). This Committee did not meet at all till March 2009 for want of expert consultant on the specialised subject.

Thus, none of the regulations required to be issued under Section 3, 4 and 6 of the Act have been notified so far. Despite the regulatory framework not being in place, Audit observed that NBA issued approvals in 13 out of 61 applications, it received for access to bioresources. It also received 13 applications for transfer of results of research and issued approvals in nine cases. It further received 325 applications relating to IPR and issued approvals in 33 cases. In the absence of notified regulations, issue of approvals can be questioned on the grounds of transparency and objectivity. NBA had itself opined in its first meeting held in November 2003 that it was not legally empowered or administratively in a position to process and issue approvals in the absence of notified regulations.

NBA stated in October 2009 that to safeguard bio-resources, pending notification of regulations, it would continue to process applications for issue of approvals. MoEF stated in March 2010 that applications were scrutinised and examined by the Expert Committees and recommendations were placed before NBA. After NBA's approval, agreements were entered into with the applicants. MoEF further stated that all approvals given were legally valid as NBA had entered into agreement with the applicants. MoEF further stated in April 2010 that access and benefit sharing being a complex issue, draft guidelines on this matter were still being deliberated upon and the revised draft guidelines inviting comments were posted on NBA's website in February 2010. As regards guidelines on transfer of research results, MoEF stated that guidelines prepared by the Committee were utilised for finalising the format for agreement on transfer of research results. Thus, the process of finalising regulations to control activities regarding access to biodiversity among persons applying for license was not completed even after a lapse of more than four years and no realistic target was also fixed for finalisation of these important regulations.

Recommendation - 10

NBA/MoEF may draw a specific timeframe for finalisation of regulations to control access to biodiversity among persons applying for license and notify them within that timeframe so that effective regulation and control of biodiversity in India can be exercised.

(b) Conservation of rare and endangered medicinal plants

After four years of its establishment, NBA constituted an Expert Committee on medicinal plants in January 2008 to:

- provide a list of medicinal plants normally traded in India,
- discuss and develop guidelines for benefit sharing of cultivated and wild medicinal plants,
- regulate bio-resources of medicinal plants to prevent bio-piracy,
- suggest ways and means of safeguarding traditional knowledge related to medicinal plants,
- suggest a list of endangered medicinal plants/develop guidelines for their conservation, and
- suggest measures to implement Section 6 of Biological Diversity Act 2002.



Dactylorhiza hatagirea—a high value medicinal plant

The Committee was to complete its work within 90 days. It was observed in audit that the Committee met only once in April 2008 and regulations had not been finalised even as of March 2009. The finalisation of these regulations was not expedited despite concerns raised in the Parliament³⁰ in March 2008 regarding extinction of herbal plants in the country.

NBA stated in April 2009 that it proposed to reconstitute the Expert Committee for developing regulations and that till notification of regulations, provisions of the Wildlife Act governed the endangered species. MoEF replied in March 2010 that Botanical Survey of India (BSI) was asked to prepare a state-wise list of threatened species of plants and comments on the list of endangered

³⁰ Rajya Sabha Unstarred Question No.S2492 regarding “Extinction of Herbal Plants” due for reply in March 2008.

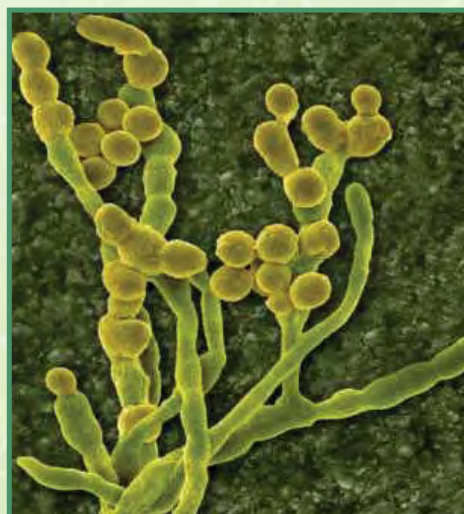
species were received from some of the State Governments. After examining their comments, lists were notified between March and September 2009, for seven states namely, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Kerala, Orissa, Mizoram and Meghalaya. MoEF further stated that matter was being pursued with other state Governments.

Recommendation - 11

NBA may draw a time bound action plan to ensure that the list of endangered species in rest of the 21 states is notified as quickly as possible so that the risk of exploitation of medicinal plants for commercial purposes and consequent threats to their conservation can be minimised.

(c) Conservation of micro-organisms

The use and transfer of biological resources including micro-organisms³¹ required prior approval under the Act. Further, NBA was to ensure equitable sharing of benefits arising out of use of micro-organisms. To achieve this purpose, NBA constituted an Expert Committee in January 2008 to develop guidelines on soil, sediment and microbial diversity including transfer and exchange of different categories of micro-organisms and mechanism for benefits sharing. It was observed in audit that the Committee met thrice in 2008 and prepared the guidelines. However, these guidelines were not notified as required. As a result, it was not possible to ensure that research organisations transferred and used micro-organisms by sharing benefits, as envisaged in the Act.



Cladosporium-a micro organism

NBA stated in October 2009 that it would modify the regulations prepared by Expert Committee, based on discussions and forward it to the Ministry for notifying. MoEF also replied in March 2010 that some more work on the draft was required and discussion was underway.

Recommendation - 12

NBA may draw specific timelines to develop guidelines on soil, sediment and microbial diversity including transfer and exchange of different categories of micro-organisms and mechanism for benefits sharing so that these activities could be effectively regulated.

(d) Normally traded commodities

Section 40 of the Act empowered the Central Government to exempt from its purview, any item or biological resources normally traded as commodities, in consultation with NBA. In this connection, NBA was required to prepare a list of biological materials which were normally traded as commodities and notify the same. NBA constituted an Expert Committee in October 2005 to define Normally Traded Commodities (NTC), prepare an inventory of NTC and to develop guidelines incorporating reciprocal livelihood measures to protect interest of those concerned in the country, duly considering measures to promote conservation of species that were under heavy pressure of trading.

³¹ Any of various microscopic organisms including algae, bacteria, fungi, protozoa and viruses.

It was observed in audit that the Expert Committee met thrice and recommended the first list of normally traded commodities containing 1040 species in March 2008. Later on, it was decided to notify only the medicinal plants, vegetables, fruits, food crops, spices and condiments which were mainly cultivated. Accordingly, fresh draft guidelines including only 180 species of medicinal plants were sent to MoEF in February 2009.

MoEF stated in March 2010 that the matter required wide ranging consultations with different stakeholders and based upon consultations, the list was finalised and notified in October 2009. MoEF further stated that there had been no adverse effect on trade as the same was regulated by Director General of Foreign Trade (DGFT).

The reply needs to be viewed in the light of the fact that the first list containing 180 species of medicinal plants only was notified as against 1040 species prepared by NBA that too after inordinate delay. Thus, the list notified was only partial and did not cover other species like marine fruits, vegetables, species etc. The reply also needs to be viewed in light of the fact that in the absence of notification of a complete list, there was bound to be loss of biodiversity due to trading of species without appropriate regulations. The contention that trade has been regulated by DGFT and hence there would be no adverse effect is to be viewed in the background of the fact that according to the Act, it was the responsibility of NBA to prepare a list of biological materials that were normally traded as commodities and to notify the same.

Recommendation - 13

NBA may prepare a comprehensive inventory of Normally Traded Commodities and guidelines for protection of livelihood and promote conservation of species that were under heavy pressure of trading.

(e) Protection of endangered species

The Act empowered the Central Government to notify any species that was on the verge of extinction or was likely to face extinction in the near future as threatened species and take appropriate steps to conserve them. NBA, in discharge of its responsibility of providing advice to the Central Government on matters relating to the Act, constituted an Expert Committee in October 2005. This Expert Committee



Gaurus - a large wild ox on the verge of extinction

was to develop guidelines within 90 days to identify, notify and de-notify rare, threatened, endangered and endemic species and also to recommend the final list and regulations for conservation. The Expert Committee made its recommendations in April 2006 and NBA approved them in June 2007 and forwarded the draft regulation to MoEF in July 2007. MoEF directed BSI and Zoological Survey of India (ZSI) to prepare state-wise list of critical species of plants and animals and prepare guidelines to prohibit or regulate collection of these species, along with measures to rehabilitate and preserve them. ZSI prepared the list in August 2008 and BSI prepared the list and guidelines in October 2008. MoEF requested all the states in October 2008 to send their views/approval on the list of threatened species in their states and also directed NBA in October 2008 to take follow up action with State Biodiversity Boards (SBBs) and State Governments for their response within one month. It was observed in audit that NBA did not revisit the list of critically endangered species of mammals, birds, reptiles, amphibian and fishes as requested by MoEF. It was further observed in audit that NBA also did not have any information on the receipt of information from the SBBs/State Governments regarding the list of critically endangered species. As a result, the list of critically endangered species could not be notified and measures to ensure their conservation also could not be put in place.

NBA stated in October 2009 that MoEF had notified the species of plants and animals which were on the verge of extinction and prohibited /regulated their collection in four states viz., Himachal Pradesh, Kerala, Uttar Pradesh and Uttarakhand during March - April 2009. MoEF stated in March 2010 that only seven states had responded by offering comments on the list prepared by BSI and hence list of species were notified for these states including Orissa, Mizoram and Meghalaya for which notification was issued in September 2009. MoEF further added that the matter was being pursued with other state Governments.

Recommendation - 14

In order to effectively protect and conserve species that are on the verge of extinction or are likely to face extinction in the near future, NBA and MoEF may intensify their efforts, after ensuring cooperation from the states, to prepare the list of threatened, endangered and endemic species and to recommend regulations for their conservation.

(f) Biodiversity Heritage Sites

The Act empowered the State Governments to notify, in consultation with the local bodies, areas of biodiversity importance as Biodiversity Heritage Sites (BHS). State Governments were to frame rules for management and conservation of BHS and to formulate schemes to provide compensation to those that were economically affected by such BHS. Accordingly, NBA constituted two Expert Committees – one in July 2006 for preparing guidelines on establishment of BHS and another in January 2009 for preparing rules for management and conservation of BHS.

The Expert Committee on establishment of BHS submitted its recommendations in June 2008. It was observed in audit that MoEF, after initially instructing NBA in July 2008 not to proceed further on the issue as the establishment of BHS was the responsibility of State Governments, again instructed NBA in September 2008 to prepare the draft rules. However, these rules have not been finalised and notified as of March 2009.

Audit also observed that the Expert Committee on management and conservation of BHS met only once in February 2009 and though draft rules were prepared, these have not been finalised as of March 2009, despite assurances³² given to the Parliament that these would be finalised by December 2008.

³² Lok Sabha Unstarred Question No. 2330 dated 29 August, 2007 seeking clarification as to whether the Expert Committee of the NBA has formed guidelines for identifying, declaring and managing bio-diversity heritage sites in the country.

NBA stated in October 2009 that the recommendations of the Expert Committee as approved by it were circulated among SBBs. It further stated that four states i.e., Arunachal Pradesh, Manipur, Punjab and Uttarakhand forwarded lists of areas of biodiversity importance that were threatened by overuse and negligence. MoEF also reiterated in March 2010 that guidelines were circulated among SBBs and NBA was making efforts in supporting SBBs for declaration of BHS. MoEF added that matter had to be discussed with experts as it was a complex issue and an ongoing exercise and, therefore, there was no delay. In April 2010, MoEF further stated that NBA was in the process of setting up a legal cell and draft rules would be prepared with legal assistance after setting up of the legal cell.

Replies of NBA and MoEF needs to be viewed in light of the fact that in the absence of uniform regulations for conservation and protection of BHS, even the sites identified as BHS would not be adequately conserved. The contention that there was no delay is also not acceptable since NBA could not notify the guidelines even after a lapse of more than five years of its establishment. Further, the legal cell was not set up by NBA so far as discussed in detail in paragraph 3.1.2 (d) and, therefore, preparation of draft rules for BHS was likely to be further delayed.

Recommendation - 15

NBA may set up a legal cell immediately to expedite the preparation of guidelines on establishment of BHS and framing of rules for management and conservation of BHS.

(g) Agro biodiversity

The Act provided for constitution of a Committee to deal with agro biodiversity³³. In this context, NBA constituted an advisory committee on agro biodiversity in December 2005 for defining clearly, the areas of overlap and explicit differences in the Act, the Seed Act and the Plant Variety Protection & Farmers Rights Act and to prepare guidelines on how the Act could be interpreted in relation to the provisions contained in the aforesaid and similar Acts. The Committee was also to identify the position of the Act in light of the provisions contained in the Patents Act and the Geographical Indications Act and to prepare guidelines for the origin of domesticated diversity and documentation of agro biodiversity issues.

It was observed in audit that the Committee met only once in December 2005 and was yet to submit the deliverables. Thus, the issues relating to agro biodiversity concerns remained unaddressed.



Agro biodiversity in India—pigeon pea

NBA stated in October 2009 that the Committee met in December 2005 and submitted recommendations on guidelines for collaborative research projects. It further stated that proposal for reconstitution of the Committee was under its consideration. MoEF replied in January 2010 that Committee had been reconstituted and it held its first meeting in January 2010. MoEF added in March 2010 that the reconstituted committee would come out with deliverables for different issues concerning agro biodiversity. The fact remained that the important issues identified by NBA on agro biodiversity in October 2005 remained unaddressed even as of March 2009 which would impact agro biodiversity in India.

³³ Biological diversity of agricultural related species and their wild relatives.

Recommendation - 16

In light of the critical nature of agro biodiversity, NBA may intensify its efforts for preparation of guidelines for the origin of domesticated diversity and documentation of agro biodiversity issues, apart from reconciling rules relating to agro biodiversity prescribed under various Acts.

3.1.4 Meetings of National Biodiversity Authority

As against the stipulation in the Biological Diversity Rules of holding the meetings of NBA four times normally in a year with a gap of three months, NBA, during the five year period 2004-09, met only 12 times against a requirement of 20 meetings. Apart from Authority meetings, NBA did not prescribe any periodical returns. This led to inadequate monitoring of functioning of various committees and of various steps taken to implement the Act as discussed in the above paragraphs.

NBA in October 2009 noted the observations for future compliance and MoEF also agreed to make efforts to organise meetings in time regularly.

3.1.5 Financial Management**(a) Finances**

The details of grants received, utilised and percentage unutilised during 2004-09 were as under.

Expenditure against the grants received during 2004-09			
Year	Grant received	Actual expenditure	per cent savings
2004-05	0.71	0.59	16.90
2005-06	1.37	1.37	0.00
2006-07	2.09	1.40	33.01
2007-08	2.15	1.90	11.63
2008-09	3.11	2.81	9.65
Total	9.43	8.07	14.42

As could be seen from the table, NBA could not utilise the funds made available in full in any of the years except in 2005-06. The amount remaining unspent was revalidated by the MoEF for being utilized for next year. MoEF stated that all efforts would be made to fully utilise the grants sanctioned to NBA.

(b) Utilisation of funds released

NBA released a sum of ₹1.60 crore to 19 SBBs as grant-in-aid during 2004-09 for creation of infrastructural facilities. Of this, utilisation certificates (UCs) for ₹67.10 lakh, comprising 54 per cent of the sums released had not been received as of March 2009 from 12 SBBs. Similarly, UCs for ₹57.22 lakh released during 2006-09 to 36 organisations for undertaking projects / awareness programmes had not been received as of March 2009. Final reports for many of these projects / programmes had also not been received as of March 2009. Thus, the receipt of UCs/final reports was not effectively monitored in NBA.

NBA stated in April 2009 that the matter for obtaining UCs was being pursued vigorously. MoEF replied in March 2010 that SBBs did not have full time Chairman, Secretary and supporting staff to carryout

various jobs and hence sanctioned amount could not be spent by SBBs. Admitting that there was problem in monitoring the progress due to inadequate staff, MoEF added that matter of obtaining UCs was being pursued vigorously.

(c) National Biodiversity Fund

The Act provided for creation of a National Biodiversity Fund by NBA by crediting it with all charges and royalties received. The Fund is to be utilised for channeling benefit to claimers, conservation of biological resources and development of areas from which these resources were accessed. NBA, however, did not so far utilise the funds for the purpose for which it was intended. Instead funds were kept in short term deposits in banks and interest earned was also credited towards the Fund. As of March 2009, there was a balance of ₹38.84 lakh in the fund Account as detailed below.

Table - 12

₹ in crore)

Balance of funds in NBA during 2004-09				
Year	Opening Balance	Receipts	Utilised	Closing Balance
2004-05	0.00	0.00	0.00	0.00
2005-06	0.70*	1.35	0.00	2.05
2006-07	2.05	3.76	0.00	5.81
2007-08	5.81	4.41	0.00	10.22
2008-09	10.22	28.62	0.00	38.84

* Transfer from another account.

NBA stated in October 2009 that an Expert Committee had been constituted to propose draft guidelines for application of funds which could be finalised for submission to the Authority. MoEF also replied in March 2010 that Expert Committee constituted in June 2009 met in August 2009 and draft guidelines prepared by them would be further deliberated and finalised. The fact remains that funds meant for conservation of biological resources had been kept idle due to inaction on the part of NBA in framing the guidelines for application of funds.

3.1.6 Conclusion

National Biodiversity Authority was established in 2003 by the Government of India for the regulation, conservation and sustainable use of bio-resources of India. Even after six years of its formation, NBA could not notify important regulations for implementation of vital provisions for preservation of biodiversity, as required under the Act. Performance of its regulatory and advisory functions was inadequate as it failed to notify all the required guidelines for regulating access to biological resources, sharing of benefits arising out of use of accessed biological resources, advice to government on conservation of biodiversity etc. Lists of endangered medicinal plants in India and measures for their conservation were not drawn up and guidelines to regulate the use and transfer of micro-organisms were yet to be notified. NBA's efforts to identify threatened, endangered and endemic species and to recommend regulations for their conservation were inadequate as list of endangered species was prepared for only seven out of 28 states. It also failed to get the Peoples' Biodiversity Registers and database of biological resources prepared, both of which were vital to efforts at protection and conservation of biological resources. It had no information on grant of Intellectual Property Rights outside India on any biological resource obtained from India or knowledge associated with such biological resources which is derived from India. It failed in its efforts at documentation of biodiversity, bio-resources and associated traditional knowledge, without which effective efforts for protection and conservation were not possible.

3.2 Role of Botanical Survey of India in meeting India's commitments to the Convention on Biological Diversity

The Convention on Biological Diversity (CBD) was ratified in 1994 by 150 countries including India. To implement the provisions of CBD, objectives of Botanical Survey of India (BSI) were remodeled. However, BSI was not effective in meeting its remodeled objectives as there was inadequate identification/ documentation and monitoring of plant species. Very few surveys and explorations were carried out to identify and document the Protected Areas and Fragile ecosystems. The Red Data Book was updated in 1990 and last updated version was printed in 2003 thereby impacting conservation efforts. Further, identification of different ethnic groups associated with usage of plant species for different purposes was not done. BSI did not generate adequate data for in-situ conservation and it did not carry out ex-situ conservation, which impacted conservation of biodiversity. As such, BSI could not effectively fulfill its role in meeting India's commitment to CBD.

3.2.1 Introduction

(i) Biodiversity in India

The Convention on Biological Diversity (CBD) was ratified in 1994 by 150 countries including India. CBD has three main objectives i.e., conserving biological diversity, using biological diversity in a sustainable fashion and sharing the benefits of biological diversity fairly and equitably.

(ii) Role of Botanical Survey of India in meeting commitments to CBD

The Botanical Survey of India (BSI) was established in 1890 at Kolkata. It is a subordinate office under the Ministry of Environment and Forests (MoEF) which is the nodal office in India for the implementation of CBD. Its basic objective was undertaking surveys by exploring the plant resources of the country and identifying flora with economic virtues. After ratification of CBD in February 1994 by the Government of India, a larger role for the BSI was envisaged and objectives of BSI were remodeled in light of India's ratification of the CBD.

Some of the major objectives of BSI in line with the provisions of CBD are as below:

1. Exploration, inventorisation and documentation of phytodiversity³⁴ in general and protected areas, Hotspots, Fragile ecosystems and Sacred Groves³⁵ in particular; publication of national, state and district floras. (*Article 7 of CBD: Identification and Monitoring*)
2. Identification of red list species³⁶ and species rich areas needing conservation; (*Article 7 of CBD: Identification and Monitoring*)
3. Survey and documentation of traditional knowledge (ethnobotany³⁷) associated with plants. (*Article 7 of CBD: Identification and Monitoring*)

³⁴ Phytodiversity is the enumeration of total number and variety plant species of an area.

³⁵ Sacred Groves are groups of plants or a small forest protected by humans inhabiting near or around them due to their religious belief.

³⁶ Red listed species are those threatened species under various categories, which are listed in the International Union for Conservation of Nature (IUCN) list.

³⁷ Ethnobotany is the scientific study of the relationships that exist between people and plants.

4. Ex-situ conservation of critically threatened taxa³⁸ in botanical gardens, develop and maintain botanical gardens, musea³⁹ and herbaria to aid conservation. (Article 8 of CBD: in-situ conservation and Article 9: ex-situ conservation)
5. Revisionary/monographic studies on selected plant groups. (Article 12 of CBD: Research and Training)
6. Environment Impact Assessment of areas assigned to BSI for study. (Article 14 of CBD: Impact Assessment and Minimising Adverse Impacts)

(iii) About BSI

BSI is headed by the Director who is assisted by Additional Directors, Joint Directors, Deputy Directors and other officers as well as a Research Advisory Committee. Besides headquarters at Kolkata, there are 11 circle offices in Itanagar, Shillong, Gangtok, Allahabad, Noida, Dehradun, Jodhpur, Pune, Hyderabad, Coimbatore and Port Blair. During 2002-09, BSI received ₹53.53 crore as Plan funds, against which it incurred an expenditure of ₹50.87 crore. Against receipt of Non-Plan funds of ₹97.17 crore, BSI incurred an expenditure of ₹90.43 crore.

Audit Findings

3.2.2 Financial Management and Manpower

Audit reviewed the role of BSI relating to CBD, especially in light of Articles 7, 8, 9, 12, and 14 of CBD during the period 2002-2009. We observed in audit that BSI did not get the projected funds from MoEF during 2002-09 as detailed in the table given below :

(₹ in crore)

Funds required and sanctioned by MoEF									
Funds asked for by BSI during 2002-2009			Funds released by MoEF during 2002-09			Actual expenditure during 2002-09			
Year	Plan	Non Plan	Total	Plan	Non Plan	Total	Plan	Non Plan	Total
2002-03	10.65	12.38	23.03	5.15	12.38	17.53	4.97	10.97	15.94
2003-04	11.33	12.27	23.60	6.41	12.27	18.68	5.83	10.62	16.45
2004-05	14.38	12.42	26.80	8.78	12.42	21.20	7.89	11.61	19.50
2005-06	16.97	13.10	30.07	6.50	13.10	19.60	6.73	12.43	19.16
2006-07	23.26	13.83	37.09	8.00	13.83	21.83	7.52	12.90	20.42
2007-08	8.00	13.84	21.84	8.00	13.84	21.84	7.66	13.09	20.75
2008-09	10.69	15.13	25.82	10.69	19.33	30.02	10.27	18.81	29.08
Total	95.28	92.97	188.25	53.53	97.17	150.70	50.87	90.43	141.30

Against the projected requirement of ₹95.28 crore towards plan activities during 2002-09, BSI got ₹53.53 crore which was only 56.18 per cent of the projections made by BSI. Further, of the ₹53.53 crore, BSI could spend ₹50.87 crore. The above funds were required by BSI during Tenth and Eleventh Five Year Plan to implement various schemes like studies on floristic diversity of wetlands/protected areas, mapping of medicinal plants, study of sacred-groves, survey & monitoring of wild plants in trade, effective collection, conservation and maintenance of germplasm/gene bank etc.

³⁸ It is plural of "Taxon" which is a taxonomic unit from the rank of Family downwards e.g., Family/genus/species (and its different infra-specific categories like subspecies, variety, sub-variety and forma) which have characters in common differentiating the unit from other such group.

³⁹ It is a depository for living and non-living objects having scientific value.

It was also observed in audit that there were number of vacancies in the various cadres of manpower at BSI as shown below:

Table - 14

Details of Sanctioned strength and men in position in BSI						
Position as on	Scientific			Non-Scientific		
	Sanctioned Strength	Men-in-position	Vacancy	Sanctioned Strength	Men-in-position	Vacancy
As on 01.04.2006	459	283	176 (38.34)	825	618	207 (25.09)
As on 01.04.2007	441	275	166 (37.64)	822	592	230 (27.98)
As on 01.04.2008	441	270	171 (38.78)	817	585	232 (28.40)
As on 01.04.2009	441	268	173 (39.23)	817	587	230 (28.15)
As on 01.04.2010	439	245	194 (44.19)	799	551	248 (31.04)

It could be seen from above that there were significant shortages of manpower in scientific cadres. MoEF replied that no proposal from BSI regarding manpower was pending with it.

The shortage of funds coupled with vacancies in scientific cadres severely impacted various activities taken up by BSI as is clear from the audit findings discussed in succeeding paragraphs. **The Audit findings, based on the revamped objectives of BSI, on meeting India's commitments to CBD are discussed below.**

3.2.3 Exploration, inventorisation and documentation of phytodiversity

Earlier botanical surveys were confined to the collection and documentation of plants species. A review conducted by MoEF/BSI in 2002 studied the activities of BSI from inception upto 2002 and found wide gaps in the status of inventorisation of phytodiversity in India. The review also found that Fragile ecosystems⁴⁰, Hotspots⁴¹ and Protected Areas⁴² like biosphere reserves⁴³, national parks and wildlife sanctuaries which need special attention, had either not been studied at all or had been inventorised in general while studying phytodiversity of districts wherein they were located. The report further stated that keeping the above gaps in mind, documentation of phytodiversity of Protected Areas, Sacred Groves and Fragile ecosystems had to be given top priority post 2002, followed by documentation of phytodiversity of other important regions.

In addition, CBD mandated national governments to undertake the following with regard to identification and monitoring:

- Identify components of biological diversity important for its conservation and sustainable use, especially those ecosystems and habitats which contain high diversity, large numbers of endemic or threatened species;
- Monitor, through sampling and other techniques, the components of biological diversity, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;

⁴⁰ A fragile environment is an ecosystem which lacks resilience or which is so heavily impacted by an 'un-natural' event that it changes in unexpected and undesirable ways.

⁴¹ Hotspots are areas that support natural ecosystems that are largely intact and where native species and communities associated with these ecosystems are well represented.

⁴² Protected Areas are locations which receive protection because of their environmental value, or environmental plus cultural values.

⁴³ The purpose of the formation of the biosphere reserve is to conserve in situ all forms of life, along with its support system, in its totality, so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems.

- Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and
- Maintain and organise, by any mechanism, data derived from identification and monitoring listed above.



Nilgiri Biosphere Reserve, Tamil Nadu

Thus, the added responsibility of CBD and its own report which pointed out shortcomings in identification and monitoring activities necessitated that BSI explore, inventorise and document phytodiversity in general and in Protected Areas, Hotspots, Fragile ecosystems and Sacred Groves in particular, in a sustained and detailed manner. The activities of BSI on survey of flora within the above four geographical areas are discussed in the succeeding paragraphs.

3.2.3.1 Exploration, inventorisation and documentation of phytodiversity in ecologically vulnerable areas

(a) Protected Areas

Protected Areas (National Parks, Wildlife Sanctuaries and Biosphere Reserves) are one of the most widely accepted and practical approaches to biodiversity conservation the world over. India, one of the



Kanha National Park, Madhya Pradesh

twelve megadiversity centres in the world, too, has an extensive Protected Area network, covering about 4.2 per cent of its total landmass. There were 89 National Parks, 13 Biosphere Reserves and 487 Wildlife Sanctuaries comprising total area of 208628 sq. km in India as of April 2002. As per the Review Report of the functions and organization of BSI undertaken in 2002 by MoEF, an area of 135296 sq. km⁴⁴ (64 per cent) remained under-explored/not explored by BSI as of April 2002.

(i) Non-dissemination of research results

We observed that in 2002, BSI proposed to undertake a scheme titled '*Floristic Diversity of Protected Areas (Biosphere Reserves, National Parks and Sanctuaries)*' at an estimated cost of ₹5 crore during the Tenth Five Year Plan. The scheme was proposed with an objective to develop management plans to sustainably manage and conserve plant resources occurring in these Protected Areas. Release of publications in respect of 45 Biosphere Reserves and National Parks which were not earlier explored was also proposed. This included periodic survey/exploration and identification work in the first three years, compilation of data during the fourth and publication in the fifth year.

The results of periodic survey/exploration and identification work by BSI during 2002-09 are depicted in the table below:

Table - 15

Results of periodic survey/exploration and identification work by BSI				
Protected Areas	Number (Total area)	Number (area) explored during 2002-09	Number (area) explored for the first time during 2002-09	Number (area) remaining unexplored
National Parks	89 (37372 sq. km)	32 (16604 sq. km)	21 (9123 sq. km)	57 (20768 sq. km)
Biosphere reserves	13 (54812 sq. km)	6 (29643 sq. km)	4 (14494 sq. km)	7 (25169 sq. km)
Wildlife sanctuaries	487 (116444 sq. km)	31 (11580 sq. km)	27 (10864 sq. km)	456 (10486 sq. km)

It could be seen from above that:

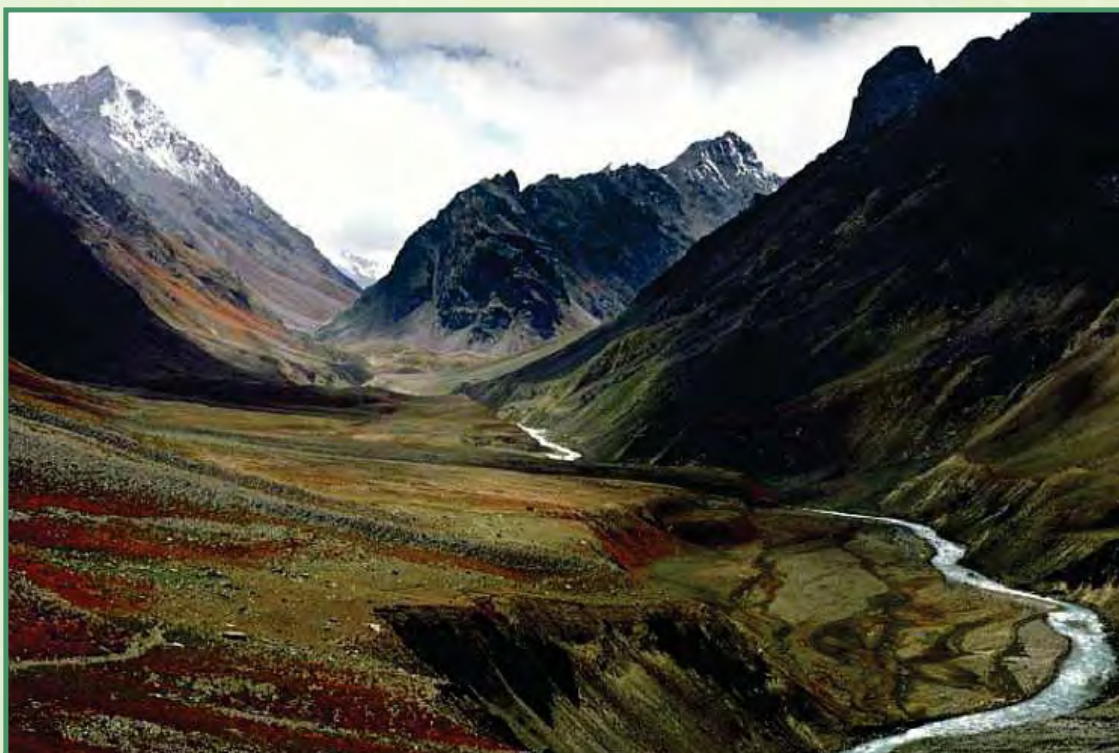
- Only 21 National Parks, 4 Biosphere Reserves and 27 Wildlife Sanctuaries covering 34481 sq. km were fully explored/partially explored for the first time during 2002-09.
- As of 2009, 64 per cent National Parks, 54 per cent Biosphere Reserves and 94 per cent of the Wildlife Sanctuaries remained to be explored.

Thus, periodic survey/exploration and identification work relating to Protected Areas was inadequate. With regard to dissemination of results of survey and exploration, it was further observed in audit that:

- No data was disseminated in the form of publications from this new coverage of 21 National Parks and four Biosphere Reserves till 2009.
- Seven documentations⁴⁵ of phytodiversity (National Parks) were published which covered an area of 6577.41 sq. km only out of 22630 sq. km which pertained to area already explored prior to April 2002.
- Only one documentation was published pertaining to a newly explored Wildlife Sanctuary (Pobitora Wildlife Sanctuary, Assam) covering an area of 38.83 sq. km.

⁴⁴ National Parks 37372 sq. km., Wildlife Sanctuaries 116444 sq. km. and Biosphere Reserves 54812 sq. km.

⁴⁵ Bandhavgarh National Park (Madhya Pradesh), Desert National Park (Rajasthan), Gulf of Mannar National Park (Tamil Nadu), Indravati Tiger Reserve (Chattisgarh), Kanha National Park (Madhya Pradesh), Pin Valley National Park (Himachal Pradesh), and Sanjay Gandhi National Park (Maharashtra).



Pin Valley National Park, Himachal Pradesh

As such, of the total 135296 sq. km, dissemination of research results for only 38.83 sq. km (0.03 per cent) was made, pertaining to area explored for the first time during 2002-09.

MoEF replied in March 2010 that it did not approve the scheme proposed by BSI and no work was undertaken by BSI. MoEF further replied that work of publishing in respect of 40 documentations was still going on, as 13 documentations of phytodiversity had been reviewed and 27 were being evaluated by experts.

Since the work pertaining to coverage of new Protected Areas was not undertaken by BSI as envisaged, it resulted in non-dissemination of research results from the coverage of new areas.

Recommendation - 17

BSI may strengthen its efforts to increase its survey and exploration activities so that the results can be disseminated for developing management plans and effectively conserving the Protected Areas.

(ii) Failure to conduct population studies and mapping

Population study is conducted to determine the total number of individuals of a taxon in the area explored while mapping is done to determine the range of distribution of that particular species. These two are the essential tool for monitoring of species. BSI proposed in the review report submitted in 2002 that while undertaking explorations, scientists were also required to undertake population study and mapping of rare and threatened species.

We reviewed 35 tour reports out of 694 tour reports submitted by scientists and observed that:

- a. In none of the cases, activities relating to population study and mapping were conducted during survey of the above areas.
- b. Tour reports did not contain adequate information for monitoring of plant species.
 - Expected outputs of the investigation were not available in the Tour Reports. As such, there were no criteria to assess/verify extent of achievement of outputs.
 - Detailed map of Protected Area including area surveyed in respect of tours undertaken was also not available in the tour reports. As such, coverage of area could not be worked out. Moreover, effective database of Protected Area could not be maintained which is one of the primary objectives of BSI.
 - Findings on Rare, Endangered and Threatened (RET) species were also not mentioned in the tour reports. Thus, status of distribution of plant species in the particular area and requirement for conservation could not be known.

BSI replied in October 2009 that mapping and population study could not be conducted due to lack of manpower. MoEF replied in March 2010 that BSI's scientists and technical staff were not trained/equipped to prepare detailed maps of the area surveyed or to undertake population studies. The reply of MoEF may be viewed in light of the fact that by not undertaking mapping and population study, BSI could not monitor plant species effectively.

MoEF further stated that findings on RET species could not form part of the tour report as it was very difficult to authentically identify specimens in the field. The reply of MoEF needs to be viewed in the light of the fact that while conducting the review in 2002, BSI itself proposed that during conduct of explorations, the scientists would undertake population study and mapping of rare and threatened species. Also, instead of studies and findings of RET species to be incorporated in the tour reports, tour reports contained only the number of RET species collected. Further, in the absence of information about expected outcomes, the actual outcome could not be measured in audit.

Recommendation - 18

The format of tour reports may prescribe the parameters including expected output of the investigation, methodology followed, photographs of identified interesting species, detailed map of the Protected Area, Hotspots, Fragile ecosystem and Sacred Groves. These tour reports may also include the area surveyed field tour-wise, mapping and population study findings on RET species etc.

(b) Biodiversity Hotspots

Biodiversity Hotspots are areas that support natural ecosystems that are largely intact and where native species and communities associated with these ecosystems are well represented. They are also areas with a high diversity of locally endemic species that are not found elsewhere or are rarely found outside the Hotspot and at the same time face a higher degree of threat. The following are the four biodiversity Hotspots in India.

- Himalayas: Includes the entire Indian Himalayan region
- Indo-Burma: includes entire North-eastern India, except Assam and Andaman group of Island
- Western Ghats
- Sundalands: Includes Nicobar group of Islands.



Western Himalayas- Biodiversity Hotspot

We observed that during 2002-09, nine out of 12 circle offices of BSI did not conduct specific tours for exploration of Hotspots even though exploration, inventorisatio and documentation of phytodiversity in Hotspots, Fragile ecosystems and Sacred Groves in particular was one of the objectives of BSI.

BSI stated in October 2009 that it had undertaken 261 survey and exploration works in Hotspots like Western Himalaya, Eastern Himalaya etc., as per Annual Action Plan. However, scrutiny of Annual Action Plan revealed that the survey work was undertaken during the course of survey work of district/state/Protected Area/wet land flora and not Hotspots in particular, as envisaged in the objectives of BSI.

MoEF stated in March 2010 that exploration made by BSI in these states/areas was in the Hotspot areas since the Hotspots encompass a larger landscape than district/state/Protected area/Fragile ecosystems as pointed out by Audit. The reply needs to be viewed in light of the fact that Hotspots are identified areas of high diversity of locally endemic species and survey work covering limited number of districts/states cannot be construed as covering a Hotspot comprehensively.

Recommendation - 19

In order to ensure that locally endemic species particular to a Hotspot are identified and conserved, it is recommended that special attention be paid to comprehensive survey and documentation of Hotspots.

(c) Fragile ecosystems

A fragile environment is an ecosystem which lacks resilience or which is so heavily impacted by unnatural events that it changes in unexpected and undesirable ways. Fragile ecosystems comprise of wetlands, cold desert regions, glacial moraines etc. BSI undertook survey work on wetlands of international and national importance.

With respect to wetlands of international importance (Ramsar Sites⁴⁶) comprising of 25 geographical⁴⁷ areas and covering 677131 hectares, we observed that:

⁴⁶ 25 designated wetlands of international importance come into force for India on 1.2.1982.

⁴⁷ List of wetlands of international importance as per Ramsar - Upper Ganga River, Surinsar-Mansar Lakes, Rudrasagar Lake, Renuka Wetland, Hokera Wetland, Chandratat Wetland, Vembanad-Kol Wetland, Tsomoriri, Sasthamkotta Lake, Ropar, Pong Dam Lake, Point Calimere Wildlife and Bird Sanctuary, Kolleru Lake, Kanjli, East Calcutta Wetland, Deepor Beel, Bhoj Wetland, Bhitarkanika Mangroves, Ashtamudi Wetland, Wular Lake, Sambhar Lake, Loktak Lake, Keoladeo National Park, Harike Lake and Chilka Lake.



Chilka Lake, Orissa- Fragile ecosystem

- Out of 25 geographical areas, only one geographical area (Chilka lake) having surface area of 116500 hectares was explored by BSI as of 2002. Thus, an area of 83 *per cent* of Fragile ecosystems remained unexplored as of 2002.
- During 2002-09, BSI explored another three geographical areas (East Kolkata Wetland, Wetland of Himachal Pradesh viz., Pong, Renuka & Chandratal and Deepor Beel, Assam) of these 25, having a total surface area of 32,231 hectares.

Thus, BSI explored only six *per cent* out of 83 *per cent* of the unexplored areas during the last seven years. Of 32,231 hectares explored, research results in the form of published documentation were disseminated only in respect of 19731 hectares⁴⁸ (four *per cent*).



Chandratal, Himachal Pradesh- Fragile ecosystem

⁴⁸ Wetlands of Himachal Pradesh (viz. Pong, Renuka and Chandratal) and Deepor Bill, Assam.

We further observed that BSI proposed to undertake three schemes during the Tenth Five Year Plan at a total cost of around ₹10 crore i.e., (i) Studies on floristic diversity of wetlands for conservation and management, (ii) Limnological⁴⁹ investigation in some lakes of national importance for conservation and management, and (iii) Floristic studies on selected critical and fragile ecosystems. However, none of these schemes were undertaken by BSI, as MoEF did not approve the same, as BSI did not have adequate infrastructure to undertake such studies. BSI stated in October 2009 that only those projects were undertaken which were within the Annual Action Plan and approved by Research Advisory Council in the absence of specific approval/funds from MoEF.

The reply of BSI needs to be viewed in light of the fact that the proposals for these three schemes indicated that funds requirement would be met from regular grants of BSI.

MoEF stated that it was not possible for BSI to undertake the above schemes without prerequisites i.e., additional manpower and funds. The reply of MoEF is not acceptable as it did not release the projected funds to BSI to carry out its activities. Further, there were significant vacancies in the scientific cadres who carry out survey and exploration activities at BSI. Thus, only four *per cent* area of fragile ecosystems of international importance was explored and data was disseminated to the scientific community and no data was generated from fragile ecosystems of national importance.

Recommendation - 20

BSI needs to increase its activities and undertake more schemes for identification, exploration and documentation of phytodiversity of Fragile ecosystems, so that the Fragile ecosystems can be effectively conserved.

(d) Sacred Groves

The objective of exploration of Sacred Groves is to inventorise the biodiversity of the Sacred Groves to conserve them and to study the ethno-botanical values of the components of biodiversity of the Sacred Groves.



Mawphlong Sacred Groves, Meghalaya

We observed that there were 15,397 Sacred Groves situated in 22 states, of which only one grove (Mawphlong Sacred Groves, Meghalaya) was explored by BSI as of 2002. We further observed that one more Sacred Grove (Kabi Sacred Grove, Sikkim) was studied during 2002-09. However, the report of the

⁴⁹ Scientific study of the life and phenomena of fresh water, especially lakes and ponds.

work is yet to be published (March 2010). Thus, only 2 out of 15,397 sacred groves were studied by BSI so far, which impacted biodiversity identification and proper management of these Sacred Groves.

MoEF stated that BSI, with its existing resources, undertook the study and documentation of floristic diversity in Kabi Sacred Grove in Sikkim. The reply of MoEF needs to be viewed in light of the fact that no targets were fixed for conducting survey of Sacred Groves. Further, study and documentation of floristic diversity in only two out of 15,397 Sacred Groves was undertaken by them so far. Due to lack of adequate resources, it would be difficult for BSI to achieve their remodeled objectives for fulfilling commitments of CBD.

Recommendation - 21

BSI may conduct more studies on Sacred Groves so that the objective of inventoring, studying and conserving biodiversity and ethno-botanical values of the Sacred Groves can be fulfilled.

3.2.3.2 Identification of red list species⁵⁰ and species rich areas needing conservation

While botanical 'survey' is conducted for collection and documentation of plants, 'status survey' is the exploration of a region which had been surveyed previously to study improvement or deterioration of the flora therein. BSI felt in 2002 that during botanical exploration and inventorisation of the phytodiversity, attention should also be focused on the taxa/ecosystems which are under threat and need conservation. Such species/habitats should be critically studied to determine the degree of threat. Subsequently, these taxa are to be documented in "Red Data Books". Thus, for effective conservation, status survey is required to be carried out. Two examples of rare and endangered species are given alongside in boxes 1 and 2.

Status survey of plant species was to be done by (i) Status survey of RET plant species which were listed in Appendices of CITES⁵¹ by conducting studies on 30 different parameters like taxonomy, biological parameters, population, estimation of distribution range etc., and (ii) Status survey and population study of RET species of Indian flora which were listed in the IUCN⁵² Red List Categories with a view to exploring areas known for the distribution of threatened species and to collect data and assess their present population status.

During this survey, species/habitats were to be critically studied to determine degree of threat. Subsequently, these taxa would be



Sapria Himalayana

Status: Rare, surviving only in Namdapha area. Destruction of its habitats is the main threat factor for its decline.

Distribution: Arunachal Pradesh, Manipur and Meghalaya.

Habitat and Ecology: It grows in dense, undisturbed forests near 40th mile in the Namdapha Biosphere Reserve, in damp moist places on the roots of *Cissus* elongate and other species of Vitaceae, as a complete root parasite.

Conservation measures proposed: This species has to be conserved in situ in the Namdapha forest area which is under protection, as other means of conservation are difficult because of its parasitic habit.

Biology and potential value: A very interesting species of the family Rafflesiaceae with large flowers of ca 12-16 cm across, and of considerable botanical interest. Earlier it was reported from different parts of NE Region. The whole plant is represented by its flower; other parts much reduced or absent having its roots attached to the host plant.

Box 1: Sapria Himalayana, a rare and endangered species

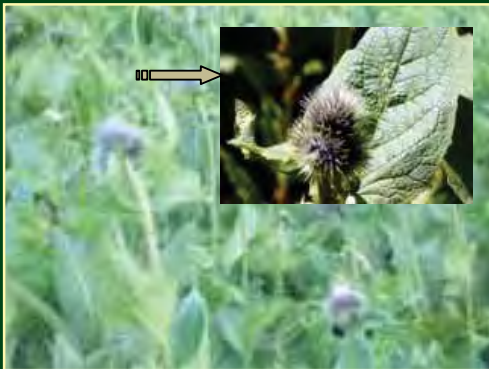
⁵⁰ Red listed species are those threatened species under various categories which are listed in IUCN list.

⁵¹ Convention on International Trade in Endangered Species of Wild Fauna and Flora.

⁵² International Union for Conservation of Nature.

documented in Red Data Books and would be taken up for ex-situ conservation in gardens. For in-situ conservation of species, information will be transmitted to concerned authorities to help them manage these species/ecosystems. We observed that:

- During 2002-09, BSI did not conduct any status survey of plant species.
- Red Data Books which represented the present status of threatened, rare, endangered, endemic, vulnerable, extinct species were updated in 1990 and last updated version was printed in 2003. As no status surveys have been conducted by BSI, the same has not been updated since then.



Saussurea Costus

Status: Endangered due to indiscriminate collection and loss of habitat.

Distribution: Jammu and Kashmir, Himachal Pradesh (Chamba), Uttar Pradesh, Pakistan.

Habitat and Ecology: In sub-alpine Himalayas, on open hill-slopes, in the altitudes of 3200-3800 m.

Conservation measures taken: None for the wild populations of its habitats, however, the species is now included in the Appendix 1 of the CITES.

Conservation measures proposed: Baseline data on the distribution and ecological status, population density, etc.; rehabilitation in its depleting habitats or ecologically akin to natural habitats in its distribution range; protection of natural habitats.

Biology and potential value: 'Kuth' is cultivated for its roots used in perfume industry. The dry root is commercially known as 'costus' root which is strongly scented and yields aromatic oil. It is also used to make insecticides. The root contains an alkaloid known as Saussurine which has medicinal properties and is good for stomach ailments. It is an antiseptic and is also used in chronic skin diseases, asthma, high blood pressure etc.

Box 2: Saussurea Costus, a rare and endangered species

BSI agreed in July 2009 that it had not conducted status survey during 2002-09. MoEF stated in March 2010 that surveys conducted by BSI during the period under review had helped in rediscovery of a number of endemic and endangered species after a gap of more than 50–150 years. The reply of MoEF needs to be viewed in the light of the fact that the scope of 'survey' is different from the scope of 'status survey'. MoEF further stated that BSI carried out specific status survey in respect of five plant species with the existing resources, though it did not spell out the period of carrying out such status survey. However, the fact remains that BSI did not conduct status survey during the period under review i.e., 2002-09, which is an essential tool for monitoring of plant species.

Recommendation - 22

BSI needs to gather and disseminate data on distribution, degree of threat, biological parameters, utilisation etc., of the plant species explored. It is further recommended that status of the threatened species in the Red Data Book may be updated urgently so that conservation efforts can be made more effective.

3.2.3.3 Survey and documentation of traditional knowledge (ethnobotany⁵³) associated with plants

Ethnobotanical studies document the traditional knowledge of different ethnic groups associated with usage of plant species for different purposes such as food, fodder, shelter, medicine, veterinary, cultural, psychosomatic etc. India presents a colourful mosaic of about 563 tribal communities which have acquired considerable knowledge on uses of plants for their livelihood, health care and other purposes through their long association with the forests, inheritance, practices and experiences. With the advancement of civilisation, this ethnobotanical information has been depleting at an alarming rate. Therefore, recording and documenting ethnobotanical data is critical for providing information which would lead to sustainable utilisation of bio-resources. While reviewing the functions and organisation of BSI in 2002, MoEF observed that BSI, during surveys, should also collect ethnobotanical data documentation of the bio-resources of the country, which could be sustainably utilised for economic development of the area.

While reviewing its strategies and objectives keeping in view its commitment towards CBD in 2002, BSI identified 112 districts of 17 States/Union Territories⁵⁴ to carry out ethnobotanical studies by 2009. Of these, ethnobotanical studies in 30 districts were to be completed for publication by 2009. In the remaining States/Union Territories, it was to carry out these studies simultaneously while studying Fragile ecosystem and Protected Areas. In this regard, we observed that:

- Eight out of 12 circles did not undertake any ethnobotanical studies during 2002-09. Two circles (AP and Northern) did not furnish information in this regard. Only BSI headquarters and A&N Circle undertook 19 studies during 2002-09.
- Except in A&N where one ethnobotanical study (Jarawa contact expedition) was conducted during 2002-03, no information was gathered from other states.
- Examination of 18 ethnobotanical study tour reports by Audit revealed the following:
 - As against 30 districts identified by BSI for undertaking ethnobotanical studies by 2009, only five districts were covered during this period. BSI also covered six more districts other than the identified districts.
 - Though BSI collected specimens of 2729 ethnobotanically important species in the abovementioned 18 tours, no ethnobotanical information about the usage of 1426 plant species (52 *per cent*) by the tribal communities for different purposes such as food, fodder, shelter, medicine, veterinary, cultural, psychosomatic was reported.
 - Though ethnobotanical information for 1303 plant species and their usage by the tribal communities for different purposes was recorded, no publication in this regard was released till date.

⁵³ Ethnobotany is the scientific study of the relationships that exist between people and plants.

⁵⁴ Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jammu and Kashmir, Kerala, Madhya Pradesh, Mizoram, Orissa, Sikkim, Tamil Nadu and West Bengal.



Nyishi women- ethnobotanical study

BSI stated in October 2009 that ethnobotany of two major tribes viz 'Adi' and 'Nyishi' of Arunachal Pradesh were published in the Annual Report of MoEF in 2007. It further stated that three⁵⁵ more publications on ethnobotany were brought out. The reply of BSI needs to be viewed in light of the fact that traditional knowledge and ethnobotany of only 5 out of 563 tribal communities were disseminated as of 2009.

MoEF further stated that the review by BSI in 2002 was a stocktaking exercise to identify gaps and propose action plan to bridge the gaps, keeping in view the optimal manpower, infrastructure and financial requirements. MoEF further stated that it did not review the functions and organisation of BSI in 2002. The reply of MoEF may be viewed in light of the fact that the review was done and gaps assessed at a workshop organised by MoEF at Jaipur in February 1997 and the objectives of BSI were remodeled in 2002 following the recommendations of the workshop vis-à-vis MoEF's commitments to CBD which was ratified in 1994.

Further, the fact remains that BSI conducted this review and formed strategy to bridge the gaps identified to fulfill the commitments under CBD, keeping in view the then existing sanctioned strength.

Recommendation - 23

BSI may prepare specific plan to survey and inventorise ethnobotanically important plant species with specific targets on distinct parameters and bring out publications for sustainable utilisation of bio-resources.

⁵⁵ Ethnobotany of Dadra, Nagar-Haveli and Daman (2001), Madhya Himalaya ki Paramparaen Evam Paramparik Gyan (2004), Ethnobotany of Mysore and Coorg, Karnataka State (2007).

3.2.4 Ex-situ⁵⁶ and In-situ⁵⁷ conservation of critically threatened taxa

Conservation is the next step after exploration and identification of plant species. According to CBD, each country needs to undertake in-situ and ex-situ conservation of species and communities which are threatened, contain high diversity, large numbers of endemic or threatened species. CBD lists out various measures to be undertaken for ex-situ and in-situ conservation, some of which are:

- Adopt measures for the ex-situ conservation of components of biological diversity, preferably in the country of origin of such components;
- Establish and maintain facilities for ex-situ conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources;
- Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
- Regulate or manage biological resources important for the conservation of biological diversity whether within or outside Protected Areas, with a view to ensuring their conservation and sustainable use.

Efforts of BSI in the area of ex-situ and in-situ conservation are discussed below.

(a) Inadequate ex-situ conservation

The objective of ex-situ conservation is to adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions. Thus, BSI was to conserve, multiply threatened taxa in botanical gardens and reintroduce them into natural habitats after multiplication.

We observed that only 163 threatened species were conserved in 10 Botanical Gardens of BSI in 118 years (since inception) which was 15 *per cent* of the total threatened species (1076) assessed by BSI to be conserved.

BSI stated in October 2009 that due to inadequate manpower, it had not been possible to even complete survey and identification/exploration activities. MoEF, in its reply in March 2010, stated that to introduce, acclimatise and multiply wild plant species in gardens was a big project by itself and needed dedicated manpower to make trials of their nursery technique etc. It further stated that due to lack of timely action in initiating proposal for filling up the vacant posts, a number of posts fell into deemed abolished category and MoEF initiated action to revive all scientific posts in 2007. MoEF also stated that mentioning the lack of manpower in a five year plan could not be taken as a requisition for increasing the manpower and that no proposal from BSI was pending in the Ministry.

Thus, lack of manpower was a result of inadequate action by MoEF and BSI. MoEF needs to provide dedicated manpower in BSI so that activities regarding multiplication, reproduction and reintroduction can be carried out by BSI and India's commitments to CBD can be effectively fulfilled.

(b) Inadequate data generation for in-situ conservation

In-situ conservation is the process of protecting an endangered plant or animal species in its natural habitat, by protecting the area in form of Wildlife Sanctuary/National Park/Community Conservation area/ Biosphere Reserve/Forest Preservation Plots etc. In this regard, BSI was required to monitor threatened plant species and disseminate data to the management authority for establishment of a system of Protected Areas or areas where special measures need to be taken to conserve biological

⁵⁶ It is a process of protecting an endangered species of plant or animal by removing part of the population from a threatened habitat and placing it in a new location which may be a wild area or botanic garden, zoo etc.

⁵⁷ It means 'on-site conservation'. It is the process of protecting an endangered species of plant or animal in its natural habitat, by protecting the area in form of wild life sanctuary, national park or bio-sphere reserve etc.

diversity. In this regard, we observed that BSI did not conduct monitoring work adequately for in-situ conservation.

BSI stated in October 2009 that due to lack of manpower, except in certain specific cases like Nanda Devi Biosphere Reserve in Western Himalaya, population of *Cycas beddomei* in Deccan Plateau, population of *Trachycerpus takil* in Western Himalaya and population of *Corypha talliera* in West Bengal, monitoring work could not be taken up. MoEF stated in March 2010 that BSI's mandate was to provide baseline information on the diversity and distribution of plants in protected areas to facilitate their monitoring and management and it had provided baseline information on some species. However, the fact remains that the same was not adequately done.

Recommendation - 24

BSI needs to strengthen monitoring work adequately for in-situ conservation so that data can be disseminated to the management authority for setting up Protected Areas or areas where special measures need to be taken to conserve biological diversity.

3.2.5 Studies on selected plant groups

According to CBD, Governments need to:

- (a) Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components and provide support for such education and training for the specific needs of developing countries;
- (b) Promote and encourage research which contributes to the conservation and sustainable use of biological diversity, particularly in developing countries; and
- (c) Promote and cooperate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources.

BSI undertook research on two topics during the Tenth Five Year Plan i.e., (i) Pollen studies of Indian Angiosperms costing ₹80 lakh and (ii) Taxonomic Revisionary studies of the flora of the country costing ₹2.08 crore, for a duration of ten and five years respectively.

The objective of the first project was to provide exhaustive palynological account of angiospermic taxa including family and genus using both light microscopic and scanning electron microscopic studies. BSI, however, did not furnish information on procurement and usage of the Scanning Electron Microscope and also the number of reference collection of pollen studies of angiospermic taxa. The project is still going on.

The objective of the second project was to survey and inventorise the floral wealth of the country in view of the fast deteriorating environmental conditions due to urbanisation, forest clearing and other biotic interferences. BSI did not furnish information on status of the progress of the work.

Thus, effectiveness of BSI in promoting and encouraging research activities could not be ascertained in audit.

3.2.6 Environment Impact Assessment of areas assigned to BSI

Studies for assessment of impact of various development activities on natural resources and environment are known as Environment Impact Assessment (EIA) studies. Result of comparative analysis of data through these studies helps in taking mitigating measures for the protection of environment and proper environmental management.

According to CBD, national governments need to:

- (a) introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimising such effects and, where appropriate, allow for public participation in such procedures;
- (b) introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account.

We observed that only one study was conducted in 2005 on 'EIA of Iron ore mining in Rawghat Iron Ore deposit'. BSI stated in October 2009 that 'EIA studies' were only carried out by BSI as and when specifically instructed by MoEF.

MoEF did not intimate the reasons and offer any comments as to why BSI was not assigned the task of conducting EIA studies despite huge environmental degradation taking places in various areas of the country due to various developmental activities.

Recommendation - 25

MoEF may indentify important areas affected by environmental degradation due to developmental activities and get EIA studies conducted through BSI for initiating appropriate corrective measures.

3.2.7 Conclusion

BSI is the nodal research organisation under Ministry of Environment and Forests playing an important role towards fulfillment of India's commitments to various international conventions, especially Convention on Biological Diversity.

The objectives of BSI were remodeled to conduct survey in Protected Areas, Fragile ecosystems, Hotspots and Sacred Groves in particular with a view to implementing the provisions of CBD. BSI needs to increase its efforts for identification/documentation and monitoring of plant species to identify and document the Protected Areas and Fragile ecosystems. Specific publications documenting these areas also needed to be brought out. BSI needs to conduct population studies, mapping and status surveys, all of which affect its identification and monitoring activities. It also needs to update the status of threatened species in the Red Data Book so that efforts at conservation can be made more effective. Further, identification of traditional knowledge of different ethnic groups associated with usage of plant species for different purposes needs to be done for wider dissemination and conservation. BSI needs to generate adequate data for in-situ conservation and carry out ex-situ conservation, which impacts conservation of biodiversity. Though BSI identified action to be taken to fill the gaps while remodeling their objectives in line with CBD, they were not supported/approved by the Ministry by providing required infrastructure.

MoEF stated that the recommendations were laudable but for their implementation, necessary wherewithal in terms of state-of-the-art infrastructure, trained manpower and in-service skill augmentation was an important prerequisite.

Recommendation - 26

MoEF, being the nodal ministry for implementation of Convention on Biological Diversity in the country, needs to properly plan and ensure that all necessary infrastructure is provided to BSI to effectively ensure conservation of precious biodiversity and also to meet its commitments to the Convention on Biological Diversity.