

1. Bryden, H. L., Roemmich, D. and Church, J., *Deep-Sea Res.*, 1991, **38**, 297–324.
2. Roemmich, D., Gilson, J., Cornuelle, B. and Weller, R., *J. Geophys. Res.*, 2001, **106**, 8597–8970.
3. Molinari, R. L. and Roemmich, D., Argo: a new paradigm for physical oceanography, Oceanology International, 2001, Americas, Miami, 3–5 April 2001.
4. Argo Science Team, On the design and implementation of Argo: An initial plan for a global array of profiling floats. International CLIVAR Project Office Report 21, GODAE Report 5, GODAE International Project Office, Melbourne Australia, 1998, p.32.
5. Stommel, J., *Deep-Sea Res.*, 1955, **2**, 284–285.
6. Swallow, J. C., *Deep-Sea Res.*, 1955, **3**, 93–104.
7. Izawa, K. *et al.*, Report of Japan Marine Sciences, and Technology Center, 2001, vol. 44, pp. 181–196.
8. Kobayashi, T. *et al.*, ARGO Technical Report FY2001, 2002, JAMSTEC, pp. 36–48.
9. Rao, R. R., Molinari, R. L. and Festa, J. F., *J. Geophys. Res.*, 1989, **94**, 10801–10815.
10. Rao, R. R. and Sivakumar, R., *J. Geophys. Res.*, 2000, **105**, 995–1015.
11. Shenoi, S. S. C., Saji P. K. and Almeida, A. M., *J. Mar. Res.*, 1999, **57**, 885–907.
12. Shankar, D., Vinayachandran, P. N. and Unnikrishnan, A. S., *Prog. Oceanogr.*, 2002, **52**, 63–120.
13. Yasuko Ichikawa, Yasushi Takatsuki, Keisuke Mizuno, Nobuyuki Shikama and Kensuke Takeuchi, ARGO Technical Report FY2001, JAMSTEC, 2002, p. 68.
14. Jong-Jin Park, Kuh Kim and Riser Stephen, C., Ocean Sciences Meeting, Honolulu, Hawaii, OS11c-4611, 15 February 2002.

ACKNOWLEDGEMENTS. We thank Dr Howard Freeland, Institute of Ocean Sciences, Sydney, Canada for providing an opportunity to deploy the Canadian Argo float in the Arabian Sea. We thank Dr S. R. Shetye, NIO and Dr R. R. Rao, NPOL for useful suggestions and comments. The CMLRE, Kochi is acknowledged for providing FORV *Sagar Sampada*, which was used to deploy the Argo float and for CTD observation. We are grateful to Dr Harsh K. Gupta, Secretary, Department of Ocean Development, Government of India for his constant encouragement and support for this programme. This work was possible because of Argo's key role in GOOS/GCOS and its commitment to free and open exchange of data.

Received 25 July 2003; revised accepted 7 November 2003

## The Biological Diversity Act of India and agro-biodiversity management

Pratibha Brahma\*, R. P. Dua and B. S. Dhillon

*After the Convention on Biological Diversity (CBD) was adopted by the United Nations, in June 1992, the contracting countries were required to integrate consideration of conservation and sustainable use of biological diversity into relevant legal procedures, programmes and policies. The Biological Diversity Act was passed by the Parliament in 2002 after a process of consultation among stakeholders. The Act provides for conservation of biological diversity, sustainable use of its components and equitable sharing of benefits arising out of the use of biological resources. Agro-biodiversity which is a subset of total biological diversity is a major concern for the world food security and the issues of conservation and management of agro-biodiversity are one of the high priorities for a diversity-rich country like India. In this article we analyse the provisions of this Act related to agro-biodiversity management and how the access to these resources may be managed to channel the benefits to the users as well as custodians of agro-biodiversity.*

BIOLOGICAL diversity is the variability among all living organisms existing on earth in various ecosystems and ecological complexes. This diversity is the basis of continuous evolution of life forms and in turn maintaining the life-sustaining systems of the biosphere. The conservation of all biological diversity is a common concern of

human kind and it is vital to anticipate, prevent and tackle the causes of loss or reduction of biological resources.

The dependence of human beings on biological diversity is undoubted, as evident in everyday life. The food, fibre, fuel, fodder, shelter, health and other needs of the growing world population are dependent on various components of biodiversity. It is also recognized that plant genetic resources for food and agriculture are a common concern of all countries and most countries depend largely on plant genetic resources that have originated elsewhere.

The authors are in the National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110 012, India.

\*For correspondence. e-mail: pratibha@nbpgr.delhi.nic.in

Therefore, the sustainable use of biological diversity at the national as well as international level is of critical importance. For the same reason, the access to and sharing of both genetic resources and technologies for their sustainable use among nations are essential.

A legally binding agreement, Convention on Biological Diversity (CBD), was adopted by the United Nations Conference on Environment and Development, held at Rio de Janeiro in June 1992. The objectives of the CBD are 'the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding'<sup>1</sup>. The Convention reaffirmed that states have sovereign rights over their biological resources and that the states are responsible for conserving these resources and using the same in a sustainable manner. The contracting parties to the CBD are, therefore, required to integrate considerations of conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

The Biological Diversity Act (BDA) was formulated after India became signatory to the CBD. The draft legislation was developed through an intensive consultation process involving all stakeholders such as the Central Government, State Governments, institutions of local self-government, scientific and technical institutions, experts, non-governmental organizations, industry, etc. The Act was passed by the Parliament in December 2002 (ref. 2). The objectives of the Act are 'to provide for conservation of biological diversity, sustainable use of its components and equitable sharing of the benefits arising out of the use of biological resources and for matters connected therewith or incidental thereto'.

### Salient provisions

Some of the salient provisions made in the BDA for regulation of access to biological diversity, its conservation and sustainable use are:

- (i) Conservation and sustainable use of biological diversity.
- (ii) Conservation and development of areas important from the standpoint of biological diversity by declaring them as biological diversity heritage sites.
- (iii) Protection and rehabilitation of threatened species.
- (iv) To respect and protect knowledge of local communities related to biodiversity.
- (v) Regulation of access to biological resources of the country with the purpose of securing equitable share in benefits arising out of the use of biological resources, and associated knowledge relating to biological resources.
- (vi) To secure sharing of benefits with local people as conservers of biological resources and holders of know-

ledge and information relating to the use of biological resources.

(vii) Involvement of institutions of self-government in the broad scheme of the implementation of the Act through constitution of committees.

### Relevant definitions

Some of the definitions in the context of the Act are:

*Benefit claimers* means the conservers of biological resources, their by-products, creators and holders of knowledge and information relating to the use of such biological resources, innovations and practices associated with such use and application.

*Biological diversity* means the variability among living organisms from all sources and the ecological complexes of which they are part and includes diversity within species or between species and of ecosystems.

*Biological resources* means plants, animals and microorganisms or parts thereof, their genetic material and by-products with actual or potential use or value but does not include human genetic material.

*Bio-survey and bio-utilization* means survey or collection of species, subspecies, genes, components and extracts of biological resources for any purpose and includes characterization, inventorization and bioassay.

*Equitable benefit sharing* means sharing of benefits as determined by the National Biodiversity Authority under section 21 of the Act.

*National Biodiversity Authority* means the National Biodiversity Authority established under section 8 of the Act.

*State Biodiversity Board* means the State Biodiversity Board established under section 22 of the Act.

*Biodiversity Management Committee* means a committee established by each local body (panchayat) under section 41 of the Act.

*Sustainable use* means the use of components of biological diversity in such manner and at such rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

### Proposed institutional mechanisms

For the effective implementation of the BDA, the Central Government would undertake activities to develop national strategies, plans and programmes for conservation and sustainable use of biological resources, with the following proposed institutional mechanisms. It would take measures for identification and monitoring biodiversity-rich areas and notify threatened species. It would also undertake promotion of incentives for research, training, public

awareness and education with respect to biodiversity, and make assessment of environment impact of any activity likely to have adverse impact on biological diversity. It would regulate, manage or control the risks associated with use and release of living modified organisms resulting from biotechnology, likely to have adverse impact on conservation and sustainable use of biodiversity and human health. It may also declare some resources to be exempted from the provisions of this Act, including resources normally traded as commodities.

It is proposed to have National Biodiversity Authority (NBA), State Biodiversity Boards (SBB) and Biodiversity Management Committees (BMC) for effective implementation of the Act.

The NBA will deal with matters relating to requests for access by foreign individuals, institutions or companies, and those relating to transfer of results of research to any foreigner. Imposition of terms and conditions to secure fair and equitable sharing of benefits arising out of utilization of biological resources and approvals for seeking any form of Intellectual Property Rights (IPR) in or outside India for an invention based on research or information pertaining to a biological resource or knowledge associated thereto obtained from India, would also be dealt with by the NBA.

SBB would be constituted for every state in India to deal with matters relating to access by Indians for commercial purposes and restrict any activity which violates the objectives of conservation, sustainable use and equitable sharing of benefits.

Institutions of self-government in their respective areas would constitute a BMC for conservation, sustainable use, documentation of biodiversity and chronicling of knowledge relating to biodiversity. BMC shall be consulted by the NBA and SBB on matters related to use of biological resources and associated knowledge within their jurisdiction.

It is also proposed to set-up 'Biodiversity Funds' at central, state and local levels. The monetary benefits, fees and royalties received as a result of approvals by NBA will be deposited in the 'National Biodiversity Fund'. The Fund will be used for conservation and development of areas from where resources have been accessed, including management and conservation of heritage sites wherever applicable.

Traditional knowledge associated with biological resources is proposed to be protected. It is also proposed that the State Governments will notify National Heritage Sites, which are important from the standpoint of biodiversity, in consultation with institutions of local self-governments.

### **Provisions for regulation of access to biological diversity**

Chapter II deals with regulation of access to biological diversity (Sections 3–7).

Section 3 of the Act restricts certain persons not to undertake biodiversity-related activities without the approval of the NBA as stated below:

1. No person referred to in sub-section (2) shall without previous approval of the National Biodiversity Authority obtain any biological resources occurring in India or knowledge associated thereto for research or for commercial utilization or for bio-survey and bio-utilization.

2. The persons who shall be required to take the approval of the National Biodiversity Authority under sub-section (1) are the following:

- (a) a person who is not a citizen of India;
- (b) a citizen of India, who is a non-resident as defined in clause (30) of section 2 of the Income Tax Act, 1961;
- (c) a body corporate, association or organization
  - (i) not incorporated or registered in India, or
  - (ii) incorporated or registered in India under any law for the time being in force which has any non-Indian participation in its share capital or management.

Section 4 provides conditions for transfer of results of research related to biodiversity. It states that 'No person shall without the previous approval of the National Biodiversity Authority, transfer the results of any research relating to any biological resources occurring or obtained from India for monetary consideration or otherwise to any person who is not a citizen of India or a body corporate or organization which is not registered or incorporated in India or which has any non-Indian participation in its share capital or management'.

However, 'transfer' does not include publication of research papers or dissemination of knowledge in any seminar or workshop, if such publication is according to the guidelines issued by the Central Government.

Exemption to provisions of Sections 3 and 4 has been provided in Section 5. Sub section (1) of Section 5 states that 'the provisions of Sections 3 and 4 shall not apply to collaborative research projects involving transfer or exchange of biological resources or information relating thereto between institutions, including Government-sponsored institutions of India, and such institutions in other countries, if such collaborative research projects satisfy the conditions specified in sub-section (3): (a) collaborative research projects should conform to the policy guidelines issued by the Central Government in this behalf, and (b) be approved by the Central Government. All collaborative research projects other than those referred to in sub-section (1) which are based on agreements concluded before the commencement of this Act and in force shall be void<sup>1</sup>.'

Section 6 deals with the application for IPR. The section states that 'No person shall apply for any intellectual property right by whatever name called in or outside India for any invention based on any research or information on a biological resource obtained from India, without obtaining the previous approval of the NBA before making such application'. This permission, however, may be

obtained after the acceptance of the patent but before scaling the patent by the patent authority concerned, in case if a person applies for a patent.

NBA may, while granting the approval under this section, impose benefit-sharing fee or royalty or both or impose conditions, including the sharing of financial benefits arising out of the commercial utilization of such rights. The provisions of this section shall not apply to any person making an application for any rights under any law relating to protection of plant varieties enacted by Parliament as the concerned authority granting such right shall enclose a copy of such document granting the right to the NBA.

Section 7 is regarding prior intimation to the SBB for obtaining biological resources for certain purposes, and it states, 'No person who is a citizen of India or a body corporate, association or organization which is registered in India shall obtain any biological resource for commercial utilization or bio-survey and bio-utilization for commercial utilization, except after giving prior intimation to the State Biodiversity Board concerned'. The provisions of this section shall not apply to the local people and communities of the area, including vaid and hakims, who have been practising indigenous medicine.

### **Functions and powers of NBA**

The duties of the NBA are defined under Section 18. It would regulate activities, issue guidelines for access to and equitable benefit sharing and it may grant approval for undertaking any activity referred to in Sections 3, 4 and 6.

The NBA would advise the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of benefits arising out of the utilization of biological resources; advise the State Governments in the selection of important areas of biodiversity to be notified as heritage sites and measures for the management of such heritage sites; perform such other functions as may be necessary to carry out the provisions of this Act.

The NBA may also take measures necessary to oppose the grant of IPR in any country outside India, on behalf of the Central Government on any biological resource obtained from India or knowledge associated with biological resource which is derived from India.

### **Determination of equitable benefit sharing by NBA**

The manner of determination of equitable benefit sharing is provided in Section 21. The NBA, while granting approvals under Section 19 or Section 20, would ensure that the terms and conditions subject to which approval is granted, secure equitable sharing of benefits arising out of the use of accessed biological resources, their by-products, innovations and practices associated with their use and appli-

cations and knowledge relating thereto in accordance with mutually agreed terms and conditions between the person applying for such approval, local bodies concerned and the benefit claimers.

The NBA shall determine the benefit sharing subject to any regulations made in this behalf, which shall be given effect in all or any of the following manner:

- (a) Grant of Joint ownership of intellectual property rights to the National Biodiversity Authority, or where benefit claimers are identified, to such benefit claimers.
- (b) Transfer of technology.
- (c) Location of production, research and development units in such areas which will facilitate better living standards to the benefit claimers.
- (d) Association of Indian scientists, benefit claimers and the local people with research and development in biological resources and bio-survey and bio-utilization.
- (e) Setting up of venture capital fund for aiding the cause of benefit claimers.
- (f) Payment of monetary compensation and other non-monetary benefits to the benefit claimers as the National Biodiversity Authority may deem fit.

Where any amount of money is ordered by way of benefit sharing, the NBA may direct the amount to be deposited in the National Biodiversity Fund.

It is further provided in the section that where biological resource or knowledge was a result of access from specific individual or group of individuals or organizations, the NBA may direct that the amount be paid directly to such individuals or group of individuals or organizations in accordance with the terms of any agreement and in such manner as it deems fit.

### **Consideration for effective implementation of BDA with reference to agro-biodiversity**

Agro-biodiversity means the biological diversity of agriculture-related species and their wild relatives. It is the most important components affecting human life. Concerns for agro-biodiversity conservation and management are one of the high priorities of biodiversity-rich nations like India. The following issues of benefit sharing and management of agro-biodiversity need to be focused.

### **Provision for benefit-sharing mechanisms**

The CBD mandates its member countries to enact national laws that would facilitate prior informed consent and benefit sharing in a fair and equitable manner, prior to access and use of biological resources and traditional knowledge. Several countries have already enacted laws to put in place the access and benefit sharing (ABS) regime. Under Section 6 of the Indian Biological Diversity Act, there is a clear message that no body can apply for IPR without

taking prior permission from NBA. The NBA can impose benefit-sharing fee or royalty or both, or ask for sharing financial benefit arising out of commercialization of the material. Section 7 envisages that no body except local communities and vairs can have access to biological resources for commercial purpose without prior intimation to the SBB concerned.

The mechanism of benefit sharing for plant genetic resources and the traditional knowledge has been well taken care of at the national level in the following Acts:

- (i) In the provisions of Section 26 (1) of Protection of Plant Varieties and Farmers' Rights (PPVFR) Act 2001 (ref. 3), wherein the Authority shall publish and invite claims of benefit sharing for the applicant variety to be registered, in the manner as may be prescribed
- (ii) In Section 10.4 (D) of Patent (Amendment) Act 2002 (ref. 4). If the patent applicant mentions a biological material in the specification, the application shall be completed by depositing the material to the authorized depository institutions and by fulfilling conditions such as the disclosure of the source and geographical origin of the biological material in the specification, when used in invention. The biological material is to be deposited not later than the date of the patent application. The depository institution would make the biological material available to public after publication of the patent [Section 11(A)].

However, at the international level there is an urgent need to harmonize the provisions under CBD and Trade Related Aspects of Intellectual Property Rights (TRIPS)<sup>5</sup>, if the interest of the all parties, namely the stakeholders of biological material/traditional knowledge, the consumer and the intellectuals are to be safeguarded. Article 7 of TRIPS agreement clearly emphasizes that the 'protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and dissemination of technology, to the mutual advantage of producers and users of the technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations'. The key issues which need to be considered for amendment of the TRIPS Agreement for harmonization with provision of CBD are:

- (i) Disclosure of the source and country of origin of the biological resources and of the traditional knowledge used in the invention.
- (ii) Evidence of prior informed consent through approval of authorities under the relevant national regime.
- (iii) Evidence of fair and equitable sharing under the relevant national regime<sup>6</sup>.

This aspect needs to be deliberated at the international institutions like WTO so that the farmers/communities of developing countries possessing a wealth of biological resources are benefited according to CBD provisions.

### **Harmonization of implementation of benefit-sharing mechanisms under the PPVFR Act and BDA**

The conservers and providers of genetic resources would receive recognition and reward from the 'National Gene Fund' proposed under the PPVFR Act. The fund shall be contributed by way of benefit sharing (monetary) received in the prescribed manner from the breeder of a variety, when the breeder develops a particular variety using the genetic resources accessed from farmers/farming communities. The details of all the genetic material (complete passport data) used by the breeder in the development of a new variety, are to be submitted to the PPVFR Authority at the time of submitting the application for registration of the variety. The Authority would then decide about the amount and manner of payment of benefit sharing to the owner of the genetic material used in the development of the variety in a prescribed manner.

Similar funds are also proposed to be constituted by NBA under this act. The National Biodiversity Fund shall be funded by way of grants and loans from the Central Government; all charges and royalties received by the NBA under this act; and all sums received by NBA from other sources as decided by the Central Government.

This fund shall be used for channelling benefits to the benefit claimers, conservation and promotion of biological resources and development, as well as socio-economic development, of areas from where such biological resources or knowledge associated has been accessed, in consultation with the local bodies concerned.

State Biodiversity Funds are proposed to be constituted for every state in India. These shall primarily be funded by the NBA and other sources as decided by the State Governments and these shall be used for management and conservation of heritage sites, compensation or rehabilitation of any section of people economically affected by the notification of biodiversity heritage sites<sup>1</sup> conservation and promotion of biological resources and socio-economic development of areas from where such biological resources have been accessed.

Therefore, a need for harmonization of provisions of benefit-sharing mechanisms is felt, when both the Acts are dealing with agro-biodiversity and provide for benefit sharing to conservers and providers of genetic resources. The consideration for rewarding conservers and holders of agro-biological resources could be determined keeping in view the level of agro-biodiversity (number of accessions or breeds) conserved by the farmers/communities, especially in biodiversity-rich areas. Other criteria could be the number of landraces conserved by the farmer/community, how many among these are rare or available only with the applicant<sup>7</sup>, number of varieties bred by other breeders using the material conserved by the community and in case of landraces or folk varieties, the amount of seed produced and sold in the area.

*Institutional mechanisms for agro-biodiversity management*

The provision for regulation of biological diversity under Section 3 of the BDA may imply that there could be delays in germplasm exchange at the international level, as well as the supply of germplasm to private sector within the country [refer 2 (c) (ii) of the Section 3]. Since most of the private sectors have non-Indian participation, each and every case will have to be referred to the NBA; it would be appropriate if this power is given to the committee on agro-biodiversity which is to be constituted under Section 13. Further, that committee may delegate the powers to Director General, Indian Council of Agricultural Research (ICAR), Deputy Director Generals (DDGs) (ICAR) and Directors of various genetic resources bureaus depending upon criticality, importance and national interest in relation to a particular genetic resource; and national and bilateral MoUs, undertakings and treaties. The foreign indentor (public sector, private sector, CG and other international institutes) will also have to be kept in view while delegating the power to DDGs/Directors of the bureaus. For effective management of genetic resources, this committee on agro-biodiversity may be given all discretions relevant to the management of agro-biodiversity, including inventorization, surveying, collection, conservation, characterization, evaluation, documentation, exchange, utilization, etc.

Further, for obtaining biological resource by any Indian (Section 7), the SBBs would have to be intimated. Also, according to Section 41, the SBB will consult the BMC, constituted by the local body of the area, even for simple use of biological resources and there could also be fees for collection activities. Since the national bureaus and other agriculture research institutions in public sector collect, characterize and evaluate the germplasm and conserve it with the ultimate objective of utilization in the national interest, it would be appropriate if the public-sector institutions are exempted from provisions of these sections, as in the case of vairs and hakims.

**Conclusions**

The CBD recognizes the sovereign rights of the nations over their natural resources and reaffirms the authority

resting with national governments to determine and facilitate access to genetic resources among nations for environmentally sound purposes, subject to national legislation and on mutually agreed terms. The CBD also recognizes the contributions of local and indigenous communities to the conservation and sustainable utilization of biological diversity through traditional knowledge, practices and innovations, and provides for fair and equitable sharing of benefits with such people. India has accordingly provided all such related mechanisms in the legislation through promulgation of different Acts (PPVFR Act, BDA and Patent (Amendment) Act). Some of the issues, particularly management of agro-biodiversity need to be dealt with by involving existing infrastructure in public-sector institutions, such as those controlled by ICAR, Department of Agriculture Research Education, local self-governments and other departments related to management of various types of biological resources, with the basic objective of conserving biological resources for sustainable use and smoothening the access for their utilization at the national level and for international exchange. Also, sincere efforts are required at the national level to pursue the case for harmonization of provisions under CBD and TRIPS at international fora for channelling the benefits to the holders of biological resources.

1. World Wide Fund, Convention on Biological Diversity, text and annexes. World Wide Fund for Nature-India, New Delhi, 1998, p. 4.
2. Anon., Publication of the Biological Diversity Act, 2002 No. 18 of 2003. Ministry of Law and Justice (Legislative Department), Govt. of India, New Delhi, 2003.
3. Sahai, S., India's plant variety protection and Farmers' Rights Act, 2001. *Curr. Sci.*, 2003, **84**, 407-412.
4. Anon., Gazette of India, Part II, Notification No. D.L.-33004/2002 No. 42. Ministry of Law, Justice and Company Affairs (Legislative Department), Govt. of India, New Delhi, 2002, p. 24.
5. Agreement on Trade-Related Aspects of Intellectual Property Right-WTO Annex IC, pp. 319-353, See <http://www.wto.org/legal.final.act.htm/>.
6. Vivas Eugui, D., Issues linked to the Convention on Biological Diversity in the WTO Negotiations: Implementing Doha Mandates. Paper prepared under CIEL/South Centre Joint Project, Centre for International Environment Law, Geneva, Switzerland, 2002, p. 18.
7. MSSRF-FAO Expert Consultation, Implementing farmers' rights for conservation and utilization of plant genetic resources in the Asia-Pacific region: from legislation to action. Proceedings No. MSSRF/PR/02/45, 2002, pp. 149-150.

Received 27 August 2003; revised accepted 4 December 2003