Biodiversity access and benefit-sharing: weaving a rope of sand

K. D. Prathapan and Priyadarsanan Dharma Rajan

The Convention on Biological Diversity (CBD)[1] is one of the most important treaties in the history of humanity as it deals with the infinitely complex but fragile diversity of life on earth. Regulating access to genetic resources and equitable sharing of commercial benefits of biodiversity has been the most contentious issue in the negotiations under CBD. As the impasse continues, the prime objective of CBD – conservation of biodiversity – is relegated to the backyard. The Nagoya Protocol (2010)[2] adopted by the Tenth Conference of Parties (CoP), concluded on 29 October 2010 in Nagoya, Japan, provides the framework to facilitate access and benefit-sharing (ABS). However, the idea of ABS itself remains a pipe dream.

A major snag of CBD and the resultant national legislations is the shift in focus from the ecological and scientific value of biodiversity to its mere commercial value. This trip has led to the establishment of sovereign rights of nation states over their biological resources that was historically treated as a common heritage of humanity. It was the biodiversity-rich developing countries that en masse pushed through and succeeded in the nationalization of biodiversity as well as inclusion of equitable sharing of commercial benefits among the objectives of CBD. The developing nations had high expectations of CBD under the premise that, biological resources being the raw material for the biotechnology, seed and pharmaceutical industries, are the key to potential economic success in the future. Biodiversity was portrayed as the green gold of the South (biodiversity-rich developing countries) that is being surreptitiously pirated by the MNCs of the North (developed countries). The politicians and policy makers of the South were carried away by the speculations, propaganda and lobbying by activists and NGOs, rather than empirical evidences. Domination of politicians and professional negotiators on the scientific board of CBD also has been hindering effective action on the basis of scientific evidence[3].

Nationalization of genetic resources to counter corporate patenting overlooks the world's interdependence on genetic resources and the evolutionary history of crop plants. Cultivated plants have originated in different regions of the globe and nations of the world are linked in a complex network of plant genetic interdependence. No region can afford to isolate itself, or be isolated, from access to plant germplasm of other regions of diversity[4,5]. This bondage is growing ever stronger, due to increasing loss of agricultural biodiversity and climate change. The International Treaty on Plant Genetic Resources for Food and Agriculture, albeit legally non-binding, reflects appreciation of the world's interdependence on genetic resources[6].

The loss of biodiversity from the common heritage of humanity would adversely affect global food security, agricultural production, biodiversity research and international relations. All these will affect the developing nations, more than the developed ones, as the former are already plagued by the problems of population explosion and underdevelopment. Moreover, sustenance and livelihood of small farmers and indigenous communities in the South is innately linked to biodiversity, both indigenous as well as introduced, making them more vulnerable to the perils of restrictions on access to the global plant genetic estate. For example, cassava (tapioca) is a major food crop in Africa and Asia, where it was introduced from South America. It is well known that cassava became the sole life savior of the marginalized and hungry during major famines in Asia and Africa.

The Southern venture of nationalization and restricted access to biodiversity for commercial benefits is unlikely to take-off due to innate weaknesses and contradictions. Global experience since the CBD in 1992 has proved that benefit-sharing, both as an incentive for conservation as well as royalties for access to traditional knowledge, is a proposition akin to fetching water in a sieve. Hardly any successful model of ABS that is a sustainable source of supplementary income for the rural communities is known. India is one of the richest countries in terms of biodiversity and the associated traditional knowledge. However, the Indian experience in this regard is not promising. India enacted the Biological Diversity Act in 2002 (refs 7–10), mainly to regulate access to biodiversity and facilitate benefit-sharing. Despite imposing severe restrictions on the access to biodiversity in the country, India's gains in sharing commercial benefits of biodiversity among its stakeholders are minimal. The widely publicized case of the 'Indian Ginseng', a 'wonder drug' based on the traditional knowledge of the Kani tribe in Kerala[11,12], hailed as the first ever example of benefit-sharing with an indigenous community, has turned out to be a cropper[13,14]. The failure of the Kani-*Trichopus* ABS model, unfurled prior to the introduction of the Biological Diversity Act, is attributed to unrelenting bureaucracy and a policy vacuum[15]. However, the truth is that reputed scientists had questioned the very scientific basis of the tall claims on the medicinal property of *Trichopus* (see Martin[15]) that went unheard in the din of euphoria and publicity.

The case of San–*Hoodia* from South Africa is the most unique example in the world, where the much touted benefits from bioprospecting have had 'practical realization'[16]. *Hoodia gordonii* is a succulent plant found in the Kalahari Desert, which the San tribes have historically consumed to mitigate hunger on long journeys. The Council for Scientific and Industrial Research (CSIR) of South Africa, a public-sector research organization, had been granted a patent in 1996 on an appetite suppressant derived from the extract of the plant. The CSIR, through its tie-up with the pharmaceutical companies, Phytopharma and Pfizer, and later with the consumer giant, Unilever, attempted further research and commercialization of an antiobesity drug derived from *Hoodia*. The South African San Council, representing the San people, struck a benefit-sharing arrangement with CSIR, which specified that the San people would receive 6% of the total payments to CSIR, including royalties. The San trust received 5,69,083 ZAR (US$ 75,000) as initial benefit-sharing payments. Through licensing the technology, CSIR was expected to earn US$ 10 million in milestone payments alone, besides 'substantial' amounts due to

royalties that remain undisclosed. In the West, the publicity and hype created by the clinical trials of Phytopharma and Unilever led to phenomenal escalation in the price of the dry product, i.e. up to US$ 200 per kilogram, leading to the incorporation of the plant into a global underground network of diamonds, drugs and abalone[17]. The sudden burst of the *Hoodia* bubble came about in November 2008, when Unilever announced its decision to abandon attempts to develop the antiobesity product after investing £ 20 m in *Hoodia* research over four years[17]. Unilever also disclosed that the clinical trials indicated potentially dangerous side effects, besides no significant effect on calorie consumption[18]. The cases of Kani–*Trichopus* and San–*Hoodia* illustrate the limitations of commercialization of traditional knowledge, which is often overvalued and glorified.

The National Biodiversity Institute (INBio) in Costa Rica, setup in 1989, is a pioneer organization that developed the concept and practice of bioprospecting and benefit-sharing[19]. INBio's commercial agreement with the pharmaceutical giant Merck, a well-known practical example for benefit-sharing, has generated substantial direct payments[20] and 27 patents, but no product has reached the market and no royalties have been paid to the providers of biodiversity[21,22]. A five-year agreement between the South African National Biodiversity Institute and the Chicago-based Ball Horticulture, which is the first North–South bioprospecting agreement in the horticulture sector, led to the development of eight commercial varieties. However the royalties, despite being substantial, did not surpass the costs of the project[16,22]. Davalos *et al.*[23] recognized the benefits obtained from ABS as entirely non-monetary, as no royalty has resulted from any such agreements in Brazil, Colombia or the Philippines. It is also known that the outcome of benefit-sharing arrangements from mining on aboriginal land in Australia has frequently been disappointing[17].

The ABS arrangement on the use of germplasm of teff (*Eragrostis tef*), the staple food of Ethiopia and Eritrea, between the government agencies of Ethiopia and the Netherlands-based company, Health and Performance Food International[16], is noteworthy. Birhanu[24] describes the centralization of power in the hands of the federal government, with little attention to regional and local governments as the major feature of the agreement. No single community was identified in the teff ABS agreement even for the purpose of benefit-sharing, given the difficulty in identifying a particular community. Teff being a food crop of immense potential for humans, restricting access to its genetic resources for commercial benefits, on the basis of geographical origin and political boundaries, has set an undesirable trend that runs on the face of humanity.

The National Biodiversity Authority (NBA) of India was established according to the Biological Diversity Act, 2002, to facilitate ABS. One of the first NBA-facilitated ABS arrangements in India was with Pepsico for the cultivation of marine alga, *Kappaphycus alvarezii*[25], which has already been established as a noxious invasive organism that causes ecological and economic devastation of the marine ecosystems[26]. This ABS agreement raises a few questions: (i) How could the communities claim a share of the commercial benefits of an exotic plant as no traditional knowledge is involved in its cultivation or processing? (ii) At the end who will be responsible for the ecological vitiation that it creates? According to this agreement, the local community will get an initial payment of 3.7 million rupees (80,000 USD). This is a pittance by any national or international standards and it is much less than any government-sponsored community development programme in India. Futility of such petty ABS models is quickly realized upon comparison with the benefits of free exchange of genetic materials. For example, rubber, an introduced crop, is the livelihood of more than one million small farmers in Kerala[27], besides being the bedrock of a robust rubber industry. This small state has also achieved the highest productivity of the crop in the world. We wonder whether any of the ABS arrangements will ever match the benefit the communities – poor Kani tribal farmers who make their livelihood from less than a dozen rubber trees to huge plantations – gain out of rubber in Kerala.

Koopman[28] has comprehensively dealt with the problems of proprietary recognition of traditional knowledge associated with biological material. Patents are granted for inventions which are susceptible to industrial applications, new and involve an inventive step. Traditional knowledge is developed in a cultural and subsistence milieu, instead of a competitive industrial context and it is often communicated and applied openly. Traditional knowledge on the use of biological resources comprises contributions of individuals that gradually became community knowledge with the demise of the creators[29]. How benefit can be given for community knowledge which is really not different from public knowledge is a challenge. Traditional knowledge is confronted with the lack of novelty and/or inventivity and is further dampened by the need to individualize the invention at hand. Proprietary rights on traditional knowledge also involve many legal questions. How should one deal with conflicts between multiple communities associated with the same public knowledge? How should one apply requirements such as authenticity? How should one approach parallel sovereignty of countries over the same or similar biological material? How should the industry verify the exclusive competence of the community or country it is dealing with and inquire the validity of its agreements? Some of the above legal questions raised by Koopman[28] are illustrated by the case of *Dodonaea viscosa* (= *D. angustifolia*), which is a pantropical plant. The farmers of Sringeri (Karnataka) and Malayalee tribes, an indigenous community of Koli Hills (Tamil Nadu), use the plant as biopesticide[30]. The villagers of Chintamani (Karnataka) and Mayan tribes of Santa Cruz (Bolivia) use it as a bone setter in cattle. The recorded cross-cultural uses of this plant in folk medicine vary from that in the treatment of itching (Hawaii) and burns (Indonesia) to snake bite (India, Pakistan), rheumatism (Hawaii, Mexico), toothache (Australia, Panama) and bleeding (Colombia)[31]. Similarly, the same species may be used for different purposes by different communities and the process and method of usage may also vary among communities. So it is difficult to attribute the right over traditional knowledge and share the benefit with any particular community. It can create conflicts between communities and even between nations over the resource.

If proprietary rights are granted to traditional knowledge that passes through generations, why should patent rights be limited to a period of merely 20 years? Acceptance of proprietary rights on age-old traditional knowledge also warrants infinite extension of patent protection.

Many Southern nations freely deal with the manufacture and trade of products such as pharmaceuticals after the expiry of the patents on them. For example, India is yet to invent its first commercial antibiotic, but is one of the largest manufacturers of antibiotics and other generic drugs. Synthetic pesticide industry in India is another such example. Similarly, India so far has contributed precious little in terms of inventions in biotechnology and genetic engineering that has made any impact in the field. Yet the country is self-sufficient in important commercial technologies in this area. Many a company in India is engaged in research and development of vaccines and diagnostic tools. Public sector in India is capable of producing transgenic crops and cloned animals. We have just uncouthly adapted the ideas and technologies from the North, mostly available in the public domain. Those who cry hoarse over appropriation of age-old traditional knowledge, forget about the gains they are making out of public knowledge produced by others, though legally.

Origin and nature of traditional knowledge makes it public knowledge. Defensive protection of traditional knowledge by documenting and making it available in the public domain would prevent misappropriation by elements in the private sector that present traditional knowledge without further novelty or inventivity as inventions for obtaining patents. This would also aid in the conservation and proper utilization, besides encouraging scientific validation and further research on traditional knowledge. On the contrary, silo-culture of traditional knowledge would be counter-productive.

Oli[29] has stressed that obtaining benefits from traditional knowledge and genetic resources is complex and, in practice, it is not clear how the local indigenous communities will benefit from bioprospecting. ABS arrangements tend to be viable and productive when the contracting parties are technologically advanced and higher levels of scientific collaboration are involved, as in the case of Griffith University and Astra Zeneca[16]. Indigenous communities are marginally benefited when the ABS deal involves collection and/or processing of high-value raw material in bulk quantities for the industry, as exemplified by the trade of Australian sandalwood[16]. But such cases are more or less akin to the normal trade in raw materials and the commercial benefits accrued are neither by virtue of the associated traditional knowledge nor due to royalties flowing out of any patented product developed from the biological material. Without adequate infrastructure and higher levels of scientific collaboration, ABS would only relegate the local communities to the status of 'fodder collectors' for the industry.

Evidently, ABS professed as a solution to the problems of development of the South is untenable. Emotion and nationalistic sentiments further obfuscate the ABS illusion for reality, thus pushing aside a rational solution. The resolution adopted by FAO in November 2009 calls upon the CoP of CBD to take into account the special nature of the genetic resources for food and agriculture, as all countries depend on genetic resources originating elsewhere to address environmental, natural resource, sustainable development, food security and climate challenges[32]. It is high time the South realizes that the commercial benefits which can be derived through sharing of biodiversity and the associated traditional knowledge are insignificant and irrelevant in the face of vital issues such as food security. Benefit-sharing, the wrong shortcut to economic development, can neither be a substitute for innovation, invention or industrialization, nor a sustainable source of income for the rural communities. Underdevelopment of the South needs to be addressed in a much broader socio-economic and political context. The genetic resources of the global plant genetic estate were traditionally available free to the industries of the North, whereas products derived from the genetic resources were subjected to intellectual property protection. It was this asymmetry in ownership of technology and commercial gains through the intellectual property regime that widened the chasm between the South and the North, ultimately leading to the nationalization of genetic resources for benefit-sharing. But as pointed out earlier, the means adopted by the South to address its grievances has now been proved to be wrong and counter-productive. A plausible way to address the issue would have been attempts to change the intellectual property rights (IPR) regime, rather than restricting access to biodiversity through locking up in the national silos. Possibility of an IPR regime that positively discriminates the South, in addition to North–South collaborations in research, development and commercialization of biodiversity is worth pondering. However, the South at present is left with few options as the present global economic scenario warrants intellectual property protection to attract investments in research and innovation. The developing world, in its own interest, should forgo benefit-sharing to facilitate free exchange of genetic resources as the benefits of the latter far outweigh those of benefit-sharing.

It is doubtful whether CBD will ever progress towards its goal of halting all extinctions by 2050, unless the fundamental flaw of nationalization of biodiversity and the misplaced thrust on commercial benefits is corrected. Biodiversity is on the brink and the rate of extinction continues to be lethal[33,34]. Nations of the world should come together for the conservation of biodiversity as time is running out fast. In the changing global scenario, India has a greater responsibility to assume the lead role, especially as the next CoP is to take place in New Delhi in 2012.

1. Convention on Biological Diversity, Rio de Janeiro, Brazil, 5 June 1992; http://www.cbd.int/convention/convention.shtml
2. Conference of the Parties to the Convention on Biological Diversity, Tenth Meeting, Nagoya, Japan, 18–29 October 2010, Agenda item 3; http://www.cbd.int/nagoya/outcomes/
3. Laikre, L. *et al*., *Conserv. Biol.*, 2008, **22**, 814–818.
4. Kloppenburg, J. and Kleinman, D. L., *Bioscience*, 1987, **37**, 190–198.
5. Fowler, C., Smale, M. and Gaiji, S., *Dev. Policy Rev*., 2001, **19**, 181–204.
6. International Treaty on Plant Genetic Resources for Food and Agriculture; http://www.sipo.gov.cn/sipo2008/ztzl/ywzt/yczyhctzsbh/zlk/gjgy/200804/P020080411461274286262.pdf
7. Biological Diversity Act, 2002. No. 18 of The Gazette of India Extraordinary, 5 February 2003; Ministry of Law and Justice (Legislative Department), Government of India; http://www.nbaindia.org/act/act.htm
8. Prathapan, K. D. *et al*., *Curr. Sci*., 2006, **91**, 1006–1007.
9. Prathapan, K. D. *et al*., *Curr. Sci*., 2008, **94**, 170–171.
10. Prathapan, K. D. and Rajan, P. D., *Curr. Sci*., 2009, **97**, 626–629.
11. Jayaraman, K. S., *Nature*, 1996, **381**, 182.
12. Mashelkar, R. A., *Curr. Sci*., 2001, **81**, 955–965.

13. Chaturvedi, S., Kani Case. A Report for GenBenefit, 2007; http://www.ris.org.in/Kani_Case.pdf
14. Value addition to local Kani tribal knowledge: patenting, licensing and benefit-sharing; http://www.worldbank.org/afr/ik/dlc/DLC%20files/kani.pdf
15. Martin, M., *Down to Earth*, 15 November 1998, pp. 29–35.
16. Laird, S. and Wynberg, R. (eds), *Access and Benefit-Sharing in Practice: Trends in Partnerships Across Sectors*, Technical Series No. 38, Secretariat of the Convention on Biological Diversity, 2008, p. 140.
17. Wynberg, R., Schroeder, D. and Chennells, R. (eds), *Indigenous Peoples, Consent and Benefit Sharing: Lessons from the San-Hoodia Case*, Springer + Business Media B. V., 2009, p. 363.
18. Unilever, Sustainable development 2008: An overview, 2008, p. 34; http://www.unilever.com/images/Unilever_Sustainable_Development_Overview2008_v3_tcm13-163522.pdf
19. Coughlin Jr, M. D., *Columbia J. Transnatl. Law*, 1993, **31**, 337–375.
20. ten Kate, K. and Laird, S. A., *Int. Affairs*, 2000, **76**(1), 241–264.
21. Laird, S. A. and Wynberg, R., The commercial use of biodiversity: an update on current trends in demand for access to genetic resources and benefit-sharing, and industry perspectives on ABS policy and implementation. 2005; UNEP/CBD/WG-ABS/4/INF/5; http://www.cbd.int/doc/meetings/abs/abswg-04/information/abswg-04-inf-05-en.pdf
22. Brendan, T. *et al*., Information document of the Third meeting of the Ad Hoc Open-ended Working Group on Access and Benefit-Sharing, United Nations University Institute of Advanced Studies, Yokohama, Japan, 2005; UNEP/CBD/WG-ABS/3/INF/5; http://www.ias.unu.edu/binaries2/abswg-03-inf-05-en_revised%202.pdf
23. Davalos, M. L. *et al*., *Biodiver. Conserv.*, 2003, **12**, 1511–1524.
24. Birhanu, F. M., *Int. Environ. Agreements*, 2010, **10**, 249–266.
25. *The Hindu*, 18 February 2010; http://www.thehindu.com/news/national/article108495.ece
26. Namboodiri, N. and Shankar, K., *Curr. Conserv.*, 2010, **4**, 18–20.
27. *Indian Rubber Statistics*, Statistics & Planning Department, Rubber Board, Kottayam, 2009, vol. 32, p. 67.
28. Koopman, J., *Ecol. Econ*., 2005, **53**, 523–541.
29. Oli, K. P., *Int. J. Biodivers. Conserv.*, 2009, **1**, 105–118.
30. Subashini, H. D., Malarvannan, S. and Pillai, R. R., *Curr. Sci*., 2004, **86**, 26–28.
31. Leonard, D. B., Medicine at your feet: healing plants of the Hawaiian Kingdom *Dodonaea viscosa* (‘A’ali’i), 2006; http://www.medicineatyourfeet.com/Dodonaea_viscosa.pdf
32. Food and Agricultural Organization of the United Nations, Report of the Conference of FAO, Thirty-sixth Session, Rome, 18–23 November 2009; http://www.fao.org/docrep/meeting/018/k6302e01.pdf
33. Secretariat of the Convention on Biological Diversity, *Global Biodiversity Outlook 3*, Montréal, 2010; http://69.90.183.227/gbo/gbo3/doc/GBO3-final-en.pdf
34. Butchart, S. H. M. *et al., Science*, 2010, **328**, 1164–1168.

ACKNOWLEDGEMENTS. Seena Narayanan critically reviewed the manuscript. K.D.P. is supported by the Kerala State Council for Science, Technology and Environment, Thiruvananthapuram.

K. D. Prathapan is in the Kerala Agricultural University, Vellayani P.O., Thiruvananthapuram 695 522, India; Priyadarsanan Dharma Rajan is in the Ashoka Trust for Research in Ecology and the Environment, Jakkur Post, Bangalore 560 064, India.*
**e-mail: prathapankd@gmail.com*