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THE CONVENTION ON BIOLOGICAL DIVERSITY-ORIGIN AND DEVELOPMENT

Evolution of the Convention on Biological Diversity

Biological diversity is a broad concept, embodying as it does the variability among all living organisms, including diversity within species, among species, and among ecosystems. Genetic resources are the hereditary material in all animals, plants, and microorganisms; the concept refers to genetic material with actual or potential use or value for humanity. Genetic diversity or variability is a necessary condition to sustain vitality in both wild and domesticated plants and animals, and also for the development of new and improved products.

Conservation of biodiversity is critical to maintaining the future of life on Earth as we know it. Conversely, the lack of such conservation will undoubtedly lead to continued elimination of life-forms, loss of genetic material, and disruption of natural processes[1]. In view of the large scale exploitation of useful diversity of various plant species from forest and open areas, particularly for medicinal and other economic plants, and the prevalence of fragile ecosystems in many part of the country[2]. Discussion of the relative merits and limitations of biodiversity prospecting agreements in realizing the objectives of the CBD has been the subject of a polarized and often emotional debate[3].

The Conservation of Biological Diversity constitutes one of today's greatest challenges, as environmental degradation world-wide has led to species extinction at a hitherto unprecedented rate. Estimates of the number of existing species in the world vary from about 5 to 100 million[4], of which only some 1.4 million have been described scientifically[5]. As the new biotechnologies make it possible to utilize the full potential of the world's genetic resources (it is now possible to transfer any gene into any organism), the economic incentive to conserve biological diversity increases. Hence, the interest in genetic material is arising from environmental concerns, as well as being based on technological developments. By the year 2000 farm-level sales of products of agricultural biotechnology are expected to have reached some US$100 billion; the value of global trade in plant-based pharmaceuticals was estimated at US$20 billion for the year 1986[6]. Apart from the ethical and aesthetic value of species diversity, we should note that mankind depends on genetic resources for food, medicines, and for raw materials in the chemical industries. The international debate on genetic resources is concerned not only with conservation, but just as much with the distribution of benefits derived from using this material. The main bulk of the global genetic resources are found in the Third World, but it is the developed countries that possess the biotechnology to exploit these resources. This potential conflict was realized by the World Commission on Environment and Development which urged: 'Industrialized nations seeking to reap some of the economic benefits of genetic resources should support the efforts of the Third World nations to conserve species' and 'developing countries must

[4] Edward O. Wilson, **The Diversity of Life**, 1st edn. (Harvard University Press, Cambridge, 1992), p.5.

[5] Edward O. Wilson (ed.), **Biodiversity,** 1st edn**.** (National Academy Press, Washington. D.C, 1998), p.24.

[6] Report of Panel II, UNEP/Bio.Div/Panels/Inf.2, Nairobi, 28 Apr. 1993.

be ensured an equitable share of the economic profit from the use of genes for commercial purposes[7]'.

The Bio Convention is not the first international treaty to address species or habitat conservation, but it is the first to address conservation of all biological diversity and the first to include sustainable utilization of these resources. There exist a great many agreements pertaining to international co-operation on the conservation of various species of plants and animals and their habitats. The Ramsar Convention on Wetlands is one of the most important global measures concerned with habitat protection (Ramsar, 1971). For the Arctic area, there is the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR, Canberra, 1980). Whales (ICRW, Washington, 1946) and tuna (ICCAT, Rio de Janeiro, 1966) have their own Conventions. Another example is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, Washington, DC, 1973).

Until the early 1980s the focus for both national and international conservation work was still on wild species of plants and animals. An important shift came when the question of access to and control over plant genetic resources was raised by governments of the developing world. The forum for this heated debate was the UN Food and Agricultural Organization (FAO); the result was the FAO International Undertaking on plant genetic resources, then representing the most comprehensive agreement in terms of linking genetic resources conservation to social and economic concerns[8]. In 1989 the UN Environment Programme (UNEP) was given the formal mandate of negotiating what was to become the

[7] WCED, **World Commission for Environment and Development**, Our **Common Future,** 1st edn. (Oxford University Press, Oxford,1987), p.8.

[8] Cary Fowler, **'Biological Diversity in a North–South Context', in Green Globe Yearbook,** 1st edn., (Oxford University Press, Oxford, 1993), p.35.

all-encompassing Convention on biological diversity, which was adopted in Nairobi in May and signed in June at the 1992 UN Conference on Environment and Development in Rio de Janeiro[9]. A first crucial question was whether to include both wild and domesticated species. In the background lurked the question of property rights to genetic resources.

CBD and Property Rights on Genetic Resources

Genetic resources are generally defined as genetic material of actual or potential value. The world's genetic resources are raw materials for biotechnology. With the advent of the new biotechnologies has come an increased realization of the value of genetic resources. In the 1970s the transnational seed and chemical corporations started applying these new technologies in plant breeding and agrochemicals, and in the course of the 1980s the biotechnology industry grew big. This realization has had a profound impact on the understanding of property rights to genetic resources. The story begins with the principle of a common heritage of mankind and ends with patents and state sovereignty. Common property resources are usually defined by their character of non-rivalry and non-exclusiveness. Non-rivalry implies that it is possible for more than one person to use or consume the good without diminishing the amount available to others. Non-exclusiveness indicates that it is hard to exclude others from using or consuming the good. The air we breathe is generally regarded as an example of a nonrival and non-exclusive good. This used to be the case with clean water as well, but its character of non-rivalry is rapidly declining in many parts of the world. The combined case of non-exclusiveness and rivalry may give rise to problems of collective action, unless some kind of management regime can be established to control access to the resource in question.

[9] G. Kristin Rosendal, A **Sustainable Development for Plant Genetic Resources: The Output of the Debate in FAO; a Sisyphean Victory for an Environmental Organization Green Globe Yearbook,** 1st edn., (Oxford University Press, Oxford, 1993), p.7.

Basic to the idea of common heritage is always an element of non-exclusiveness or open access: the absence of well-defined property rights. This was the case with ocean fisheries in the past century, in the Grotian doctrine of the freedom of the high seas[10]. Common heritage, however, is not necessarily identical with the idea of open access as practiced under the high seas doctrine[11]. Open access merely implies that no one can be excluded from using the resources, save by lack of economic and technological capacity. Conversely, the common heritage principle may imply that everyone (all mankind) has a right to benefit from exploitation of the resources. In international negotiations the common heritage principle was first introduced at the UN Conference on the Law of the Sea (UNCLOS) in 1967 by the Maltese ambassador to the UN, Arvid Pardo, as a guiding principle in governing the exploitation of minerals on the deep sea-bed. Both in the UNCLOS negotiations and later in the Antarctic Treaty negotiations, the idea was to secure greater equity between developed and developing countries in the exploitation of a 'common' resource. The majority of industrialized states objected to the principle as being legally diffuse and practically impossible. All along, however, the principle of common heritage did constitute the international regime for exchange of and access to plant genetic resources, in other words, seeds. International gene-banks were stocked with seeds from the most commonly used food plants, these seeds were primarily collected from the extensive variation found in the Third World, and the gene-banks were based on the principle of open access.

[10] Hedley Bull, Benedict Kingsbury, and Adam Roberts (eds.) **Hugo Grotius and International Relations,** (Clarendon Press, Oxford, 1992), p.8.

[11] R. B. Bilder '*International Law and Natural Resources Policies',* Natural Resources Journal, Vol.20, (July,1980), pp 451–86 at p.453.

'Technically', the collection of seed samples was considered by all as a non-rival and non-exclusive activity. Moreover, no one questioned this practice on moral grounds, as the seeds of our most utilized food plants were seen to be of basic significance to all mankind. While most gene-banks still operate on the basis of open access to genetic resources, the common heritage regime for genetic resources is rapidly becoming a thing of the past. This change may be traced back to the 1930s, with the introduction of hybridization, tailored to secure exclusive rights to superior plant varieties. More recently, the regime change has come about swiftly, primarily as a reaction to the introduction of intellectual property rights for organic material, which allow private ownership to genetic resources through patents or plant breeders' rights. Prior to this development it became necessary to change, or rather reinterpret, national patent laws. The moral notion that food and medicine should be excluded from patentability because of their fundamental importance to basic human needs is rapidly losing ground. On the other hand, there have also been technical barriers to patentability. National and international patent legislation draws no a priori distinction between various sectors of technology. Traditionally, it is true; the patent system was limited to technologies dealing with non-organic material. Biological material was regarded as natural products rather than industrial products discoveries rather than inventions[12]. Biological products or processes were originally excluded from patentability on the grounds that such inventions could not meet all the requisite patent criteria. For an invention to be patented, it must meet four fundamental criteria.

First, the invention must be novel, meaning basically that it has not been published anywhere before. Secondly, there is the criterion of non-obviousness the invention must

[12] R. S. Crespi, **Patents: A Basic Guide to Patenting in Biotechnology,** 1st edn. (Cambridge University Press, Cambridge, 1988), p.12.

display an inventive step. The third criterion states that the invention must have an industrial application a practical utility. One function of this utility requirement is to distinguish between basic researches, considered to belong to the public domain, and applied technology, which is eligible for patenting. Finally, the patent application must fulfil the criterion of reproducibility, in the sense that it must describe the invention in such detail that other experts may repeat the experiment and arrive at the same results. In addition to these criteria, patent legislation commonly excludes from patentability inventions whose utilization would run counter to 'public order or morality'. The barriers represented by these patent criteria have now been largely overcome by developments in the new biotechnologies. These developments have not only made patenting a practical possibility: they have also created a need for it, from the perspective of the US, Japanese, and West-European biotechnology industries. Research in biotechnology often involves high costs, as compared to traditional breeding methods. Competition is fierce, and research is increasingly being carried out by the private sector. The biotechnology sector has been arguing strongly for compensation in terms of royalties, along the lines of other fields of technology. The principal ruling on the patentability of biological material appeared in the German Federal Supreme Court in 1969 (the Red Dove Case), which determined that a breeding process for animals was indeed patentable[13]. In the Chakrabarty Case of 1980 the US Supreme Court of Justice decided, by five against four, to allow industrial patents for naturally occurring living matter, including both asexually and sexually reproduced plants[14]. A judge from this case was later employed by the EC Commission in drawing up its

[13] Pat Mooney, Cary Fowler, Eva Lachkovics, and Hope Shand, '**The Laws of Life: Another Development and the New Biotechnologies', Development Dialogue,** 1st edn. (Dag Hammarskjöld Foundation, Uppsala, 1988), p.31.

[14] S. A. Bent, R. L. Schwaab, D. G. Conlin, and D. D. Jeffery, **Intellectual Property Rights in Biotechnology Worldwide,** 1st edn. (Stockton Press, New York, 1987), p.17.

formulation of a directive on industrial patents in biotechnology. Plant varieties can be protected by 'plant breeders' rights', as under the US Plant Variety Protection Act of 1970. Intellectual property rights may also be granted through the 'plant breeders' rights' of the 1961 UPOV Convention (International Union for the Protection of New Varieties of Plants). In order to be subject to UPOV protection, a plant be 'uniform, stable and distinct from existing varieties'.

In order to attain protection by breeders' rights or patents, some kind of systematic breeding is required. This is seldom the case with Third World breeders' lines, however. This controversy is not confined to the agricultural sector. There is a growing awareness that the largely unexplored components of biodiversity may conceal treasures, for example, of great medicinal value. A much-cited case from medicine is the Rosy Periwinkle, a native plant of Jamaica and Madagascar. Two components from the plant have been turned into a medicine for treatment of Hodgkin's Disease and certain types of Leukemia by the US pharmaceutical firm Eli Lilly. The company's annual return on the invention is about £60 million, none of which is returned to the country of origin[15]. As patenting was catching on rapidly in the industrialized world, the governments of developing countries started to question whether the common heritage principle would eventually apply solely to resources from the South. They reasoned that the elaborated material of the industrialized countries was based largely on material from the South, and should thus also be seen as part of the common heritage. This view met with strong resistance from the industrialized countries, who argued that such an arrangement would not be compatible with Northern 'breeders' rights' and patent legislation. Third World governments abandoned the claim for an all-embracing common heritage regime and turned the argument around. Their new line of

[15] F. Pierce , '*Brazil, Where the Ice Cream Comes From'*, New Scientist, (July 1992), p.47.

argumentation was to claim *national sovereignty* over their genetic heritage, regarding it as a national asset along the lines of other natural resources, like oil and minerals. Genetic resources differ, however, from oil and minerals in being non-rival and largely nonexclusive goods. These characteristics will obviously hamper state control over genetic resources. Nevertheless, national sovereignty ended up as the only passageway for reaching consensus about property rights between the North and the South. The next section traces this international debate through the international forums in which it took place during the 1980s and early 1990s.

The Negotiation Process of Bio Convention

The Bio Convention was negotiated by a UNEP ad hoc Working Group of legal and technical experts, which later changed its name to the Intergovernmental Negotiating Committee (INC). The first meeting in the *ad hoc* group drew experts from twenty-five countries, as well as some NGO observers (including the World Conservation Union (IUCN) and World Wide Fund for Nature (WWF) and IGOs (such as FAO). The number of delegates expanded rapidly. Negotiations started in November 1989, and the Bio Convention was signed by 153 countries and the European Community at UNCED in Rio de Janeiro on 5th June 1992. When the issue of biodiversity was first moved to UNEP several parties suspected that this was in fact an attempt to un-link the politicized plant genetic resources debate in FAO from the more traditional values of wildlife conservation in protected areas. That is exactly what it was: an attempt, led by the USA and the IUCN, to retain a focus on *in situ* conservation, rather than tackle the controversial issue of 'sustainable use of biological resources'. Their fears were legitimate enough, as linking these packages would clearly cause hotter negotiations. The USA hoped that the move to UNEP would quench the fire,

and refused to include any mention of biotechnology or to talk about the value of genetic resources. Obviously, the controversy concerning conservation and sustainable utilization of biological resources was further fired by the consequences this would eventually have for financing: first, because putting a price-tag on biodiversity might disclose how profits in the agricultural and pharmaceutical sectors in the North are extracted from genetic resources from the South. Secondly, because the new perspectives draw attention to biodiversity in a much wider sense and could lead to stricter regulations on agricultural and forestry practices in all parts of the world.

Environmental and wildlife management NGOs like IUCN and WWF feared that no conservation agreement would in the end be reached, either for wild or domesticated species, if the latter was to be included in the negotiations[16]. Hence, the first IUCN draft convention presented to the participants reflected the Western traditions of nature conservation in full. The role of IUCN was also symptomatic of the NGOs represented as observers in the UNEP negotiations. These were mainly concerned with habitat and species protection, rather than what had been the case in FAO, where the International Coalition for Development Action (ICDA) helped to advocate the interests of Third World farmers. The UNEP agenda was characterized by a high degree of flexibility, and participants kept adding on new elements. Nevertheless, for a long time the agenda was dominated by a focus on protecting biological 'hot-spots' like tropical rainforests and other places of high biological diversity. It was primarily the Nordic delegations which emphasized the development aspects and an improved utilization of resources as a means to provide incentives for better conservation of natural species or habitats. They also stressed that biodiversity conservation is essential in all countries, regardless of the number of species—thus trying to counter the

[16]Available at http:// www.fni.no/ybiced/95_06_rosendal.p.Last visited on 28.03.2014.

bias towards tropical forests. Eventually the developed countries realized that putting off these issues would mean that the developing countries, especially countries like Brazil and Malaysia, would not join the Bio Convention but as the main bulk of biodiversity are located in the tropics, negotiations simply could not proceed without them.

As of June 1994 the Biodiversity Convention has been signed by 167 states and the European Community, and has been ratified by sixty four. The objective of the Convention is twofold: to ensure conservation and sustainable use of biological diversity; and to promote a fair and equitable sharing of the benefits arising from the utilization of genetic resources[17]. The Convention sets out obligations and objectives for nations to combat the destruction of plant and animal species and ecosystems. Among other things, the Contracting Parties shall integrate conservation and sustainable use of biological diversity into relevant sectoral plans and policies and develop systems of protected areas. The international community is given the responsibility for conserving biodiversity in developing countries, including the most environmentally vulnerable, such as those with arid and semi-arid zones, and coastal or mountainous areas. Each Contracting Party is to present reports on the measures it has taken towards implementing the provisions of the Convention and how effective these have been in meeting the objectives. It is left to each Party to decide on which measures are most effective to conserve biodiversity. Furthermore, the Contracting Parties agree to respect, preserve, and maintain knowledge and practices of indigenous and local communities, and encourage the equitable sharing of the benefits arising from the utilization of such knowledge and practices. The Bio Convention states that each country

[17] Available at http:// www.fni.no/ybiced/95_06_rosendal.p.Last visited on 28.03.2014.

has the sovereign authority to determine access to its genetic resources, that access to genetic resources requires prior informed consent and must be on mutually agreed terms, and that a country providing genetic resources is entitled to benefit from the commercial use of its resources. The Convention envisages three basic mechanisms by which a country may benefit from the use of its genetic resources: participation in the research using the resources, receiving technology which embodies or utilizes the resources, and sharing the financial benefits realized from commercial exploitation of the genetic material or resource. This sovereignty does not include genetic material in international gene banks which was collected prior to the Convention entering into force[18]. In Article 39 the Global Environment Facility (GEF) of the United Nations Environment Programme, the United Nations Development Programme, and the World Bank is accepted as the interim financial mechanism of the Convention. It is up to the Conference of the Parties to decide on policy, programme priorities, and eligibility criteria relating to access to the financial mechanism. As far as patenting is concerned, the Convention stipulates that technology transfers 'shall be provided on terms which recognize, and are consistent with, the adequate and effective protection of intellectual property rights'. Seeking to reconcile the conflicting interests in the patent issue, the Bio Convention states that the Contracting Parties shall co-operate to ensure that intellectual property rights '*do not run counter to its objectives*'. This sentence was one of the main reasons why US president George Bush refused to sign the Bio Convention in Rio.

Moreover, that was still a major concern with the Clinton administration, as the decision to sign the Convention was followed by an interpretative statement addressing

[18] Ruiz, M. and I. Lapeña (eds.), **A Moving Target: Monitoring the International Flow of Genetic Resources**, 1st edn. (IUCN Environmental Policy and Law Paper, Switzerland, 2007), p. 67.

intellectual property rights as well as the provisions for financial mechanisms. As regards links to biotechnology, the final version of the Convention also sought to smoke out another controversial issue. As the USA was fervently opposed to international regulations on 'living modified organisms resulting from biotechnology', it was left to the Parties to consider the 'need for, and modalities of' a protocol on biosafety in the future. It is pertinent to mention about the commitments of the Convention.

It is in the nature of human beings to organize our world into a hierarchical structure, whether it be with regard to leadership, sports teams, or-more prosaically-the classification of international laws. On the latter point, two simple categories have developed to organize international law into a hierarchical structure. At the top is so called "hard law,"[19] generally created by treaties, which theoretically imposes binding legal obligations on member states. At the bottom is "soft law," created by other instruments that theoretically are more in the nature of aspirational or moral goals. The operative word of course, is "theoretically." It practice, it can be quite difficult to determine whether a particular instrument operates as hard or soft law[20]. One such instrument that is difficult to classify is the CBD and its subsidiary instruments. In theory, the CBD is hard law, a binding international treaty negotiated by governments. In practice, however, it has been argued that the CBD conforms to the characteristics of other international hard laws that possess a soft nature. This section explores the international legal context within which Multilateral Environmental Agreements (MEAS) such as the CBD are developed. It then provides a brief description and preliminary analysis of the legal weight of the CBD.

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[19]Abbot, K.W. and Snidal, D., *Hard and Soft Law in International Governance,* International Organization, Vol. 54, (2000), pp. 421-456.

[20]Harrop, S.R. and DJ. Pritchard, A *Hard Instrument Goes Soft: The Implications of the Convention on Biological Diversity's Current Trajectory,* Global environmental Change, Vol. 21, (2011), pp. 474-480, at p. 476.

Traditionally, binding[21] International Law (including International Environmental Law) is created pursuant to the Vienna Convention on the Law of Treaties (Vienna Convention). Under the Vienna Convention, parties consent to be bound by a treaty at an international conference and the treaty enters into force once it has been ratified by a minimum number of parties[22]. This is the "traditional process of lawmaking, states protects their individual interests by exercising their sovereign right to withhold their consent to be bound and their prerogative to demand reciprocal concessions of their bargaining partners[23]." This is the method under which conventions such as the CBD and the United Nations Framework Convention on Climate Change (UNFCCC) entered into force.

While this process protects states' sovereign rights to withhold or grant consent to be bound by a treaty, it has been criticized in the context of MEAS as being inadequate to respond to the realities of environmental degradation and loss of biodiversity in a timely and effective manner. This has prompted calls for "new approaches to international environmental law-making", including approaches aimed at overcoming the constraints of the consent requirement. The Conference of the Parties (COP) to MEAS is one avenue through which restraints imposed by the consent requirement is being addressed.

Under traditional treaty law analysis, the actions of the COP which most closely approximate traditional treaty formation, adoption and ratification will constitute hard law. Thus, amendments to the CBD, protocols, and amendments to protocols, which require

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[21] J. Brunee, *Coping with Consent: Law Making Under Multilateral Environmental Agreements,* Leiden Journal of international Law, Vol. 1, (2002), p.32-35.

[22] J. Werksman, *The Conference of Parties to Environmental Treaties ,* in **Greening International institutions,** 1st edn. (Earthscan, London, 1996), p.56.

[23] R. Churchill *et al*., *Autonomous Institutional Arrangements in Multilateral Environmental Agreements: A Little-Noticed Phenomenon in International Law,* Australian Journal of International Law, Vol. 94, (2000), p. 623

express consent from Parties before they are bound, should constitute hard law. Annexes and amendments thereto deviate from the traditional treaty-law formation in that they require opting out in order to avoid being bound. As set forth in Article 11 of the Vienna Convention, however, "the consent of a State to be bound by a treaty may be expressed… by any other means if so agreed." It could be argued that the opt-out process in the CBD is another means by which Parties can express consent. Even if a literal interpretation of the term "express consent" is taken, Parties still have the opportunity to determine whether or not to be bound by an annex or amendment thereto.

On the other hand, the legal weight of actions which take place outside of this context (such as certain COP Decisions) are "at best ambiguous." In regard to COP Decisions in particular, "they do not appear to be binding in a formal sense." According to Brunee, "[t]o the extent that parties understand some of the rules contained in the relevant decisions as 'mandatory' and agree to subject themselves to their terms, the distinction between COP decisions that are, technically speaking, legally binding and those that are not may well be more apparent than real[24]." It is important to note that some commentators argue that traditional treaty analysis is inadequate to address the scope of COP decision-making. Brunee "argue[s] for an interactional understanding of international law ... [where] international law arises from a mutually generative process, [meaning that] ... actors come to understand themselves and their interests in light of their interaction with others and in light of the norms that frame the interaction." The point here is that rather than focusing on whether or not a decision was made within the formal confines of traditional treaty law, decisions are analyzed according to general concepts of transparency, mutual understanding, and customary practice.

[24] J. Brunee, *COPing with Consent- Law Making Under Multilateral Environmental Agreements*, Leiden Journal of International Law, Vol.15, (2002), pp.32-65.

The Right wing commentators have noted that by its nature, the CBD is more in the realm of a soft law instrument. Because of the contentious issues addressed by the CBD, the instrument was drafted with a "broad remit, with many of the details to be implemented by individual Parties. Rather than implementing additional hard law instruments, however, the CBD COP developed soft instruments which are not backed by obligations.

The CBD is a landmark in that it is the first global treaty to explicitly take a comprehensive, ecosystems-based approach to the protection of biodiversity. It also reaffirms state control over biological resources within national territories, while simultaneously noting that biodiversity is the common concern of all. The central objectives of the treaty are threefold: the conservation of biological diversity, the promotion of its sustainable use, and the equitable sharing of the benefits of genetic resources. It is the last objective, with its clear redistributive implications, that was and remains the cause of much diplomatic strife. The basis of the perceived North-South bargain was summarized in the words of one developing country participant: "We have the biodiversity, they have the technology."[25] The commitments made by participants may be grouped into four clusters that reflect the major issues.

The CBD is a true framework treaty. Aspirational in tone and well salted with caveats, it contains no targets, time tables, or lists of any kind. Some countries (led by France) pushed for lists of special areas, and their absence is viewed as a failing by some observers. Each party to the CBD is obligated to develop national programs for the conservation and sustainable use of biodiversity "in accordance with its particular conditions and capabilities. Parties must monitor components of biodiversity and activities that are particularly deleterious, establish a system of

[25] E. Diringer, *"Why US Opposes Biodiversity Pact,"* San Francisco Chronicle, Vol. 9, (1992), p.7.

protected areas, regulate their resources, and rehabilitate degraded areas. These activities are called *"in situ"* conservation. *"ex situ'* conservation, such as occurs in botanical gardens, zoos, and the global net-work of gene centers, also figures prominently but is clearly secondary. Additionally, the treaty mandates that consideration of biodiversity be included in all aspects of decision making and that governments conduct environmental impact assessments of proposed projects with ramifications for conservation. These commitments, while significant, are modest and did not provoke notable debate. For most developed nations, they simply codify existing practices. If implemented properly, the extension of such practices to the developing world could substantially enhance protection of biodiversity, however.

Developing nations insisted that the obligations they undertake be coupled with financial and technical transfers to pay the incremental costs of compliance. In return, developed nations insisted that access to technology and financial transfers only occur subject to mutually agreed terms. The focus on technology transfers further fed fears that the CBD was becoming a grab bag of items linked only tangentially to actual conservation. The bargaining over financial terms and mechanisms was particularly divisive. The key questions were what specifically would be covered by a biodiversity fund and what body would control it. Developed countries have committed themselves to provide financial resources to developing countries to meet the "agreed full incremental costs" of implementation[26]. The issue of funding incremental costs has appeared in a number of environ-mental treaties, most notably those on climate change. What exactly constitutes an incremental cost is not defined in the CBD text and his is likely to be a source of considerable disagreement in the future. The pilot phase of the Global Environment Facility

[26] Beatson, J., and E. Schrage, eds., **Cases, Materials and Texts on Unjustified Enrichment**, 1st edn. (Hart Publishing. Oxford, 2003), p.57.

(GEF) shows the difficulty of defining and measuring the costs and benefits of biodiversity projects; in practice, the concept may be useless in setting priorities and funding levels.

Developing nations preferred to place the CBD fund under the control of the Conference of the Parties. Donor states adamantly refused, preferring to employ the newly created GEF, which was and still is to a lesser degree controlled by the donors. In the end, the donor states won this particular battle, but DEF was only designated the interim mechanism and then only if it was fully restructured to include a "democratic and transparent system of governance."

Yet even at the close of negotiations, ambiguity about the financing terms remained, and the delegations of 19 industrialized nations joined in a declaration emphasizing their right to determine the amount of their individual and joint contributions. For many developed nations particularly the United States, the linkage between biodiversity and the safety of biotechnology is contrived. Indeed, a UNEP study commissioned in the period proceeding the treaty negotiations found almost no linkages between the two, with those that were found tending to benefit biodiversity[27] . The treaty text clearly presumes other-wise, however. The biosafety issue arose late in the negotiations through a proposal from Malaysia that received immediate widespread support from developing countries and many nongovernmental organizations (NGOs). While the biotechnology industry tends to be closely regulated in industrialized countries (mostly through national laws on laboratory practices and the release of living modified organisms outside the laboratory), there are few international regulations governing these activities.

[27] L. V. Giddings and G. Persley, **Biotechnology and Biodiversity, UNEP/Biodiv/SWGB. 1/3 (United Nations Environment Programme,** October 1990, p.27.

The CBD consolidates the role of government in protecting and maintaining resources and reaffirms that states have sovereign rights over their own biological resources. Yet the convention simultaneously propounds a more global view of biological resources, stating that conservation is the "common concern" of all humanity and that states are responsible for using biodiversity in a sustainable manner. The uneasy coexistence between these two aims leaves unresolved how to divide the benefits that flow from bio-diversity. The problem is most acute when biological resources have been improved through innovation. In addition to elaborating a set of commitments and goals, the CBD establishes several new international institutions to carry out its mandate and continue the cooperative process. The flexible and often vague structure of the treaty and commitments will be animated and focused by debate within these institutions. The primary new body is the Conference of the Parties (COP), which makes all formal decisions regarding the treaty. Formal membership is limited to the actual parties, although important nonparties such as the United States also play a role as observers. The COP has a number of responsibilities that are mentioned specifically in the CBD, including examining new scientific data on biodiversity, examining the issues of liability and redress for damage to biodiversity, defining incremental costs, choosing the appropriate level of financing for the financial mechanism, and considering the need for a biosafety protocol. Arguably, the main achievement of the CBD so far has been to create this ongoing body through which global biodiversity issues can be addressed. The COP, which held its first session in 1994, meets annually.

The CBD includes a provision to transfer financial resources to developing countries to pay the "agreed full incremental costs" of implementation. Because donor states feared the creation of yet another international institution, the CBD will rely on GEF as its interim

financial mechanism until at least 1997[28]. GEF is already disbursing money on biodiversity projects according to criteria and priorities established by the COP. According to the CBD's, definition, the developed countries consist of the members of the Organization for Economic Cooperation and Development (OECD) plus Monaco. A third group comprises countries with economies in transition that emphatically declare they are not developing but do not wish to assume the financial obligations of developed countries (though they may voluntarily assume those obligations). Virtually the same distinctions are employed in the climate treaty. Positions on GEF's council, which governs GEF- financed activities, are earmarked for developing, developed, and transitional countries. These distinctions are elastic, however: Several developing countries, including Brazil, China, and Egypt, have been both contributors and recipients of GEF funding.

As required by the CBD, the COP has established a clearing-house mechanism to operate in a pilot phase from 1996 to 1997[29]. The mechanism is charged with promoting international scientific and technical cooperation, disseminating information on the lessons learned during implementation, and facilitating the transfer of technology. While these functions are important, it remains to be seen if a formal institution can contribute to them effectively; there is Rule guidance from other international institutions on how to do so. Most technology and information diffuse through markets and scientific collaboration. Absent large resources with which to intervene-such as to fund sorely needed taxonomists in developing countries-the clearing-house mechanism may prove inconsequential. The CBD also creates a secretariat to arrange meetings, prepare reports, coordinate with other international organizations, and so forth. The form and function of this body mirror those of a number of other new

[28] D. Pruzin, *"Treaty Parties Fail Again in Effort to Set Up GEF in Permanent Financing Role,"* International Environment Reporter, Vol. 29 (November 1995), pp.898-899.

[29] UNEP/CBD/COP/3/38 Annex II: Decisions Adopted by the Third Meeting of the Conference of the Parties.

secretariats. Secretariats vary in size and effective-ness but are considered necessary components of any comprehensive and complex formal regime. Many hoped that coordination among secretariats would improve if they were concentrated in Geneva, the interim home of the CED and climate secretariats as well as several others. In 1995, however, Montreal was chosen as the permanent site for the CBD secretariat, while the climate secretariat is currently in the midst of a move to Bonn. The costs of the CED secretariat (and those of some developing country participants) are covered by a trust fund into which all parties con-tribute according to a scale of assessments similar to the UN scale.

The CBD creates one subsidiary body to provide assistance to the COP as needed. The Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA) is open to all parties and is multidisciplinary in focus. Its tasks are to provide advice and assessments relating to biodiversity, produce policy analyses, and monitor research on biodiversity protection.

Legal Status of the Convention on Biological Diversity

Prior to the Biodiversity Convention's ratification, there was no recognized basis under international law for granting a sovereign property right in unmodified genetic material. While commentators have searched for ways to apply patent law, copyright law, trademark law and the law of plant breeder's rights to unprocessed genetic material, none of these approaches has proved entirely satisfactory[30]. A brief analysis of patent law's application to preserving biodiversity will shed some light on the difficulties in creating an intellectual property right in genetic material. To obtain a patent in most countries, an object must be "useful, novel and non-obvious." By obtaining a patent, one obtains the exclusive right to make, use, sell or license such object or process for a fixed period of time.

[30] Daniel T. Jenks, *A Convention on Biological Diversity-- An Efficient Framework for the Preservation of Life on Earth?* Nw. J. Int'l L.& Bus, Vol. 15, (1995), pp.636-653.

The patent system's intellectual legitimacy rests in part upon (i) Lockean labor theory, which justifies the grant of a property interest in those whose labor has fundamentally transformed a thing, and (ii) Utilitarian theory, which recognizes an optimal trade-off between an inventor's interest in exploiting his innovation and society's interest in broadly utilizing this knowledge and which thus requires that patent rights be limited in duration. Patent law also requires that all information related to the creation of an object be clearly disclosed. Traditional patent theory is not particularly useful in the effort to preserve biodiversity. First, non-modified genetic material is clearly "obvious" under current definitions of this word. Second, as the vast majority of the world's species have not been classified, the recognition of intellectual property rights in these "undiscovered" species seems incongruous given the patent law information disclosure requirement. Third, the discovery of a new species, while useful, clearly does not justify the granting of an intellectual property right under the Lockean labor theory for the owner has done nothing with his labor to transform the thing[31]. Finally, placing time restrictions on an owner of biodiversity's right to exploit his intellectual property as required under the patent system would be counterproductive to the goal of long-term preservation. The Biodiversity Convention creates a new type of intellectual property right whose legitimacy rests on a different basis than traditional intellectual property rights. For example, while Lockean labor theory seeks to reward those who expend effort in *creating* something new, the philosophy underpinning the Convention seeks to reward those who exercise forbearance and thus *preserve* biodiversity.

[31] Rebecca L. Margulies, Note, *ProtectingBiodiversity: Recognizing International Intellectual Property Rights in Plant Genetic Resources*, Mich. J. Int'l. L, Vol. 14, (1993), pp.322-330.

Because each nation has a sovereign right to develop its property as it sees fit and because as more rain forest is developed, more species are lost, those nations which do not develop ecologically-sensitive areas are sacrificing economic development opportunities for the preservation of biodiversity. The sacrifice which developing nations make in forbearing from development arguably equates to the sacrifice of expending labor under the Lockean labor theory and therefore, if it is just to recognize a property right resulting from "fruits of one's labor," it should be equally just to recognize a property right resulting from forbearance in this context[32]. While it is uncertain at this time which property rights among the "bundle" of possible property rights the Biodiversity Convention recognizes within sovereign nations, two rights are clearly identifiable - the right to restrict access to biodiversity and the right to compensation for use of biodiversity. Article 15, paragraph 1 clearly recognizes the sovereign right of nations to "determine access to genetic resources" and Article 15, paragraphs 4, 5 and 7 require that access shall be given "upon mutually agreed upon terms," "based upon prior informed consent" and with benefits of biodiversity shared in a "fair and equitable way." Unlike other types of intellectual property, the sovereign right in biodiversity has no time limit to it and presumably each nation's interest in a specie's genetic matter, unless entirely alienated, will continue indefinitely. To understand why the establishment of a sovereign property right in unmodified genetic material under the Convention is so important, this Comment will now examine the environmental background to the Convention and the economic benefits of biodiversity to mankind.

Environmental concern about the loss of habitat, and the consequent loss of biodiversity, has been growing during the past thirty years. During this time, a number of

[32] Lawrence C. Becker, *Deserving to Own Intellectual Property,* Chi.-Kent. L. Rev. Vol. 68, (1992), p.609- 620. Available at: http://scholarship.kentlaw.iit.edu/cklawreview/vol68/iss2/4. Last visited on 13.04.2014.

ecologically-sensitive areas have been destroyed due to the severe social and economic pressures that many developing countries have faced[33]. Tropical rain forests have been disappearing at a particularly fast rate, estimated to be seventeen million hectares per year. Major causes of deforestation include (i) the establishment of farms and cattle ranches, (ii) fuel wood gathering by peasants and (iii) commercial logging for export. Largely because of deforestation, some scientists believe that up to twenty-five percent of all species on earth today may become extinct in the next thirty to forty years. Mankind's awareness of the extent of the biodiversity on earth has risen over time as well. During the past twenty years, scientists have continued to upwardly revise their estimates of the number of species on Earth[34]. As these estimates have risen, the percentage of the Earth's species catalogued has fallen.

Over fifty percent of the world's biodiversity is located in the rain forests of the world and much of it may be found in insects and small plants. For example, there are close to three hundred thousand species of beetle. Many species are found only in very small geographical areas and have evolved differently from related species due to specific variations in local conditions. Through evolution, individual species have evolved unique chemical defenses to the threats around them. The uniqueness in chemical make-up between seemingly similar species is what drives the value of biodiversity from a commercial perspective.

The problem of conserving biodiversity in a world without intellectual property protection for genetic resources is a "commons" problem. A "commons" is typically an area of land, air or water which is owned communally by a group. In the absence of strict and

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[33] Available at http://www.un.org/dpcsd/earthsummit. Last visited on 20.4.2014.

[34] Brian F. Chase, *Tropical Forests and Trade Policy: The Legality of Unilateral Attempts to Promote Sustainable Development Under the GATT*, Hastings Int'l & Comp. L. Rev, Vol. 17, (1994), pp. 349-352.

enforced regulation limiting access to and use of the "commons," rational action by individual members of the group will create a "commons" problem. Traditional "commons" problems have included the depletion of fisheries, the overgrazing of animals on common lands and air pollution.' "Commons" problems traditionally occur when an individual actor is able to derive all of the benefits from his action while spreading the cost of such action onto other parties. If all of the actors involved in a "commons" problem pursue the seemingly rational course of maximizing their individual net economic benefit, overproduction occurs i.e. production where the marginal benefit is less than the marginal cost from a collective perspective and the net economic rents to be derived from a particular "commons" are eroded down to nothing.

"Commons" theorists argue that by converting the "commons" to private property where possible, problems of overproduction are solved as each actor fully internalizes the marginal cost of his actions and net economic rents return to market levels. The biodiversity "common" represents a non-traditional "commons" problem from the perspective of developing countries. Instead of spreading the marginal cost of preserving biodiversity onto other parties, each nation must fully internalize this cost which is the opportunity cost of foregone development. More importantly, instead of fully internalizing the benefit of preserving biodiversity, many developing nations derive no direct benefit from biodiversity as international intellectual property law prior to the Convention did not recognize a property right in unmodified genetic material. From the perspective of biotechnology companies, the biodiversity "commons" is more like a traditional "commons" problem. When a biotechnology company discovers a new drug from the rain forest, in most cases it derives all of the net benefit from this drug. However, part of the cost inherent in developing

the drug-preserving ecologically- sensitive areas are not incurred by the biotechnology company. Unlike traditional actors in "commons" situations, biotechnology companies neither physically destroy the "commons" nor engage in behavior which results in a situation where the net economic rent from the "commons" is reduced to zero. Still, by not fully internalizing the cost of their behavior, these companies in part help to erode conservation of ecologically-sensitive areas[35]. The Biodiversity Convention "solves" the "commons" problem by recognizing a sovereign property right in biodiversity.

By granting this right, the Convention allows developing nations to internalize the benefits of preserving biodiversity which here therefore have been impossible to capture. As a result of internalizing this benefit, the marginal cost of land development (which includes the foregone marginal benefit of conservation) rises and, *ceteris paribus,* less land development is consequently demanded and more biodiversity is preserved. The grant of a sovereign property right under the Convention is Kaldor-Hicks efficient[36]. Under the Convention, the net economic benefit which individual pharmaceutical companies derive (at least in the short-run) from biodiversity will be reduced, as these institutions will be forced to make upfront and royalty payments to developing nations. However, the net benefit which developing countries receive will be higher under the new legal regime and the net long-term benefit to the world community will be higher as more biodiversity is preserved. As the value of the new legal regime to developing nations and the world community is arguably higher than the cost of the new regime to biotechnology companies, efficiency is enhanced. How the sovereign right in biodiversity is interpreted and how nations internally share the benefits associated with this right will have an impact on the level of efficiency under the

[35] S. V. Ciracy-Wantrup, *"Common Property" as A Conception of Natural Resources Policy*, Nat. Res. J, Vol. 15, (1975), pp.713-716.

[36] Richard A. Posner, **Economic Analysis of Law**. 4th edn. (Little Brown and Company, U.K, 1992), p.57.

Convention. For example, if a species lives in two different countries, who owns the right to exploit this species. If the right is not shared equitably, then developing nations will be incented to protect and research border areas first so as to "capture" species common to multiple countries and, as a result, sub-optimal preservation of biodiversity may occur.

As well, even if a sovereign right in biodiversity exists, will the benefits associated with exploiting this right actually filter down to the individuals and groups who are the "agents" of land development in many developing countries. If benefits from biodiversity are misaligned with costs of preservation at any societal level, then sub-optimal preservation will occur. While the single action of granting a sovereign property right in biodiversity enhances global efficiency, the Biodiversity Convention also calls upon developed nations to create a multilateral fund to support the purposes of the Convention and transfer certain intellectual property rights to developing nations.

The “common heritage of mankind” is an ethical concept and a general concept of international law. It establishes that some localities belong to all humanity and that their resources are available for everyone’s use and benefit, taking into account future generations and the needs of developing countries. It is intended to achieve aspects of the sustainable development of common spaces and their resources, but may apply beyond this traditional scope. When first introduced in the 1960s, the “Common Heritage of Mankind” (CHM) was a controversial concept, and it remains so to this day. This controversy includes issues of scope, content and status, together with CHM’s relationship to other legal concepts. Some commentators consider it out of fashion due to its lack of use in practice, e.g., for mining of seabed resources, and its subsequent rejection by modern environmental treaty regimes. In

contrast, other commentators consider it a general principle of international law with enduring significance[37].

"Common heritage" has historically been the implicit system for managing the diffusion of crop genetic resources, from the informal movement of crops in prehistoric times to the formal national and international framework of crop exploration and conservation agencies. Common heritage refers to the treatment of genetic resources as belonging to the public domain and not owned or otherwise monopolized by a single group or interest. Defining common heritage is similar to belated and sometimes last ditch efforts to demarcate the public domain after the expansion of private property. Just as the public domain is most easily defined when its constituent parts are appropriated and privatized, common heritage is made visible when exchange and use of biological resources are restricted and privatized. An obstacle to understanding and appreciating common heritage is its inherently implicit nature, but roots of the concept are visible in the free exchange of seed among farmers, the long history of diffusion through informal and formal mechanisms, established scientific practices, and the application of the term to other resources in the international arena[38].

The main innovation included in the United Nations Convention on the Law of the Sea (Montego Bay, 1982; UNCLOS) is the concept of common heritage of mankind. While other important new aspects of the UNCLOS, such as the exclusive economic zone or the regime relating to the protection of the marine environment, are the result of the natural evolution of international law of the sea, the concept of common heritage of mankind has a

[37] Available at http://wealthofthecommons.org/essay/common-heritage-mankind-bold-doctrine-kept-within- strict-boundaries. Last visited on 22.03.2014.

[38] Available at http://www.planttreaty.org/sites/default/files/demise_CH.pdf.Last visited on 22.03.2014.

revolutionary character. It presupposes a third kind of regime which is different from both the traditional regimes of sovereignty, applicable in the territorial sea, and of freedom, applicable on the high seas. The idea of the common heritage of mankind was launched in a memorable speech made at the United Nations General Assembly on 1st November 1967 by the representative of Malta, Mr. Arvid Pardo.

The major challenge posed for today's planners is unambiguous. New modes of thinking are demanded and new approaches to the management and use of world resources of all kinds must be made. Furthermore, people especially in the industrialized countries will have to reassess, with generational consequences, their life styles and to appreciate the need to change the* aspirations from quantity towards quality. This suggests that a thorough examination is required as to how and to what extent the CHM concept with its operational principles and its institutional implications should be extended to the efficient, equitable and sustainable management of other areas of global concern which span not only the oceans but also the terrestrial environment and even the atmosphere[39].

Prior to the CBD, genetic resources were considered part of the Common Heritage of Mankind (CHM) and treated as commons. Importantly, placing genetic resources in the CHM has a symbolic meaning: it denotes the importance of these resources for all humanity. CHM is not incompatible with the exercise of state sovereignty, especially when the resources are found within the territory of a country. It differs from classic global commons resources that are not clearly circumscribed by national borders, such as the high seas and

[39] Available at http://archive.unu.edu/unupress/unupbooks/uu15oe/uu15oe0q.htm. Last visited on 22.03.2014.

airspace[40]. Hence, the CHM should not necessarily imply that such resources are accessible to and usable by anyone without restrictions. However, in practice, genetic resources ranked in the CHM are treated as commons, resulting in overuse and extinction. Indeed, under international law, states enjoy sovereignty[41] over their lands and natural and biological resources, and nothing denies state sovereignty over their genetic resources. In reality, the discourse over the nature of genetic resources in international law started when genetic resources contributions to commercial uses and the financial benefits of these uses were realized from the source countries[42]. The first international agreement dealing with genetic resources and their sustainable management at the global level was the 1983 International Undertaking (IU) on Plant Genetic Resources, passed by the United Nations Food and Agriculture Organization (FAO)[43]. The resolution asserted that all plant germplasm was the "common heritage of mankind." However, the use of genetic resources and the fact that the IU is a soft law instrument fails to shape the necessary *opinio juris* and justify customary law in the treatment of the resources as global commons[44].

More specifically, global commons are free to be used by anyone, and the free use of biogenetic resources in the production of medicines causes market failure (biopiracy), because the bioprospecting market fails to adequately involve and compensate all

[40] Graham Dutfield, **What is Biopiracy? International Expert Workshop on Access to Genetic Resources and Benefit Sharing** (2004). Available at http://www.canmexworkshop.com/documents/papers/1.3.pdf. Last visited on 22.03.2014.

[41] U.N. Charter Article 2; Declaration on Principles of International Law Concerning Friendly Relationships and Cooperation among States in Accordance with the Charter, G.A. Res. 2625 (XXV), U.N. Doc. A/2625 (Oct. 24, 1970), 9 I.L.M. 1292 (1970); Declaration on Permanent Sovereignty over Natural Resources, G.A. Res. 1803 (XVII), U.N. Doc. A/1803 (Dec. 14,1962).

[42] Lyle Glowka, **A Guide to Designing Legal Frameworks to Determine Access to Genetic Resources** , (IUCN, Gland, Switzerland.1998), p.55.

[43] Food and Agriculture Organization Conference, Rome, Italy, 1983, International Undertaking on Plant Genetic Resources, FAO Res. 8/83, available at http://www.fao.org/ ag/cgrfa/Res/C8-83E.pdf. Last visted on 22.03.2014.

[44] J. Goodman, V. Walsh, **The Story of Taxol: Nature and Politics in the Pursuit of an Anti-Cancer Drug,**

1st edn. (Cambridge University Press, Cambridge, 2001), p.182.

stakeholders, directing them to alternative and more destructive uses of biodiversity. Furthermore, the sourcing of the biological resources to be used in bioprospecting is unsustainable and threatens species to extinction[45]. The CHM principle linked in common practice to common property creates a practical problem, the so-called "tragedy of the commons[46]." The tragedy of the commons exists when too many individuals have the right to use a scarce resource, and overuse of that resource potentially leads to its complete depletion. The lack of property rights leads to overexploitation of resources because of a lack of economic incentives to protect them[47]. It should be noted here that sovereignty, although significantly different from property ownership, has property characteristics in that it assigns exclusive rights to exercise supreme authority over land and resources.

To address the problem of the nature of genetic resources, the international community attached the same importance to the conservation and sustainable use of resources by replacing the CHM in the CBD with the "common concern" of mankind, and reaffirmed the authority of the state. In turn, states have accepted the increased responsibility to regulate and manage access and benefit sharing[48]. This recent emphasis in exercising control over biological resources contrasts markedly to past approaches largely due to the

[45] Kerry Ten Kate & Adrian Wells, *The Access and Benefit Sharing Policies of the United States National Cancer Institute: A Comparative Account of the Discovery and Development of the Drugs,* Calanolide and Topotecan (1998), pp.108-119. Available at http://www.biodiv.org/doc/case-studies/abs/cs-abs-nci.pdf Last visited on 22.06.2014.

[46] E. Kula, **Economics of Natural Resources and the Environment,** 1st edn. (Chapman and Hall publishers, London, 1992), p.158.

[47] Daniel. W. Bromley, **Environment and Economy: Property Rights and Public Policy,** 1st edn. (Blackwell, Oxford, UK, 1991), p.167.

[48] R. David Simpson, *Valuing Biodiversity for Use in Pharmaceutical Research*, Journal of Political Economy, Vol. 104, (1996), pp.163-166.

fact that states now feel the pressure of scarcity, while not long ago natural assets were perceived as abundant and conservation measures unnecessary[49].

A major snag of the CBD is a shift in focus from the ecological and scientific value of biodiversity to its commercial value. Articles 3 and 15 of the CBD recognise the sovereign rights of nation states over their biological resources and their authority to determine access to genetic resources through national legislation. Several countries have developed legal regimes and implementing mechanisms to regulate access to genetic resources[50].

This undermines global food security that is critically dependent on transnational sharing and distribution of genetic resources among human societies. National legislation like India's Biological Diversity Act 2002 and the Philippine Executive Order No. 247 shut down national boundaries against free access and sharing of genetic resources. Such parochial restrictive measures are gradually becoming ubiquitous all over the world.

No country ever possessed all the genetic resources essential for its existence. Every country in the world uses exotic genetic material to enhance the productivity of its crops and livestock as the genetic limits of the native stock can be overcome only by incorporating genes from such material. The Food and Agriculture Organisation's (FAO) 22nd conference adopted a resolution (Resolution 8/83)4 that plant genetic resources are a heritage of mankind to be preserved, and to be freely available for use, for the benefit of present and

[49] W. Lesser, **Sustainable Use of Genetic Resources Under the Convention on Biological Diversity: Exploring Access and Benefit Sharing,** 1st edn. (CAB International, New York, 1997), p130.

[50] Available at http://globaljusticeecology.org/files/biodiversity.pdf. Last visited on 22.03.2014.

future generations[51]. Developing countries en masse pushed through and adopted the resolution, while Canada, France, Germany, Japan, the United Kingdom and the United States officially reserved their position with respect to the FAO undertaking as it explicitly specifies that the term "plant genetic resources" also includes newly developed varieties and special genetic stocks.

The developing countries' efforts to keep all types of breeding material within the public domain were at variance with the demand of the developed countries to provide and respect intellectual property protection. In 1989, developed countries succeeded in establishing Plant Breeders' Rights as provided under the International Union for the Protection of New Varieties of Plants (UPOV). This FAO resolution, though it recognises farmers' rights, set the stage for the showdown between the technologically-advanced North and the biodiversity-rich South over genetic resources in the United Nations Convention on Biological Diversity. In lieu of their demand to keep all breeding material in the public domain, the developed countries collectively bargained and succeeded in establishing national sovereign rights over genetic resources that was historically treated as a common heritage of mankind. The CBD in its current form, yet to be adopted by the US, is an outcome of this conflict over genetic resources.

The biodiversity-rich developing nations had high expectations for CBD under the premise that biological resources, being the raw material for the biotechnology, seeds and pharmaceutical industries, are the key to potential economic success in the future. The high tide of publicity and hope in the popular and scientific media portrayed biodiversity as the

[51] Hamilton, N. D. *'Who Owns Dinner: Evolving Legal Mechanisms for Ownership of Plant Genetic Resources'*, Tulsa Law Journal, Vol. 28, (1993), pp.587- 590.

most commercially important natural resource like oil or gold. The politicians and policymakers in the developing world were carried away by the waves of speculation, propaganda and lobbying by activists and NGOs, rather than empirical evidence. The South abandoned the common heritage strategy adopted in the FAO and successfully demanded national sovereign rights over genetic resources in the CBD negotiations. They also pushed for and succeeded in including equitable sharing of genetic resources in the CBD.

The transfer of funds and intellectual property to developing nations can be thought of as additional compensation for the preservation of biodiversity[52]. An analysis of option theory will demonstrate why granting additional compensation to developing nations may also be necessary to further global efficiency. Because the value of biodiversity is largely speculative in nature, the value of preserving biodiversity can be compared to holding an "option" on the future benefits of biodiversity. While there is no upfront cost to this option, there is an on-going opportunity cost to the option which is the cost of foregone economic development. Elements involved in valuing an option include (i) the probability and expected size of future cash flow(s), (ii) timing of such cash flows and (iii) the discount rate ("cost of capital") applied to these cash flows.

From a developing nation's perspective, the cost of the option may outweigh its speculative benefits. Developing nations usually have very high costs of capital and as a result, the value of a new drug which may generate cash flows ten years from now may not be particularly high. As well, the absolute size of the royalties which a developing nation may receive from a new drug is not particularly large in comparison to the total value which such drug may create. (i) the long-time horizon involved in biodiversity prospecting, (ii) the

[52] Martin. A, McGuire, S.Sullivan, *Global Environmental Justice and Biodiversity Conservation*, Geogr. J, Vol. 179, (2013), pp.122–131.

relatively high cost of capital in developing nations and (iii) the relatively small amounts which these nations will receive in royalties, it may be efficient (from a local perspective) for developing countries to develop ecologically-sensitive areas rather than preserve them. From a global perspective, the value of the "biodiversity option" may outweigh the opportunity cost of foregone development to a particular developing nation. The international community (and in particular the developed world) has a lower cost of capital than many developing nations and will enjoy larger benefits from the exploitation of biodiversity than any single country. As a result, it may be globally efficient to preserve biodiversity in instances where local preservation would not make economic sense.

By compensating developing nations *via* multilateral payments and transfers of intellectual property, the Biodiversity Convention helps to increase the option value of biodiversity to the developing world[53]. By increasing this value, more biodiversity will be preserved and global efficiency should be enhanced. Having addressed the ways in which the Convention theoretically improves economic efficiency, this Comment will now argue that each nation under the Convention is in effect a trustee of an international public trust, the corpus of which is such nation's biodiversity and the beneficiary of which is the international community.

The historical notion of a "public trust" has its roots in English common law and is loosely based on earlier Roman law[54]. The historical doctrine posited that certain things - like air, running water, the ocean - are common to mankind and, therefore, cannot be privately owned but are held by the sovereign in trust for the benefit of all citizens.

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[53] George B. Frisvold, Peter Condon, *The Convention on Biological Diversity: Implications for Agriculture,* Technological Forecasting and Social Change, Vol. 50, (1995), pp. 41-54 .

[54] Joseph L. Sax, The *Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, Miac. L. Rev, Vol. 68, (1970), pp.471- 475.

The historical doctrine has a largely economic rationale (the promotion of commerce) and was used primarily by courts to maintain the navigability of rivers and bays. Around 1970, under the leadership of Professor Joseph Sax, efforts were made to "update" the public trust doctrine and transform it into a tool for the promotion of environmental protection. While much of the modem public trust doctrine is ill-defined, at base the doctrine is rooted in the notion that a great deal of property that is both publicly and privately owned is bundled with an extensive set of pre-existing communal rights.

As the takings clause of the Constitution protects the property rights of minorities from action by the majority, the public trust doctrine protects the communal property rights of the majority from actions by a minority. In theory, the public trust doctrine states a cause of action (which may rest in the government or in private parties) for any use of a property which infringes on a pre-existing communal right[55]. The Biodiversity Convention has many of the indication of a public trust. The purpose of the trust is "to preserve biodiversity. The trust property is the biodiversity of the world, and by logical extension, the habitats of the world in which biodiversity resides. Trust property may be alienated; however, use of trust property is restricted to those uses which do not materially affect biodiversity[56]. Trust property may be harmed in certain circumstances, but only if the harm is minimized and is "necessary." The beneficiaries of the trust are the international community and perhaps future generations.

The trustees who may or may not have legal title to the trust property are the sovereign nations in which trust property is located. The Biodiversity Convention is more of

[55] Lloyd R. Cohen, *The Public Trust Doctrine: An Economic Perspective*, Cal. W. Law. Review, Vol. 29, (1992), pp.239- 250.

[56] Ved P. Nanda, William K. Ris. Jr., *The Public Trust Doctrine" A Viable Approach to International Environmental Protection*, Ecol-L. Q, Vol. 5, (1976), pp. 291- 302.

a "true" public trust than many of the public trusts that environmentalists have tried to judicially establish in the United States in the past twenty years, because the Convention specifically looks at the "totality of public interests" in the preservation of biodiversity[57]. Since such interests are not entirely environmental, environmental interests must be weighed with and balanced against other public interests such as economic growth, preservation of indigenous cultures, etc.

This balancing act is seen within the Convention, which recognizes the sovereign right to economic development in Article 2 but which also requires states to minimize the environmental impact of proposed projects in Article 14. While the Convention's attention to the "totality of public interest" may disappoint some environmentalists, it enhances the Convention's legal legitimacy because it makes the Convention look more like an historical public trust. U.S. courts have been hesitant to adopt the modem public trust doctrine, in part because (i) plaintiffs have been unable to demonstrate a prior reservation by the sovereign of certain communal rights in property' and (ii) restrictions on the private use of property often appear like governmental "takings". The Biodiversity Convention avoids the first critique of the public trust doctrine because the public, communal rights in biodiversity under the convention were explicitly created at the same time that the sovereign property rights in genetic material were recognized. The outline of an international public trust clearly exists under the Convention.

International Legal Instruments Regulating Biodiversity

Rich biodiversity and equally rich cultural heritages are thus two invaluable assets of most of the TWCs. The developmental scenario of the world is now changing fast at

[57] Richard J. Lazarus, *Changing Conceptions of Property and Sovereignty in Natural Resources: Questions the Public Trust Doctrine*, Iowa. L. Rev. Vol. 71, (1996), pp.631-715.

breathtaking speed. The TWCs therefore have to be alert and sensitive to the changing global developmental scenario and must adopt and adapt appropriate measures to safeguard their interests and to take the best advantage of the legally binding international laws and multilateral agreements such as CBD, TRIPS 19 (Trade-Related Intellectual Property Rights of WTO), ITPGRFA, which are now in force. CBD is the first international legal instrument that brought out a radical change from the prevailing common perception on genetic resources as common heritage of humankind to a legally binding regime that confers sovereign rights to the states over their biological resources and associated TK.

The WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC) was established in 2001[58] and it began to study the issues related to pro-viding an international dimension to protection of TK associated with the use of genetic resources. IGC made a series of discussions and debates on TK related issues with other international instruments such as CBD and WTO- TRIPS. The ongoing discussions and negotiations helped to develop two main forms of IPR related protection to TK: 1. Positive protection-i.e. establishing legal entitlements for TK holders, 2. Defensive protection-i.e. safeguarding against illegitimate acquisition of IPR over TK or associated genetic resources. Ensuring the practice of PIC and benefit- sharing agreements with TK holders are other issues involved in TK - derived bio prospecting and technology transfer programmes. Several national governments, WIPO -IGC and CBD secretariat are actively discussing these issues with the participation of local and indigenous communities and institutions. WIPO- IGC is in the process of finalizing the policy objectives and core principles for protection of TK. National governments have also been addressing the issue of

[58] Available at, http://www.wipo.int/meetings/en/topic.jsp?group_id=110. Last Visited on 14.03.2014.

providing IP protection to TK under the existing IP laws or sui *generis* mechanisms, so that the intellectual as well as customary rights of the TK- holders are respected, recognized and rewarded[59].

Article 15 of the CBD unambiguously states that the authority to determine access to genetic resources rests with national governments and is subject to national legislation and that access, where granted, shall be on mutually agreed terms and shall be subject to the prior informed consent of the Contracting Party providing such resources. Article 15 specially obliges Parties to take necessary measures to share in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Party providing such resources, on mutually agreed terms. Article 16 deals with the access to and the transfer of technology. Article 16 para 5 of CBD refers to the relationship between IPR and the CBD by stating that "patents and IPR may have an influence on the implementation of this convention, and therefore, Members states shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives".

Article 80 of the CBD enjoins upon Contracting Parties to respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities and encourages the equitable sharing of benefits arising from their utilization. The concept of fair and equitable sharing of benefits arising out of use of genetic resources enshrined in the CBD, needs to be examined in the light of the TRIPS Agreement. TRIPS and CBD represent

[59] Medaglia, J. C, *Access to Genetic Resources, Protection of Traditional Knowledge, and Intellectual Property Rights: The Costa Rican Experience.* In Twarog, S. and Kapoor, P. (Eds.), **Protecting and Promoting Traditional Knowledge: Systems, National Experiences And International Dimension**, 1st edn. (United Nations, New York, 2004), p.59.

two different approaches to the utilization of living resources[60]. CBD clearly recognizes the sovereign rights of States over their biological resources and seeks to ensure that where these are taken from the country of origin, there should be fair and equitable sharing of any subsequently developed benefits[61]. It seeks to protect, preserve and benefit, by providing an equitable sharing of the utilization of the indigenous and traditional knowledge systems which do not readily fit into any standard form of IP protection. The TRIPS Agreement does not cover protection of such intellectual contributions. The TRIPS Agreement, on the other hand, recognizes IPR to be private rights and believes in rewarding inventions by IPR, without referring to the source of biological material and associated traditional knowledge and without commitment for fair and equitable sharing of benefits with the country of origin/holders of such knowledge For reconciliation of these contradictions in provisions of TRIPS Agreement and the CBD, India has been advocating the argument in international forum, under CBD as well as under Committee on Trade and Environment (CTE) of the WTO, that Article 29 of the TRIPS Agreement should require mandatory disclosure, in the patent application of the origin of biological resources/traditional knowledge used in the technological invention.

The present mandatory conditions for patents in almost all countries are confined to disclosure of the invention in a manner sufficiently clear and complete for invention to be carried out by a person skilled in art. In addition, these conditions were developed in the patent laws of different countries basically in respect of mechanical and chemical inventions. The issue is whether the inventions using biological material, need to be

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[60] Greg K. Venbrux, *When Two Worlds Collide: Ownership of Genetic Resources Under the Convention on Biological Diversity and the Agreement on Trade-Related Aspects of Intellectual Property Rights*, Journal of Technology Law and Policy, (2006), pp.24-30.

[61] McManis, C.R, *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, Washington University Law Quarterly, Vol. 6(1), (1998), pp.245-249.

governed by a set of additional requirements. A case is being argued for mandatory disclosure in the patent applications of the country of origin of biological resource and associated knowledge and consent of the country providing the resource and knowledge, to ensure equitable sharing of benefits. In this context, it is pertinent to mention here that the Conference of Parties (COP) to the CBD in its fourth meeting held in May 1998 emphasized that further work is required to help develop a common appreciation of the relationship between IPR and relevant provisions of TRIPS and CBD, particularly on issues relating to technology transfer, and conservation and sustainable use of biological diversity and fair and equitable sharing of benefits arising out of the use of genetic resources. Thereafter, an Inter sessional Meeting held in June 1999 has recommended the following follow-up activities for the COP. To develop ways and options to closely follow the work of WIPO and WTO on the issue and to provide inputs to this work when relevant from CBD's perspective. To recognize the importance of systems such as *sui generis* and others for protection of traditional knowledge, taking into account the ongoing work on Article 8G, and transmit its findings to WTO and WIPO. These recommendations will be considered for adoption by the COP in its fifth meeting to be held in May 2000.

Commercialization of Biological Resources- Bio-piracy and Bio-prospecting

Humankind has been prospecting biodiversity from the very dawn of the civilization. Modified use of bio-resources for food, medicine and other material requirements had been the traditional form of bio-prospecting. Modern prospecting involves well-organized research and methodologies. Bio prospecting in essence means - an activity involving survey, exploration, documentation and evaluation of biological resources and their derivatives and/or associated TK, leading to identification and/or isolation of commercially

valuable products (genes, biochemical) compounds, derivatives and/or any other tangible and in-tangible components including IPR covered processes, technologies and services derived from wild or domesticated biodiversity. With the advent of new tools and techniques, the power of bio prospecting has been incredibly increased[62].

Modern bioprospecting now includes systematic search for genes, natural compounds, designs and whole organisms of either domesticated or wild source with a potential for product development. Bio prospecting has thus three faces-chemical prospecting, gene prospecting and bionic prospecting[63]. It is essentially an action-oriented multidisciplinary programme with the end in view of generating both knowledge and avenues for the development of a diverse array of IPR-covered value-added products and their commercialization with appropriate benefit- sharing arrangements.

Third World Country (TWC) members are still at the receiving end as far as the development of special value-added products and herbal technologies are concerned. The developed countries, on the other hand, are emerging as super powers with their biotechnological strength. This North-South divide has been in existence for years and will continue to remain so, until the biodiversity-rich countries of South, strive their best to develop capability in biotechnology, bioinformatics and related technologies[64]. The major concerns of the developing countries with regard to access to and transfer of genetic resources and biotechnology are: (1) prevention of bio piracy and misappropriation, (2) development of international systems of protection of TK and (3) means for fair and equitable benefit sharing

[62] George Frisvold, Kelly Day-Rubenstein, *Bioprospecting and Biodiversity Conservation: What Happens When Discoveries are Made?,* Arizona Law Review, Vol. 50, (2007), pp.545-576.

[63] D. Newman, G.M. Cragg, *Natural Products as Sources of New Drugs over the Last 25 Years*, J. NAT. PRODUCTS, Vol. 70, (2007), pp.461-471.

[64] R.D. Firn, *Bioprospecting- Why Is It so Unrewarding?* Biodiversity &Conservation, Vol.12, (2003), pp. 207-208.

and technology transfer. One of the key issues involved in prospecting and commercialization of TK-derived technologies and products is the inadequacies in providing protection of TK through appropriate intellectual property laws and policy measures at national and international levels[65]. Increasing incidences of appropriation or misuse of TK for obtaining IPR rights without even acknowledging the role and contribution of TK holders are mounting with the recent booms in bio prospecting involving the use of genetic resources and associated TK. Establishing legally binding instruments and mechanisms to ensure the prior informed consent (PIC) of TK holder(s) and arriving at Mutually Agreed Terms (MAT) for benefit sharing, third party transfers, IPR claims, and commercialization of the products or technologies derived from the use of TK associated with genetic resources are other concerns that are being discussed[66] and de-bated at international forums, such as Convention on Biological Diversity, Food and Agricultural Organization, World Intellectual Property Organization, United Nation Environment Program, etc.

Biopiracy is a term that was first coined by the Canada-based NGO Rural Advancement Foundation International (RAFI, now the Action Group on Erosion, Technology and Concentration [ETC Group]) and is usually attributed to activist Pat Mooney[67]. In order to arrive at a definition of biopiracy one must appreciate the historical context within which the term arose. First, Western intellectual property owners have often accused Third World states and economic actors of "pirating" or unlawfully "appropriating" the intellectual property rights of industrialized entities, especially patents and copyrights. In the wake of

[65] Srividya Raghavan, *Protection of Traditional Knowledge*, Minnesota Intellectual Property Review, Vol. 2(1), (2001), pp.213-217.

[66] Nijar, G. S. *Community Intellectual Property Rights Protect Indigenous Knowledge,* Biotechnology and Development Monitor, Vol. 36, (1998), pp.11–12.

[67] Robinson, Daniel. F, **Confronting Biopiracy : Challenges, Cases and International Debates**, 1st edn., (Earthscan, London, 2010), p.14.

biotechnological inventions and the patenting by Western states and entities of indigenous peoples bio cultural resources, obtained without their lawful informed consent, Third World States contend that industrialized states, business entities, and research institutions are "pirating" their biological resources. Therefore, the Third World applies the term "biopiracy" to describe what it sees as a misappropriation of indigenous peoples knowledge and bio cultural resources, especially through the use of intellectual property mechanisms[68]. If the infringement of patents, copyrights, and trademarks constitutes intellectual piracy, then so does the failure to recognize and compensate indigenous and traditional peoples for the creations arising from their knowledge. Inherent to the biopiracy rhetoric are the notions of unauthorized appropriation/theft of biological diversity and its associated traditional knowledge. The concept of biopiracy concerns law, ethics, morality, and fairness. The term was developed due to growing frustrations about the appropriation and monopolization of long-held medicinal and agricultural knowledge about nature, as well as the related physical resources (plants, animals and their components). The flow of these resources and knowledge, often 'from biodiversity in the South to medicines, cosmetics and crops in the North[69]', has been targeted by NGOs as a hypocritical injustice on the part of corporations and researchers predominantly from Japan, the US, Europe and other parts of the Western world.

Biopiracy connotes any attempt to acquire proprietary rights over biological resources and its associated indigenous knowledge, or upon product(s) based on them, disregarding the consent and contribution of the holders of such resources and knowledge.

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[68] Chidi Oguamanam, *"Localizing Intellectual Property in the Globalization Epoch: The Integration of Indigenous Knowledge",* Indiana Journal of Global Legal Studies, Vol.11(2), (2004), pp.135-169.

[69] Dhillion, S.S and Ampornpan, L.A., *'Bioprospecting and Phytomedicines in Thailand: Conservation, Benefit-sharing and Regulations'*, in Svarstad, H. and Dhillion, S.S. **Responding to Bioprospecting: From Biodiversity in the South to Medicines in the North,** 1st edn., (Spartacus Forlag AS, Oslo,2000), p.59.

The Action Group on Erosion, Technology and Concentration (ETC Group) defines biopiracy as 'the appropriation of the knowledge and genetic resources of farming and indigenous communities by individuals or institutions seeking exclusive monopoly control (usually patents or plant breeder's rights) over these resources and knowledge[70]'.

Vandana Shiva defines biopiracy as " Biopiracy refers to the use of intellectual property systems to legitimize the exclusive ownership and control over biological resources and biological products and processes that have been used over centuries in non-industrialized cultures"[71]. Dutfield states that " Biopiracy: normally refers either to the unauthorized extraction of biological resources and/or associated traditional knowledge from developing countries, or to the patenting of spurious 'inventions' based on such knowledge or resources without compensation[72].

Biopiracy also refers to the asymmetrical and unrequited movement of plants and TKUP from the South to the North through the processes of international institutions and the patent system. As Rosemary Coombe has rightly pointed out, this process is characterized by the non-recognition of the intellectual contributions of holders and practitioners of traditional knowledge towards the improvement of the plants or TKUP in question[73]. RAFI linked biopiracy claims to evidence that transnational seed companies were planning to use terminator technologies for seed sterilization, thus inhibiting farmer re-use of seeds. In this

[70] Suman Sahai, Prasmi Pavithran, Indrani Barpujari, **Biopiracy Imitations Not Innovations, (**Gene Campaign, New Delhi, 2007), p.9.

[71] V. Shiva, **Protect or Plunder: Understanding Intellectual Property Rights**, 1st edn., (Zed Books, London, 2001), p.59.

[72] Graham Dutfield, **Intellectual Property, Biogenetic Resources and Traditional Knowledge**, 1st edn., (Earthscan, London, 2004), p.77.

[73] Coombe. R, *'Intellectual Property, Human Rights, and Sovereignty: New Dilemmas in International Law Posed by the Recognition of Indigenous Knowledge and the Conservation of Biodiversity'*, Indiana Journal of Global Legal Studies, Vol.6(1), (1999), pp.59–116.

way, RAFI was able to highlight the ongoing legal and technical institutionalization of farmers from the global south.

The origins of the term bioprospecting are usually associated with the 1993 book *Biodiversity Prospecting* by Reid *et al*. from the World Resources Institute, where it was defined as, 'the exploration of biodiversity for commercially valuable genetic and biochemical resources'. For these authors, when conducted appropriately, bioprospecting can: contribute greatly to environmentally sound development and return benefits to the custodians of genetic resources the national public at large, the staff of conservation units, the farmers, the forest dwellers, and the indigenous people who maintain or tolerate the resources involved. As Cori Hayden states that Bioprospecting is the new name for an old practice: it refers to corporate drug development based on medicinal plants, traditional knowledge, and microbes culled from the 'biodiversity rich' regions of the globe, most of which reside in the so-called developing nations[74].

Biological diversity, the variability among living organisms and the ecosystems of which they are part, underpins our very existence. It provides essential ecosystem services such as the purification of water, prevention of soil erosion and floods, and regulation of the climate. Furthermore, 'genetic resources' biological materials of actual or potential value containing functional units of heredity[75] form the basis of a significant proportion of the world's economic activity. A crude estimate of combined annual global markets for a portion of the products derived from genetic resources lies between US$500 billion and

[74] Hayden, C. **When Nature Goes Public: The Making and Unmaking of Bioprospecting in Mexico**, 1st edn., (Princeton University Press, Princeton, New Jersey, 2003), p.14.

[75] Article 2 of the CBD defines 'genetic resources' as 'genetic material of actual or potential value' and 'genetic material' as 'any material of plant, animal, microbial or other origin containing functional units of heredity'.

US$800 billion. The world's biological diversity is distributed largely in inverse proportion to scientific and technological capacity[76].

At present, biologically diverse countries with developing economies and limited scientific infrastructure rarely participate in the rapid scientific and technological advances that make new and varied use of their genetic resources, but many of them aspire to do so. Companies and research institutions based in developed countries seek diversity and novelty in the genetic resources they study and use, and many look outside their borders for new leads. The need for access to genetic resources by industry on the one hand, and, on the other, the benefits sought by biologically diverse countries, asked by the international community to conserve biodiversity, set the scene for an exchange. The 1992 CBD reflects a commitment by the participating governments to facilitate access to genetic resources in return for a fair and equitable sharing of benefits such as technology transfer (CBD Article 1), an exchange that has been described as a 'grand bargain[77]'. 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 from the use of genetic resources, including through access to genetic resources, technology transfer and funding.

Article 15 of the Convention requires governments to facilitate access to genetic resources, but it also states that the authority to determine access rests with national governments, and is subject to their prior informed consent and to the fair and equitable sharing of benefits on mutually agreed terms. The CBD itself is a framework convention. In

[76] C. Macilwain, **'***When Rhetoric Hits Reality in Debate on Bioprospecting'*, Nature**,** Vol. 9(1), (April, 1998), pp.535-541 at p.541.

[77] M. A. Gollin, '*An Intellectual Property Rights Framework for Biodiversity Prospecting'*, in W. V. Reid, S. A. Laird, C. A. Meyer, R. Games, A. Sittenfeld, D. H. Janzen, M. A. Gollin and C. Juma, eds, **Biodiversity Prospecting: Using Genetic Resources for Sustainable Development,** 1st edn. (World Resources Institute, Washington D.C, 1993), p.56.

the field of access and benefit-sharing, its implementation at the national level is proceeding at quite a pace. Laws and other policy measures aimed at securing fair partnerships with researchers and with companies have been introduced or are under development in over 40 countries, and more are set to follow. These regulate access to genetic resources and require the sharing of benefits that arise from their use, such as publications, training, research results and capacity-building, as well as monetary benefits such as fees, royalties and 'milestone payments' made at key stages in the development process, in addition to the initial fees for samples or grants to cover research. The CBD and the national laws on access introduced to implement it have an important bearing on the work of any person or company seeking access to genetic resources of any kind, whether for academic study or for commercial research and development. These measures are attempting to redraw ethical and legal norms established over a long history of trade in genetic resources, and aim to balance the needs of both technologically and biologically endowed countries. The practical implementation of these principles poses an enormous challenge for the 176 parties (and the regional economic integration organization of the EU) that have ratified the CBD, and for the many sectors of industry that need access to genetic resources for product discovery and development. Together, they must find workable rules and procedures that reflect the rights of sovereign states, communities, research institutions, individuals and companies but deliver partnerships that are 'fair and equitable' in the context of the risks and rewards of product development. The rules and procedures need to be speedy, simple and efficient. A number of factors conspire to make this difficult to achieve.

To begin with, despite its importance to humankind, the biological diversity at the heart of the exchange is being eroded. Conservative estimates place current extinction rates

for well-documented groups of vertebrates and vascular plants at 50–100 times larger than the expected natural rates[78]. Secondly, the countries, institutions, communities and companies involved in the exchange of genetic resources particularly by multinational companies have extremely different perceptions about the relative value of those resources and of the information, innovation, and research and development that are needed for product discovery and development. The gulfs that divide these different expectations often block the successful conclusion of partnerships for scientific research and commercialization. Although there is a wide range of different perspectives, a caricature of the different perspectives can be seen as having two extremes. On the one hand, some feel that the legal and policy environment does not adequately ensure prior informed consent and adequate benefit-sharing, any commercial use of genetic resources is 'biopiracy'[79]. On the other hand, some believe that countries have an unrealistic and inflated estimation of the value to industry of access to their genetic resources, and fear that the 'grand bargain' may be misconceived, because there is insufficient commercial demand for access to genetic resources to generate the benefits that will in turn create the incentive to conserve biological diversity or to help countries develop[80]. A third problem is that a number of features of the transfer of genetic resources and the discovery and development of products make the monitoring and enforcement of access and benefit-sharing agreements extremely difficult[81]. Material often travels from countries of origin to private sector concerns in other countries

[78] Janetos, A.C, *Do We Still Need Nature? The Importance Of Biological Diversity*, Saginaw Valley State University Journal, Vol.3(1), (1997), pp.24-29.

[79] V. Shiva, **Bio Piracy: The Plunder of Nature and Knowledge**, 1st edn. (Green Books, Devon 1998), p.13.

[80] K. ten Kate and S. A. Laird, **The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing,** 1st edn. (Earthscan, London, 1999), p.6.

[81] Bronwyn Parry, '*The Fate of the Collections: Social Justice and the Annexation of Plant Genetic Resources*',in Charles Zerner, ed., **People, Plants and Justice: The Politics of Nature Conservation,** 1st Edn.(Columbia University Press, New York, 1999), p.47.

through a complicated route, passing through many hands from collection to commercialization, with value being added at each stage.

In many cases, the product which is commercialized is not physically linked to the original genetic resources collected; for example, it may have been manufactured from scratch on the basis of modifications of chemical structures originally found in nature. Consequently, it is difficult to track the exchange of genetic resources and link it to the sharing of benefits. This lack of transparency, compounded by the common requirement for confidentiality in commercial partnerships, does nothing to dispel the high levels of distrust prevalent between potential partner countries, companies and institutions.

Rapid scientific developments over the past few decades in the fields of biology, chemistry[82], genomics and information technology have revealed a vast range of new targets for the development of medicines and agricultural products, and have transformed the processes of discovery and development. Biological discoveries that would once have taken years can now be completed in days, thanks to new technologies such as combinatorial chemistry, ultra-high through put screening and 'laboratories on a chip'. In response to these scientific and technological developments, a constellation of companies, nearly as diverse as the genetic resources on which they work, has arisen in a shifting pattern of partnerships within an increasingly globalized economy.

Discernible among this complex pattern are trends towards, on the one hand, consolidation through mergers and acquisitions, and on the other, a proliferation of small companies that specialize in aspects of discovery or development. Thus 'life science titans' such as Monsanto, Novartis and Aventis evolve alongside a host of small research

[82] Kerry Ten Kate, Sarah A. Laird, *Biodiversity and Business: Coming to Terms with the 'Grand Bargain'*, International Affairs, Vol. 76, (2000), pp.241-264.

biotechnology companies to which, particularly in the area of health care, the larger companies 'outsource' an increasing proportion of their research[83]. There is enormous variety within and between industry sectors in market size and growth, strategies for research and development, and the cost, time and probabilities of success involved in developing commercial products from natural product samples. The richness and complexity of the legal, political, scientific and socio-economic framework for the commercial use of biodiversity does not lend itself to generalities and simple conclusions. However, we will endeavor to draw some broad conclusions about the extent of markets and nature of industrial demand for access to genetic resources. In some sectors such as the seed industry, horticulture and the botanical medicines industry all products sold are derived from genetic resources.

Taken as a whole, industry has an interest in every conceivable kind of genetic resource. Given the enormous variety of approaches to R&D and to the choice of starting material across industry and even within each sector it is difficult to generalize about the kinds of material that companies seek to acquire. While the majority of companies in the pharmaceutical industry, for example, maintain a broad interest in plants and micro-organisms, some focus primarily or even exclusively on a narrow area perhaps particular fungi, or animal toxins. Many small and medium-sized enterprises concentrate their research efforts entirely on one kind of genetic resource, such as a single species of plant or category of micro-organism, or on compounds isolated from samples taken from one source, be it sharks, frogs, leeches or venomous insects. The botanical medicine, horticulture and seed industries are primarily plant based industries.

[83] *Supra* Note, no. 68, in, p. 65.

However, within the botanical medicine trade there is a growing interest in marine organisms and fungi, and the advent of genetic engineering has led to a growing number of crop plants that incorporate genetic resources from other kingdoms, from the Bt bacterium to fish genes coding for cold tolerance. Some cosmetic and personal care companies operate marine prospecting programmes and investigate novel therapeutic actions in microorganisms, although the bulk of 'natural' cosmetic products contain botanical ingredients[84]. The biotechnology industry devoted to products in fields other than pharmaceuticals and agriculture conducts a great deal of its research on micro-organisms, but also has interests in many other categories of genetic resources. The basis for the crop protection industry is plant genetic resources, but chemical crop protection products and biological control systems also make use of a wide range of micro-organisms and insects. Pharmaceutical, biotechnology and crop protection companies often prefer to acquire material as raw samples such as dried plant and soil samples or extracts organic or aqueous. Some samples may have been selected on the basis of ethno botanical information or will be supplied with such information. Some companies, however, acquire 'value-added' genetic resources. Typically, these could be samples supplied with the results of screening, pre-bred crop lines, identified bioactive compounds, or even data emerging from product trials usually in the course of collaborative partnerships.

Companies rarely collect material on their own behalf and can be reluctant to negotiate directly with source countries. Increasingly, they turn to intermediaries such as botanic gardens, universities, research institutions, gene banks and commercial brokers not only for collection and scientific services, but also to broker access and benefit-sharing relationships on their behalf with source countries, sometimes as their agents and sometimes

[84] Available at https://cbd.int/doc/articles/2002-/A-00473.Last visited on 28.05.2014.

independently[85]. A number of different intermediaries may be involved between the initial collection of material and the ultimate commercialization of the product. Consequently, intermediaries play a key role in determining benefit-sharing relationships. To date, the majority of samples obtained from developing countries have little value added, but some projects include capacity-building to supply value added products as part of joint research programmes.

The number of joint ventures and partnerships based on research and development conducted in source countries is gradually growing. Assisted by the development of best practice in benefit-sharing arrangements, countries with the requisite scientific and institutional infrastructure will increasingly be able to supply companies with value-added products, often protected by intellectual property rights, thereby enabling source country institutions to capture a larger share of the resultant benefits. As a result of such capacity-building measures, the National Cancer Institute in the United States is today able to build partnerships involving more drug discovery in high-biodiversity countries than was possible just five years ago. In some cases, such as the joint venture between the government of Sarawak and the US pharmaceutical company Medichem Research, high-biodiversity countries are participating in research on endemic species[86]. In others, such as the Nigerian project of the International Biodiversity Cooperative Group, the partnership is creating the opportunity for research on diseases prevalent in the source country that do not otherwise attract much research attention within multinational pharmaceutical companies. The kind of genetic resources and derivatives that companies seek from providers varies enormously

[85] Verolme. H.J.H. et al. **'Access to Genetic Resources: An Evaluation of the Development and Implementation of Recent Regulation and Access Agreements**.' 1st edn. (Columbia University press, Columbia, 1999), p.57.

[86] Asbey, E. J, and J. D. Kempenaar*, 'Biodiversity Prospecting: Fulfilling the Mandate of the Biodiversity Convention'*, Vanderbilt Journal of Transnational Law, Vol. 28, (1995), pp.703- 707.

both between and within industry sectors, but the factors that guide a company's choice of source are fairly consistent across all sectors.

Perhaps the most important criteria for companies are the quality of the samples and the caliber of the scientists in the provider institution. An ability to supply biologically and chemically diverse samples also attracts companies to particular providers. Factors that are becoming increasingly important to many companies are the simplicity of the process by which permission is granted to obtain samples and the clarity of the legal framework (thus protecting the company from risk, since it can be sure of obtaining good title to the samples). The cost of samples and their freedom from intellectual property rights also bear on a company's choice of partners, but seem not to figure quite so prominently as the other criteria mentioned here.

However, countries supplying samples to industry are increasingly familiar with the costs, risks and delays inherent in product development, and, rather than pinning their hopes on the slim chance of a royalty payment 20 years or more down the line, are increasingly prioritizing 'non-monetary' benefits such as the sharing of research results, participation in research, technology transfer, training and capacity building[87]. Some partnerships offer help in kind, such as medical assistance and investment in local infrastructure. Before describing best practice in benefit-sharing in particular industry sectors, it is important to note that the circumstances in which companies of all sectors acquire samples often do not give rise to opportunities for benefit sharing. Years of exchange across cultures and continents mean that many genetic resources have passed outside their countries of origin, and today many are found in vast *ex situ* collections housed in developed countries, where they may be available without the obligation to share benefits arising with their original providers. In

[87] Available at, http://www.doko.vn/tai-lieu/key-marketing-skills-197211.Last Visited on 14.03.2014.

other cases, access and benefit-sharing are severed when benefits arise many decades after the original access, and in a completely different part of the world.

A prime example of this is SmithKline Beecham's anti-cancer drug Topotecan, based on samples of *Camptotheca acuminata* sent from China to the United States in 1911 and put on the market in the United States in 1996, more than 80 years later[88]. Access to traditional knowledge is commonly decoupled from benefit-sharing because it is usually accessed by companies through literature and databases, fed by academic publications, rather than directly from the people holding the knowledge. This said, there is a gradual but palpable trend towards more creative benefit sharing, involving monetary and non-monetary benefits in the short, medium and long terms.

At the same time, there is a growing appreciation that what is 'fair and equitable' is likely to differ substantially according to industry sector, product area, individual research and development programme, and country, and that successful benefit-sharing arrangements are those tailored to the specific circumstances of an individual case. Experience and 'best practice' in benefit sharing have progressed quite significantly on a number of fronts in the decade since the concept first emerged. Many companies in all sectors are willing to pay fees for samples and, in many cases, royalties on net sales. Willingness to share non-monetary benefits is mainly confined to collaborative research relationships not only the highly value added activities of discovery and development, but also fairly low value-added activities like the processing of extracts[89]. Some companies view non-monetary benefit-sharing, whether in the form of research collaborations or in-kind benefits such as supply of

[88] Fernández-Ugalde, J.C. *'Tracking and Monitoring of International Flows of Genetic Resources: Why, How and, Is It Worth the Effort?'* In Ruiz, M. and I. Lapeña (eds.), **A Moving Target: Monitoring the International Flow of Genetic Resources.**1st edn. (IUCN, Bonn, 2007),p.67.

[89] Available at, https://www.creativekorea.or.kr/attach/common/1086.pdf. Last Visited on 14.03.2014.

medical assistance, as a form of charitable contribution rather than as part of the cost of R&D. Others consider these forms of benefit-sharing as integral to any collaborative partnership with providers of genetic resources, and an essential requirement for business activity that allows them to secure access to high-quality samples and to work with high-calibre collaborators. Benefit-sharing varies dramatically across and within sectors, and recent trends embody a response in varying degrees to international policy developments such as the CBD. Best practice in benefit-sharing evolves in tandem with technological and scientific developments, and also reflects changes in market and regulatory environments.

The most effective form of benefit-sharing appears to result from well-developed partnerships between the private sector and source country institutions. Technology transfer and capacity-building within partnerships frequently becomes more valuable to the provider of genetic resources over time, involving more extensive collaborations and resulting in a wider range of benefits. For example, during the initial three-year term of the agreement between INBio of Costa Rica and the US Diversa Corporation, all samples were sent to the company's laboratories in the United States for analysis, but when the agreement was renewed in 1998, Diversa set up a DNA processing laboratory at bio prospecting division in Costa Rica.

Biotechnology companies often obtain without charge samples collected by academic researchers. Licensing agreements for access to value-added genetic resources and biotechnologies are rarely seen by companies in this sector as 'benefit-sharing', but rather as an inevitable part of the bargain in order to maintain access to quality samples, to enjoy the advantages of collaboration with high-calibre scientists, and to remain competitive in the

future. Many of the smaller, recently formed companies, often founded as spin-offs from university departments, are unfamiliar with the CBD[90]. Several believe that the microorganisms which form the mainstay of so much work in the biotechnology sector are not covered by the CBD, and most are inexperienced in negotiating licensing and benefit-sharing arrangements. Rather than initiating benefit sharing agreements of their own, these companies tend to follow the lead of intermediary organizations such as culture collections (*ex situ* collections of microorganisms), which are increasingly supplying materials under material transfer agreements. Genetic resources may have passed through many hands and, in the case of micro-organisms, are often deposited in and accessed from culture collections before reaching the biotechnology company that ultimately commercializes a product.

The link between access and benefit-sharing is thus often broken. Benefit-sharing with 'source countries' is relatively rare, and usually confined to occasions where companies collect genetic resources themselves, or establish access arrangements with intermediary institutions overseas[91]. Comparatively few companies are accustomed to developing benefit-sharing agreements to comply with access legislation, but such agreements as do exist typically involve technology transfer and training as well as commitments to pay royalties. Others, which obtain their materials, especially derivatives such as enzymes, exclusively from suppliers other than the companies themselves, are generally unfamiliar with the CBD. Their 'benefit-sharing' extends only as far as the purchase price or license fee for the derivative concerned. The seed industry involved in the development of major crops

[90] Laird, S. A. and K. ten Kate, *'Biodiversity Prospecting: The Commercial Use of Genetic Resources and Best Practice in Benefit Sharing'*, in S. A. Laird (ed) **Biodiversity and Traditional Knowledge**, 1st edn. (Earthscan, London, 2002), pp241.

[91] Available at http:// www.researchgate.net/.../227603548_Biodiversity_and_Business_Coming.Last visited on 14.03.2014.

approaches benefit-sharing in a very different way from the pharmaceutical industry[92]. The exchange and commercialization of plant genetic resources for food and agriculture has been the subject of public scrutiny and intergovernmental negotiations for more than a decade, but in this sector benefits are shared in a much more indirect fashion than in pharmaceuticals. Our interviews with seed breeders revealed that it is still common for many seed companies to obtain genetic resources for no charge or for a nominal handling fee, particularly if the germ plasm acquired is 'unimproved'. Many actors are involved in the chain from initial access, through pre-breeding and commercial development, to sale of the final product to the farmer or consumer. The gradual privatization of the seed industry in many parts of the world and the growing use of licenses as more seed is patented mean that sophisticated agreements do occur towards the end of this chain.

However, these benefits do not pass back directly along the chain to each contributor, particularly as the vast majority of the materials used have been obtained from collections maintained by seed companies themselves, or by national governments. Several seed breeders we interviewed, from both public and private sectors, felt that it was the increasing use of intellectual property rights, and not developments in law and policy on access and benefit sharing that was driving change in partnerships in the industry. The majority of researchers in agriculture view unrestricted, reciprocal access to genetic resources as the major benefit 'shared' through the current informal system of exchange. At the national scale, tax revenue from the seed industry supports research and pre-breeding in the public sector, including some extension services to farmers. Industry also supports research in academia directly, by endowing chairs and funding basic research programmes

[92] Dutfield, G. *'Sharing the Benefits of Biodiversity – Is There a Role for the Patent System?'* The Journal of World Intellectual Property, Vol. 5(6), (2002), pp.899–932.

in universities. At the international level, donor governments support the work of the Consultative Group on International Agricultural Research (CGIAR).

Companies' responses to the CBD have been mixed, and the development of best practice in industry varies accordingly. For the most part, awareness of the Convention is highest within the pharmaceutical, crop protection, seed and biotechnology sectors, and direct impacts on corporate business practice are greatest in the pharmaceutical sector[93]. The horticulture, botanical medicines, and personal care and cosmetics sectors tend to be largely unaware of the content of the CBD. Companies in the pharmaceutical sector reported most experience with access and benefit-sharing measures and with the CBD policy process, and a number of companies have drafted policies on the acquisition of natural products. Awareness and experience of partnerships that reflect the CBD vary enormously between sectors, from company to company, and even within single companies, where individual researchers and management staff may differ in their perspectives. However, awareness of the CBD is spreading rapidly, and more and more companies report that they are changing their business practices in response to it. To date, very few companies have developed policies in response to the CBD, let alone clear and detailed public documents designed to ensure and to demonstrate compliance with the CBD and national laws on access. However, a number of pharmaceuticals companies have introduced corporate policies to clarify their approach to the requirements of prior informed consent and benefit-sharing introduced by the CBD and increasingly reflected in national laws, and a number more are in the process of doing so

[93] Reid, W. V., Laird, S., Meyer, C. A., Ga´mez, R., Sittenfeld, A., Janzen, D. H., Gollin, M. A., and Juma, C. **Biodiversity Prospecting: Using Genetic Resources for Sustainable Development**. 1st edn. (World Resources Institute, Washington, D.C.1993), p. 97.

Development of a corporate or institutional policy on access and benefit sharing offers several advantages to a company or other organization. The preparation of a policy provides an opportunity and a mechanism for a company to familiarize itself with the letter and spirit of the Convention and access legislation, and will result in a management tool that can protect the company from liability by ensuring compliance with required standards and procedures[94].

A corporate policy can enable more proactive companies to design tools for continuous improvement in their supplier and user chains, and can contribute to the development of a company's R&D strategy, since the process of developing such a policy will help the company identify parameters such as the number of countries it is likely to work in, its main suppliers and collaborators, and the monetary and non-monetary costs of partnerships. A policy also provides a tool for transparency and good corporate citizenship, enabling companies to communicate their positions and commitments to suppliers and other outside collaborators.

Not only individual companies but also industry and professional associations have taken steps to address questions of broader social and environmental responsibility in business. These networks and associations including the Social Venture Network, Businesses for Social Responsibility and the Coalition for Environmentally Responsible Economies—might be encouraged to take up issues arising from the CBD, including access and benefit-sharing. First, it is important to realize that a number of factors limit both the interest of companies in obtaining samples and the opportunities to obtain benefits when they do so. There is plenty of biological diversity to be found in samples already held in *ex situ* collections outside the country of origin, and in many cases the use of historical

[94] Available at, http://www.kpmg.de/docs/expect-unexpected.pdf. Last Visited on 25.4.20014.

collections does not give rise to benefit-sharing with countries of origin. Much biodiversity (in forms such as micro-organisms) located within developed countries remains poorly understood, and its commercial potential as yet unexplored. As a result, many researchers today conduct research on genetic resources readily available *in situ* or *ex situ* at home. Many companies have already built up large internal compound libraries and collections and have become more selective in their hunt for new samples. Companies in the pharmaceutical, biotechnology, botanical medicine and personal care and cosmetics sectors now commonly pursue a strategy that could be termed 'cherry picking'. This involves a focused and targeted selection of a relatively small number of samples, based on specific chemotaxonomic, ethno botanical or bio rational leads, in order to fill gaps in existing collections, or develop products for categories identified as priorities by marketing departments[95]. Companies are also now often selective in terms of the quality of samples, accepting only those for which there is adequate accompanying taxonomic, geographical, ecological and other information. Finally, companies find the leads for many products, even those derived from genetic resources, from literature and databases, without the need for recourse to physical material or knowledge taken directly from people. For example, discovery of new products from wholly synthesized analogues once modelled on a template from nature does not require access to genetic resources.

The idea can be generated from studying literature, and the compound synthesized from laboratory chemicals. Another factor is that it is difficult to predict the nature of companies' demand for access to genetic resources in the future. Over the last 40 years, interest in accessing biodiversity for pharmaceutical development has been cyclical: high in the 1960s when successful antibiotics and anti-tumor agents were found in nature; falling off

[95] Thayer, A. M. *Pharmaceuticals, Redesigning R&D*, Chem.Engineering News, Vol. 25, (1998), pp.25–37.

in the 1970s with the advent of recombinant DNA technology and molecular pharmacology; and rising again in the 1980s, as technologies such as robotic high-throughput screens and improved separation techniques made it cost-effective to explore many hundreds of thousands of samples a year[96]. Currently, capital markets, corporate mergers and research directors are less attracted to natural products than to alternative fields of discovery and development. In many sectors, research dollars are flowing out of natural products and into synthetic chemistry to fund rational drug design, combinatorial approaches and genetics, often with a focus largely on human material. The jury is out on the future of natural products. Despite these factors, the extraordinary diversity and novelty of genetic resources found in high-biodiversity regions remain a valuable source of leads for new product development, and many companies continue to seek access to these materials. Increasingly, companies are prepared to share a number of monetary and non-monetary benefits in exchange for high-quality samples, preferably supplied with reliable accompanying data by a reputable scientific organization[97]. Such value-added partnerships also enable source countries to capture a greater proportion of the benefits that arise from product development. In addition, companies are increasingly concerned to ensure that they do business with organizations which can provide legal certainty that they have good title to the materials; so, while they look for swift and un bureaucratic access to materials, they are also concerned to obtain written guarantees that samples have been acquired in accordance with both the CBD and relevant national law on private property, access and benefit-sharing. In order to benefit from potential partnerships, countries may need to rethink the kind of policy measures they

[96] Srividhya Ragavan, "*New Paradigms for Protection of Biodiversity*", Journal of Intellectual Property Rights, Vol. 13, (September 2008), pp.514-522.

[97] Tamayo, G., Nader, W. F., and Sittenfeld, A, *Biodiversity for Bioindustries*. In J. A. Callow, B. V. Ford- Lloyd, and H. J. Newbury, **Biotechnology and Plant Genetic Resources** eds. 1st edn. (CAB International, Wallingford, United Kingdom, 1997), p.225.

can introduce to foster value-added partnerships, and to streamline requirements imposed by access laws so that they are cost-effective and unbureaucratic. Countries will need to be responsive to the factors which attract companies, and those that build up their capacity to provide an attractive service are likely to gain most from partnerships. The differences in benefit-sharing between and within sectors suggests that it will be necessary for access and benefit-sharing measures to be flexible enough to reflect this diversity, and require the drafters of such measures to be highly informed and to follow closely a wide range of scientific, technological and marketing developments. Commercial activities involving genetic resources can provide direct benefits for conservation programmes and protected areas in the form of financial benefits for park systems, projects and government departments involved in biodiversity conservation. For example, INBio in Costa Rica dedicates 10% of its research funds and 50% of royalties it receives from companies to the Ministry of Natural Resources. To date, INBio's bioprospecting agreements have contributed over US$390,000 to the Ministry of Environment and Energy (MINAE) of the government of Costa Rica, US$710,000 to conservation areas, US$710,000 to public universities and US$740,000 to other groups at INBio, particularly INBio's national biodiversity inventories. In another example, US$380,000 from the Australian pharmaceutical company AMRAD was put directly into conservation projects in Western Australia, with US$190,000 dedicated to the conservation of rare and endangered Western Australian flora and fauna and US$190,000 to other conservation activities, including the development of information technology in such areas as geographical information systems, data capture and the study of population dynamics[98]. A third instance is the taxonomic work

[98] F. Grifo, D. J. Newman, A. S. Fairfield, B. Bhattacharya, J. T. Grupenhoff, *'The Origins of Prescription Drugs'*, in F. Grifo and J. Rosenthal, eds, **Biodiversity and Human Health,** 1st edn. (Island Press Publishers,

undertaken by the Sarawak State Department of Forests and the University of Illinois at Chicago under a collecting agreement with the US National Cancer Institute.

Bioprospecting partnerships can thus provide a source of funds to support activities related to conservation such as resource surveys, taxonomic research and inventories, and other activities integral to ecosystem and species management. Sustainable economic activities based on biodiversity can also serve to boost sustainable development by providing an incentive for conservation and an alternative to more destructive income-generating schemes. For example, within the pharmaceutical, botanical medicines, personal care and cosmetics industries, employment and income generation have been associated with the sustainable supply of raw materials, and the processing and manufacture of products. Examples include the work of Shaman Pharmaceuticals with *Croton*, the work of NCI on *Ancistrocladus*, the Aveda Corporation's Bixa programme in Brazil, and the Body Shop community trade programme. The provision of value-added derivatives of genetic resources, such as extracts for screening, or of pre-bred materials for crop development, or the processing of material into finished products for local, regional or international markets also provides jobs[99]. The expansion of markets for such value-added materials can promote sustainable development in several ways, including by creating employment, by supporting trade in higher-value products, by generating export revenues, and by substituting for imports where through developing their own appropriate medicines and other products countries can avoid having to buy and import expensive pharmaceuticals.

Biodiversity prospecting serves sustainable development perhaps best certainly through the capacity-building and technology transfer that result from commercial research

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Washington DC, 1996), p.89.

[99] Wilhelm Barthlott, Matthias Winiger, **Biodiversity: A Challenge for Development Research and Policy**, 1st Edn. (Springer-Verlag, Berlin Heidelberg, New York, 2001), p.121.

collaborations. For instance, efforts are currently under way in a number of countries, many with the support of the World Health Organization, to study and standardize traditional medical systems. The skills and capacity needed to undertake these studies and integrate the results into national and local health care are important benefits that can be developed through partnerships involving access to genetic resources, and can result in improved and affordable local health care. Scientific capacity to study tropical diseases and locally important health conditions and agricultural problems can be improved by research collaborations in biodiversity prospecting.

Partnerships with companies can also provide local institutions with training, technology, access to market information, and other forms of capacity-building that will allow them to develop relationships and work more effectively with the private sector, as well as to build local programmes and domestic or joint venture companies[100]. Examples include the joint venture between the state government of Sarawak and the US firm Medichem Pharmaceuticals; the partnership between INBio and the Diversa Corporation; Successful access and benefit-sharing partnerships can lead to new medicines, crops to feed the growing world population and other useful products for humankind. They can also help to build scientific and technological capacity within high-biodiversity countries, can promote legal and policy regimes that protect the rights of countries, individuals, communities and corporations, and can help promote sustainable development and the conservation of biological diversity. Respecting local rights can be the first step to nurture respect for IPR. Developing countries should ensure that the trilogy of objectives protection of biodiversity, sustainable development, and equitable sharing of resources work in tandem with trade objectives. However, for these objectives to be achieved, the many stakeholders

[100]Available at https://cbd.int/doc/articles/2002-/A-00473.pdf.Last visited on 28.03.2014.

involved in biodiversity prospecting will need to be involved in the development of appropriate laws, policies and capacity-building activities.