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Daniel T. Jenks

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The Convention on Biological Diversity—An Efficient Framework for the Preservation of Life on Earth?

*Daniel T. Jenks**

So God created man in his own image, in the image of God he created him; male and female he created them. And God blessed them, and God said to them, "Be fruitful and multiply, and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth." And God said, "Behold, I have given you every plant yielding seed which is upon the face of all the earth, and every tree with seed in its fruit; you shall have them for food. And to every beast of the earth, and to every bird of the air, and to everything that creeps on the earth, everything that has the breath of life, I have given every green plant for food." And it was so. And God saw everything that he had made, and behold, it was very good.¹

I. INTRODUCTION

On June 5, 1992, the Convention on Biological Diversity was introduced for signature at the so-called "Earth Summit" in Rio de Janeiro.² The Convention was one of four international agreements proposed at the Earth Summit.³ The Convention's explicit objectives are to conserve the Earth's biological diversity (or "biodiversity") for future generations, to exploit this biodiversity in a sustainable way and

* Juris Doctor Candidate, Northwestern University School of Law; Masters of Management Candidate, J.L. Kellogg Graduate School of Management, 1995. I would like to thank my wife Mary for her support and insight in writing this Comment.

¹ *Genesis* 1:27-30.

² Convention on Biological Diversity, June 5, 1992, art. 1, 31 I.L.M. 818 (entered into force Dec. 29, 1993)[hereinafter Convention].

³ The Agreements include the Rio Declaration, Convention on Climate Change, Convention on Biological Diversity and Statement of Principles on Forests.

to share the benefits of biodiversity in a fair and equitable manner.⁴ Biological diversity is defined as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part."⁵

The Convention has several major provisions. First, it recognizes a limited sovereign property right in genetic material found within a nation's boundaries.⁶ Genetic material is defined as "any material of plant, animal, microbial or other origin containing functioning units of heredity."⁷ Second, the Convention calls on developed countries to transfer to developing countries (i) technology "relevant to the conservation and sustainable use of biodiversity"⁸ and (ii) "technology which makes use of . . . (genetic) resources."⁹ Third, the Convention requires the establishment of a multi-lateral fund financed by the developed countries to support the purposes of the Convention.¹⁰ Finally, the Convention contains provisions related to the monitoring of biodiversity and the handling of biotechnology.¹¹

II. THE UNITED STATES DEBATE

While most of the industrialized world signed the Convention at Rio de Janeiro, the United States under President Bush declined to adopt the Convention for a number of reasons including (i) the Convention's treatment of existing intellectual property rights and technology transfers, (ii) concerns about how the Convention would be financed and (iii) disincentives to the development of new biotechnology products.¹² The loudest criticism in the United States came chiefly from biotechnology companies and their advocates. These critics contended that (i) elements of the Convention seemed to call for the compulsory licensing of intellectual property products and (ii)

⁴ Convention, *supra* note 2, art. 1, 31 I.L.M., at 823.

⁵ Convention, *supra* note 2, art. 2, 31 I.L.M., at 823.

⁶ Convention, *supra* note 2, art. 15, §§ 1, 4, 5, 7, 31 I.L.M., at 828.

⁷ Convention, *supra* note 2, art. 2, 31 I.L.M., at 824.

⁸ Convention, *supra* note 2, art. 16, § 1, 31 I.L.M., at 829.

⁹ Convention, *supra* note 2, art. 16, § 3, 31 I.L.M., at 829.

¹⁰ Convention, *supra* note 2, arts. 20-21, 31 I.L.M., at 830-32.

¹¹ Convention, *supra* note 2, art. 7, 31 I.L.M., at 825; Convention, *supra* note 2, art. 14, 31 I.L.M., at 827-28; Convention, *supra* note 2, art. 19, 31 I.L.M., at 830.

¹² See United States, Declaration Made at the United Nations Environment Programme for the Adoption of the Agreed Text of the Convention on Biological Diversity, issued May 22, 1992, 31 I.L.M. 848. See also U.S. Pledges Support for Global Environmental Facility, Reuters, USA, Aug. 4, 1993, available in WESTLAW, INT-NEWS; Tom Kenworthy, *Saving Plant and Animal Life: Treaty on Biological Diversity Offers Possibility of Breakthrough*, WASH. POST, June 1, 1992, at A15.

the granting of a sovereign property right in genetic material would discourage pharmaceutical research and would result in fewer new drugs being discovered.¹³ Supporters of the Convention, in contrast, argued that there could be no long-term pharmaceutical research without the Convention because, absent conservation incentives for the developing world, there would be very little biodiversity left.¹⁴

On April 21, 1993 (Earth Day), President Clinton announced that the United States would sign the Convention on Biological Diversity and on June 4, 1993, the United States became a signatory.¹⁵ In signing the Convention, which most observers agreed was poorly drafted,¹⁶ the United States explicitly retained the right to issue, concurrent with United States ratification, an "interpretive statement" concerning the Convention's provisions.¹⁷

While there were many reasons for signing the Convention,¹⁸ President Clinton made two chief arguments in support of the Con-

¹³ See John H. Barton, *Biodiversity at Rio*, 42 *BIOSCIENCE* 773, 775 (Nov. 1992) (Convention's critics believe art. 16, § 5 calls for compulsory licensing). See also Melinda Chandler, *The Biodiversity Convention: Selected Issues of Interest to the International Lawyer*, 4 *COLO. J. INT'L L. & POL'Y* 141, 163 (1993) (art. 16, § 5 was perhaps the most objectionable provision with regard to intellectual property protection). See also Dan L. Burk et al., *Biodiversity and Biotechnology*, 260 *SCI.* 1900, 1901 (1993) (language of treaty seems to suggest compulsory licenses, which is ironic given the low level of intellectual property protection in the developing world). See also Graeme Browning, *Biodiversity Battle*, *NAT'L JOURNAL*, June 8, 1992, at 1830. Biotechnology companies have other concerns with the Convention, such as the possible need under Article 19 for a protocol on the handling of biotechnology. *Draft Statements to Interpret Treaty Said Under Examination By Administration*, Apr. 5, 1993, available in WESTLAW, BNA-IED.

¹⁴ See Adam L. Steltzer, Comment, *U.S. Biotechnology Intellectual Property Rights As An Obstacle to the UNCED Convention on Biological Diversity: It Just Doesn't Matter*, 6 *TRANS-NAT'L LAW* 271 (1993).

¹⁵ Alex Barnum, *Companies, Environmentalists United on Treaty*, *S.F. CHRON.*, Apr. 24, 1993, at B1; *As It Signs Treaty, United States Calls For Global Patent Protection For Biotech*, June 8, 1993, available in WESTLAW, BNA-IED; Remarks on Earth Day, 29 *WEEKLY COMP. PRES. DOC.* 632 (Apr. 26, 1993).

¹⁶ See Chandler, *supra* note 13, at 174 (text was sloppy and ambiguous even where there was no intended ambiguity).

¹⁷ *As It Signs Treaty, United States Calls For Global Patent Protection For Biotech*, June 8, 1993, available in WESTLAW, BNA-IED. See also *Ratification Sought for the Convention on Biological Diversity*, 5 *DEPT. OF STATE DISPATCH* 16 (statement of Timothy E. Wirth, Counselor to the Dept. of State, before the Senate Foreign Relations Committee on Apr. 12, 1994). A draft of the United States "interpretative statement" is set forth in the Appendix to Mr. Wirth's testimony.

¹⁸ Major industrialized nations like Japan, Germany, Britain and France had signed the Convention and the Clinton Administration believed that in order to retain American access to genetic material in developing countries, the United States had to sign the Convention as well. The Clinton Administration also felt that the wording of the Convention, particularly with regard to intellectual property rights, had to be clarified and that as a signatory to the Convention, the United States would be able to have a significant impact on how the Convention was interpreted.

vention. First, acknowledging that loss of biodiversity was an important threat to the global community, Clinton argued that the Convention was a means of *effectively* safeguarding biodiversity.¹⁹ Second, Clinton argued that the Convention (albeit with certain modifications) would provide net economic benefits to the United States and would therefore be *efficient* from an economic point of view.²⁰

The United States Senate has yet to ratify the Convention, despite the fact that the Convention entered into force on December 29, 1993 and that the first meeting of the parties was held in late 1994.²¹ President Clinton submitted the Convention to the Senate on November 19, 1993.²² However, despite being favorably reported by the Senate Foreign Relations Committee (by a 16-3 vote)²³ and notwithstanding the backing of a number of important pharmaceutical and agricultural organizations,²⁴ the Convention did not reach the floor of the Senate for a vote in 1994.²⁵ Importantly, concerns about the effectiveness and efficiency of the Biodiversity Convention in protecting biodiversity continue to be raised.²⁶

This Comment will argue that the Biodiversity Convention provides a solid legal framework for the "efficient" protection of biodiversity, but has several significant deficiencies which must be

¹⁹ ". . .the treaty is critically important. . .because of what it will do to preserve species." Remarks on Earth Day, 29 WEEKLY COMP. PRES. DOC. 632 (Apr. 26, 1993).

²⁰ *Id.* at 633 ("...the treaty is critically important to the future. . .because of opportunities it offers for cutting-edge companies whose research creates new medicines, new products and new jobs" and "the agreement protects both American interests and the world environment").

²¹ *Biodiversity: Treaty Enters Into Force Eighteen Months After Its Signing At 1992 Earth Summit*, Dec. 30, 1994, available in WESTLAW, BNA-IED. The parties met from Nov. 28, 1994 to Dec. 9, 1994 in Nassau, Bahamas. *UNEP Selected As Permanent Secretariat For Treaty But Location Still Unresolved*, INT'L ENVTL. REP. (BNA), Dec. 14, 1994, at 1019.

²² 139 CONG. REC. S16,572 (1993).

²³ 140 CONG. REC. S14,047 (daily ed. Oct. 4, 1994). The Convention was reported from the Senate Foreign Relations Committee on July 11, 1994.

²⁴ *Id.* A number of organizations announced their general support for the Convention including the Biotechnology Industry Organization, the Pharmaceutical Manufacturers Association, Merck & Co, Inc., the U.S. Council for International Business, the American Seed Trade Association, Inc., Archer Daniels Midland Co. and the American Corn Growers Association. See also 140 CONG. REC. S15,067-01 (daily ed. Oct. 8, 1994) for a more complete list of organizations supporting the Convention.

²⁵ 140 CONG. REC. S15,066-01 (daily ed. Oct. 8, 1994).

²⁶ See 140 CONG. REC. S14,050 (daily ed. Oct. 4, 1994) for a copy of a letter which was sent to the Senate Majority Leader on Aug. 5, 1994 and signed by thirty-five Senators. This letter raised a number of concerns with the Biodiversity Convention, including whether the Convention would impinge on U.S. sovereignty and negatively affect intellectual property rights. See also 140 CONG. REC. S13,792 (daily ed. Sept. 30, 1994). Senator Helms stated "[i]n particular, I find the [C]onvention's treatment of intellectual property rights, finances, voting procedures, technology transfer and biotechnology dangerously muddled, vague and disturbing."

addressed by the Clinton Administration if the Convention is to be both efficient and effective. To understand this contention, this Comment will: (i) *discuss* the legal and environmental background behind the Convention and the financial stakes involved; (ii) *highlight* the importance and value of biodiversity from a medicinal and agricultural perspective; (iii) *define* efficiency and effectiveness in the context of the Biodiversity Convention; (iv) *describe* how the establishment of a sovereign property right in genetic material helps to overcome the inefficient underpreservation of biodiversity under the current international legal system; (v) *explain* why the establishment of an international property right by itself is insufficient to efficiently protect biodiversity; (vi) *argue* that the Biodiversity Convention establishes an international public trust for the preservation of biodiversity, but must be modified to be effective in achieving its goals; and (vii) *address* the effectiveness and efficiency of various forms of "trustee compensation" under this trust for the preservation of biodiversity.

III. LEGAL BACKGROUND TO THE CONVENTION

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.²⁷ 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.²⁸ 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.

²⁷ See Browning, *supra* note 13, at 1830 (telling the story of Eli Lilly and Co. and the discovery of two very important drugs from the Madagascan rosy periwinkle. While Lilly made millions of dollars, the government of Madagascar received nothing). See also Catherine M. Valerio Barrad, Comment, *Genetic Information and Property Theory*, 87 Nw. U. L. REV. 1037 (1993) (for a broad discussion of whether and how property theory can be applied to find a recognizable property interest in one's genetic material).

²⁸ See Michael A. Gollin, *An Intellectual Property Rights Framework for Biodiversity Prospecting*, in BIODIVERSITY PROSPECTING: USING GENETIC ENGINEERING RESOURCES FOR SUSTAINABLE DEVELOPMENT (Walter Reid et al. eds., 1993). See also Liz Hanellin, *Protecting Plant-Derived Drugs: Patents & Beyond*, 10 CARDOZO ARTS & ENT. L.J. 169 (1991) (analyzing the difficulties which pharmaceutical companies have in obtaining patents on plant-derived drugs and advocating a new type of intellectual property system to cover plant-derived drugs). See also Rebecca L. Margulies, Note, *Protecting Biodiversity: Recognizing International Intellectual Property Rights in Plant Genetic Resources*, 14 MICH. J. INT'L L. 322 (1993) (addressing and reviewing applicability of Plant Variety Act and Plant Patent Act to biodiversity).

To obtain a patent in most countries, an object must be "useful, novel and non-obvious."²⁹ 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 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.³¹ 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. 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.³² Because each nation has a sovereign right to develop its property as it sees fit³³ and because as more rain forest is developed, more species

²⁹ See Hanellin, *supra* note 28 (discussing how U.S. courts have applied the requirements of these areas of substantive law to unprocessed genetic material).

³⁰ See BLACK'S LAW DICTIONARY 778 (6th ed. 1991).

³¹ See Hanellin, *supra* note 21.

³² In submitting the Convention to the Senate, the Clinton Administration expressly supported this philosophy, stating that the "benefits stemming from the use of genetic resources should flow back to those nations that act to conserve biological diversity and provide access to their genetic resources." 103 CONG. REC. S16,752 (daily ed. Nov. 19, 1993).

³³ Convention, *supra* note 2, art. 3, 31 I.L.M., at 824.

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.

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.³⁴ 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.

IV. ENVIRONMENTAL BACKGROUND TO THE CONVENTION

Environmental concern about the loss of habitat, and the consequent loss of biodiversity, has been growing during the past thirty years.³⁵ During this time, a number of ecologically-sensitive areas have been destroyed due to the severe social and economic pressures that many developing countries have faced.³⁶ Tropical rain forests have been disappearing at a particularly fast rate, estimated to be sev-

³⁴ See Convention, *supra* note 2, art. 15, 31 I.L.M., at 828.

³⁵ See Edward O. Wilson, *The Diversity of Life* (1992); *BIODIVERSITY* (E. O. Wilson & Frances M. Peter, eds., 1988).

³⁶ See Kenworthy, *supra* note 12, at A15 (citing noted biologist E.O. Wilson's estimate that 1.8 percent of the world's rain forest was lost to deforestation each year during the 1980's).

enteen million hectares per year.³⁷ 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.³⁸ 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.³⁹

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.⁴⁰ As these estimates have risen, the percentage of the Earth's species catalogued has fallen. The absolute number of species catalogued - 1.4 million - is tiny in comparison to the perhaps thirty million species in existence.⁴¹ Of the number catalogued, scientists have thoroughly "researched" only eleven hundred of the forty thousand plants with possible medicinal or nutritional value for humans.⁴²

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.⁴³ For example, there are close to three hundred thousand species of beetle.⁴⁴ As a rule, the smaller the size of an animal or plant

³⁷ Brian F. Chase, *Tropical Forests and Trade Policy: The Legality of Unilateral Attempts to Promote Sustainable Development Under the GATT*, 17 HASTINGS INT'L & COMP. L. REV. 349, 352 (1994).

³⁸ *Id.* at 356-361.

³⁹ Julie B. Bloch, *Preserving Biological Diversity in the United States: The Case for Moving to an Ecosystems Approach to Protect the Nation's Biological Wealth*, 10 PACE ENVTL. L. REV. 175, 194 (1992). The rate of biodiversity loss is believed to be faster today than at any time since the dinosaurs became extinct sixty-five million years ago. *Ratification Sought for the Convention on Biological Diversity*, *supra* note 17.

⁴⁰ See Robert M. May, *How Many Species Inhabit the Earth*, SCI. AM., Oct. 1992, at 42. May notes that while fifty percent of the world's birds were known by 1845 and only a few new birds are added each year, only fifty percent of the world's arthropods were known in 1960 and sixty-five thousand species have been added since that date. Presumably, we have just scratched the surface in identifying species which are very small.

⁴¹ Robert M. Adams, *Smithsonian Horizons: Can we find a way to balance the survival of endangered species with the livelihoods of people?*, SMITHSONIAN, Mar. 1992. May, *supra* note 40, at 42. Estimates of the number of species in the world runs as high as one hundred million. Kenworthy, *supra* note 12, at A15.

⁴² Kirsten Peterson, Comment, *Recent Intellectual Property Trends in Developing Countries*, 33 HARV. INT'L L.J. 277 (1992) (quoting Peter R. Principle, *Economic Significance of Plants and Plant-Derived Drugs*, 3 ECON. & MED. PLANT RESEARCH 1, 5, 9 (H. Wagner et al., eds., 1989)).

⁴³ Kenworthy, *supra* note 12, at A15 (quoting noted biologist E.O. Wilson, who calls the tropical rain forests the "central treasure house of the world's biodiversity"). May, *supra* note 40, at 45 (nine hundred thousand of the world's 1.5 to 1.8 million recorded species are insects).

⁴⁴ See May, *supra* note 40, at 45 (given 1.4 million species and fact that one in five identified species are beetles, close to three hundred thousand species must be beetles).

family, the larger the number of different species.⁴⁵ 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.⁴⁶

As estimates of Earth's biodiversity have risen, environmentalists have become aware that biodiversity is very fragile and easily destroyed. Scientists believe that for every twenty thousand acres of rain forest developed, approximately six hundred species are made extinct.⁴⁷ As well, scientists have realized that the amount of land conserved does not directly correlate with the amount of biodiversity preserved.⁴⁸ To reduce the influence of non-native ecosystems (and thus maximize levels of biodiversity), buffers must be established around protected areas and protected areas must be large enough in size to ensure ecosystem viability.⁴⁹

Having briefly examined the nature, extent and rapid loss of the world's biodiversity, this Comment will now address the tangible benefits to mankind of preserving biodiversity. These benefits lie chiefly in the areas of agriculture and medicine.

V. THE ECONOMIC IMPORTANCE OF BIODIVERSITY FROM AN AGRICULTURAL & MEDICINAL PERSPECTIVE

The existence of plant biodiversity plays a crucial role in maintaining the world's food supplies. While fewer than twenty plant spe-

⁴⁵ *Id.* at 48.

⁴⁶ But see Karen Anne Goldman, Note, *Compensation for Use of Biological Resources Under the Convention on Biological Diversity: Compatibility of Conservation Measures and Competitiveness of the Biotechnology Industry*, 25 LAW & POL'Y INT'L BUS. 695, 717 (1994) (noting that "while a highly valuable portion of a species' DNA may be unique, nearly identical sequences might also be obtained from another species").

⁴⁷ Kenworthy, *supra* note 12, at A15 (citing E.O. Wilson's estimate that 0.5 percent of all rain forest species (or as many as fifty thousand) are disappearing each year).

⁴⁸ David Skole & Compton Tucker, *Tropical Deforestation and Habitat Fragmentation in the Amazon: Satellite Data from 1978 to 1988*, 260 SCI. 1905, 1905 (1993). See also Joe Alper, *How to Make the Forests of the World Pay Their Way*, 260 SCI. 1895, 1896 (1993) (noting that species richness and abundance in logged areas was still twenty-five percent lower than in unlogged control areas).

⁴⁹ Skole & Tucker, *supra* note 48, at 1905 (noting the problems of "edge effects" and "islands of biodiversity"). See Alper, *supra* note 48, at 1895 (noting that even the most unobtrusive of commercial practices may erode a forest's biodiversity).

cies produce ninety percent of the world's food supply,⁵⁰ these species must be modified continually via cross-breeding with wild strains in order to both enhance yields and combat disease.⁵¹ Importantly, the existence of a single plant species (out of hundreds of related types) can play a critical role in the development of a new variety. For example, when scientists examined twenty-six thousand samples of wheat for resistance to the Russian Wheat Aphid, only four species with resistance to this pest were identified.⁵²

Because of the constant need for new plant varieties, the commercial value of biodiversity from an agricultural perspective is enormous. For example, it is estimated that the exploitation of biodiversity (via cross-breeding) over the past sixty years in the United States annually increases the value of the American soybean and corn crops by roughly three billion and seven billion dollars, respectively.⁵³ However, despite an extensive plant repository system in the United States (which maintains many non-native species), at least fifty percent of the world's agricultural biodiversity lies outside of this country.⁵⁴

Mankind's understanding of the value of biodiversity to the development of new medicines has accelerated during the past few years. Over one hundred different major drugs have been found in the rain forests of the world, with the majority of drugs having been found during the last decade.⁵⁵ Important rain forest drugs include vincristine and vinblastine (found in the Madagascan periwinkle and used in treating Hodgkin's disease and acute lymphocytic leukemia) and quinine (found in bark of an evergreen tree in Peru and used to fight malaria).⁵⁶ Given the relatively small number of plants evaluated to date for medicinal uses, the potential value of new drugs de-

⁵⁰ Howard G. Buffett, *Senate Inaction Threatens Biodiversity Treaty*, ST. LOUIS POST-DISPATCH, Aug. 31, 1994, at 7D.

⁵¹ *Id.* See also Jack R. Kloppenburg, *FIRST THE SEED: THE POLITICAL ECONOMY OF PLANT BIOTECHNOLOGY 1492-2000* (1988) (discussing the extent and location of genetic "store-houses" for common plants (like wheat, etc.)).

⁵² 140 CONG. REC. S14,053 (daily ed. Oct. 4, 1994).

⁵³ *Ratification Sought for the Convention on Biological Diversity*, *supra* note 17 (experts estimate that biodiversity adds a value of about three billion dollars to the eleven billion dollar annual soybean crop and about seven billion dollars to the eighteen billion dollar annual corn crop).

⁵⁴ 140 CONG. REC. S14,053 (daily ed. Oct. 4, 1994). Ninety-nine percent of American crop land is planted with species that originate outside of the United States.

⁵⁵ Approximately forty-one percent of all our medicines are derived from living things. Sam Thornstrom, *Jungle Fever*, NEW REPUBLIC, Apr. 19, 1993, at 12-13.

⁵⁶ *Id.* at 12-13; Browning, *supra* note 13, at 1829.

rived from rain forest plants may be immense.⁵⁷ However, producing a new, commercially-available rain forest drug is very expensive and may take many years due to the long research and development efforts involved.⁵⁸ As well, laboratory synthesis of a new compound can be extremely difficult and therefore, many biotechnology companies must successfully cultivate a particular species in order to bring a new drug to market.⁵⁹

Indigenous groups have played a major role in discovering new drugs in the rain forest.⁶⁰ Seventy-five commercially available drugs (or seventy-five percent of all drugs derived from rain forest inputs) have been found with the help of local tribes.⁶¹ Many indigenous groups have long used certain plants for medicinal purposes. Their pharmacological knowledge, albeit primitive, has enabled researchers to more readily identify useful medicinal "needles" in the biodiversity "haystack" of the rain forest.⁶² Absent the aid of indigenous groups, it is estimated that for every one commercially-successful drug, at least five thousand species must be tested.⁶³

In summary, despite the large amount of time and resources which may be required to find commercially useful biodiversity, such biodiversity clearly has great potential economic value. Given the rapid loss of biodiversity, however, the question remains whether the Convention is an "efficient" and "effective" means of preserving biodiversity. To answer this question, one must first define the terms "efficient" and "effective."

⁵⁷ See *supra* note 42 and accompanying text. See also *Ratification Sought for the Convention on Biological Diversity*, *supra* note 17 (noting that plant species provide the active ingredient for twenty-five percent of the prescription drugs sold in the United States, with an annual market value in excess of ten billion dollars). But see Peter Huber, *Biodiversity vs. Bioengineering?*, FORBES, Oct. 26, 1992, at 266 (suggesting that the economic value of the rain forest's genetic material may be overstated).

⁵⁸ See Ana Sittenfeld & Rodrigo Gomez, *Biodiversity Prospecting by INBIO*, in BIODIVERSITY PROSPECTING: USING GENETIC ENGINEERING RESOURCES FOR SUSTAINABLE DEVELOPMENT 75 (Walter Reid et al. eds., 1993) (noting that the average cost of bringing a new drug to market is two hundred and thirty million dollars and that a drug takes nearly ten years to go from source to market).

⁵⁹ See Browning, *supra* note 13, at 1830 (in order to create a sufficient supply of vincristine and vinblastine, Eli Lilly & Co. had to set up rosy periwinkle farms in Madagascar).

⁶⁰ See Peterson, *supra* note 42.

⁶¹ Peterson, *supra* note 42, at 277 (quoting Steven R. King, *The Source of Our Cures*, CULTURAL SURVIVAL Q., Summer 1991, at 9).

⁶² One pharmaceutical company, Shaman Pharmaceuticals, specifically focuses its drug development strategy on how indigenous groups use plants for medicinal purposes. *Shaman Pharmaceuticals Supports Biodiversity Convention*, BUSINESSWIRE, April 21, 1993, available in WESTLAW, INT-NEWS.

⁶³ Peterson, *supra* note 42, at 277 n.30.

VI. "EFFICIENCY" & "EFFECTIVENESS" DEFINED

There are two major views of economic efficiency which could be applied in analyzing the Biodiversity Convention - Pareto efficiency and Kaldor-Hicks efficiency.⁶⁴ A Pareto efficient (or Pareto superior) agreement is a *voluntary* agreement which enhances the *utility* of at least one party to the agreement without diminishing the utility of another party.⁶⁵ The concept of Pareto efficiency has two significant drawbacks in the context of the Biodiversity Convention. First, if constituencies like the biotechnology industry are considered "parties" to the Convention, then it is hard to argue that any change to the current international intellectual property rights regime (which benefits the biotechnology industry greatly) is Pareto efficient because any grant of a property right in unmodified genetic material will make these parties worse off (at least in the short run). Second, and more importantly, Pareto efficiency is typically based on the non-monetary concept of "utility."⁶⁶ Utility is defined as the sum total of an individual's "happiness," is virtually impossible to quantify and is a function of personal preferences.⁶⁷ In general, any agreement which is voluntarily entered into is Pareto efficient by definition, because, absent an enhancement in each signatory's utility, the agreement would not be signed. By this logic, the Biodiversity Convention is "Pareto efficient" (at least upon the signatories) and there is a rebuttable presumption that the Convention is "Pareto optimal" (which is to say that there is no superior agreement possible between the signatories).

The Kaldor-Hicks view of efficiency offers a better mechanism for analyzing the Biodiversity Convention because it does not require that each party be at least as well off under the Convention as under the current regime nor does it rely on the non-monetary notion of utility.⁶⁸ Instead, the Kaldor-Hicks view posits that an agreement is (i) efficient if, after the agreement, the collective wealth of the parties is enhanced and (ii) optimally efficient if, after the agreement, no modification to the agreement will further enhance the collective wealth of the parties.⁶⁹ Determining whether collective wealth is enhanced may be difficult, given the problem of idiosyncratic value and the fact that all parties affected by a transaction may not be voluntary

⁶⁴ RICHARD POSNER, *ECONOMIC ANALYSIS OF LAW* 12-14 (4th ed. 1992).

⁶⁵ *Id.* at 13.

⁶⁶ See ROBERT COOTER & THOMAS ULEN, *LAW AND ECONOMICS* 49-50 (1988).

⁶⁷ STEVEN T. CALL & WILLIAM L. HOLAHAN, *MICROECONOMICS* 492 (1983).

⁶⁸ POSNER, *supra* note 64, at 13-14.

⁶⁹ POSNER, *supra* note 64, at 13-14.

participants. However, despite its limitations, the concept of wealth enhancement is a better tool than "utility" because it provides in theory a market-based measure against which different provisions of the Convention may be analyzed.

The concept of "effectiveness," like the concept of "efficiency," has two readily apparent interpretations in the context of the Convention's goal of "preserving biodiversity." One could measure the "effectiveness" of the Convention or provisions of the Convention by determining the degree of biodiversity lost after its enactment. If little or no biodiversity is lost, then from this absolutist perspective, the Convention is effective. Were this definition adopted, then there would be no way that the Convention could be both economically efficient and environmentally effective unless, as some commentators suggest, an infinite value is assigned to the preservation of each species.⁷⁰ If an infinite value is assigned to the preservation of each species, then any destruction of an ecologically sensitive area is economically inefficient as the value from the alternative use of such area will be less than the value of the species destroyed. However, assigning an infinite value to the preservation of biodiversity in relation to development projects in the developing world seems impractical as, notwithstanding international efforts, significant amounts of biodiversity will be lost in the future. The important policy question is how can mankind design a legal regime which helps to protect the most valuable aspects of the world's biodiversity?

To this end, a better definition of "effectiveness" explicitly contemplates an optimal ("efficient") level of preservation and focuses on how well a particular legal regime is able to achieve this efficient end. This approach concentrates on implementation issues (such as how compensation under the Convention should be allocated), because, as an analysis of the Convention will show, a seemingly efficient legal framework may not be effectively implemented, and thus, inefficient outcomes may occur.

This Comment will now discuss why underpreservation of biodiversity occurred under the pre-Convention legal regime and apply the concept of Kaldor-Hicks efficiency to argue that the Convention's grant of a sovereign property right in unmodified genetic material enhances global economic efficiency.

⁷⁰ See Bryan G. Norton, *On the Inherent Danger of Undervaluing Species* (Mar. 1983)(unpublished working paper, Center for Philosophy and Public Policy, University of Maryland) (arguing that any attempt to value a species will ultimately end up undervaluing such species).

VII. THE UNDERPRESERVATION OF BIODIVERSITY—A
“COMMONS” PROBLEM

The problem of conserving biodiversity in a world without intellectual property protection for genetic resources is a “commons” problem.⁷¹ A “commons” is typically an area of land, air or water which is owned communally by a group. In the absence of strict and 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.⁷² “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.⁷³ 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.⁷⁴ “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.⁷⁵

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 interna-

⁷¹ See H. Scott Gordon, *The Economic Theory of a Common Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954); S. V. Ciracy-Wantrup, “Common Property” As A Concept In Natural Resources Policy, 15 NAT. RES. J. 713 (1975); Garrett Hardin, *The Tragedy of the Commons*, 142 SCI. 1243 (1968).

⁷² See Gordon, *supra* note 71 (for an analysis of the fisheries problem). See Hardin, *supra* note 71 (for a brief analysis of the grazing and pollution problems).

⁷³ See Hardin, *supra* note 71, at 1244.

⁷⁴ Gordon, *supra* note 71, at 135.

⁷⁵ See Gordon, *supra* note 71, at 135. Commons theorists also note that other actions, such as strict and enforceable regulation (either formal or informal) which also limit access to the commons, will help to solve a commons problems.

tional intellectual property law (prior to the Convention) did not recognize a property right in unmodified genetic material.⁷⁶

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.⁷⁷ However, part of the cost inherent in developing the drug-preserving ecologically-sensitive areas is 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.

The Biodiversity Convention "solves" the "commons" problem by recognizing a sovereign property right in biodiversity.⁷⁸ By granting this right (which, as noted above, includes the right to condition access to biodiversity in exchange for compensation), the Convention allows developing nations to internalize the benefits of preserving biodiversity which heretofore 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. 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

⁷⁶ See discussion *infra* part III (for a discussion of the historical absence of property rights in unmodified genetic material).

⁷⁷ But see Merck-INBIO agreement, where analysts speculate that Costa Rica will receive between one and fifteen percent in royalties on any new drug found within its boundaries. Sarah A. Laird, *Contracts for Biodiversity Prospecting*, in BIODIVERSITY PROSPECTING: USING GENETIC ENGINEERING RESOURCES FOR SUSTAINABLE DEVELOPMENT 111 (Walter Reid et al. eds., 1993). In this transaction, Merck made a one million dollar advanced payment to Costa Rica, donated chemical extraction equipment worth one hundred and thirty-five thousand dollars and agreed to train Costa Rican scientists. Goldman, *supra* note 46, at 720.

⁷⁸ Convention, *supra* note 2, art. 15, §§ 1, 4, 5, 7, 31 I.L.M., at 828.

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 Convention. For example, if a species lives in two different countries, who owns the right to exploit this species?⁷⁹ Is the right shared? 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.⁸⁰ 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? Will these agents "internalize" the benefit of land preservation? If benefits from biodiversity are misaligned with costs of preservation at any societal level, then sub-optimal preservation will occur.

In summary, by granting a sovereign property right in biodiversity, the Biodiversity Convention arguably increases efficiency from a Kaldor-Hicks perspective. However, as the next section will show, the Convention also enhances efficiency in other ways as well.

VIII. THE NEED FOR INTERNATIONAL COMPENSATION

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.⁸¹ The transfer of funds and intellectual property to developing nations can be thought of as additional compensation for the preservation of biodiversity. An analysis of option theory will demonstrate why granting additional compensa-

⁷⁹ See Peterson, *supra* note 42. See also Goldman, *supra* note 46, at 716 (noting that "geographic distributions of plant and animal species are not limited by national borders").

⁸⁰ This is a classic "fugitive property" problem. A typical example of the fugitive property problem is an oil pool which lies beneath several owner's properties. Each owner may attempt to pre-empt the other adjacent property owners by making uneconomic investments. See COOTER & ULEN, *supra* note 66, at 124-35 (discussing the economics of fugitive property).

⁸¹ Convention, *supra* note 2, art. 16, 31 I.L.M., at 829; Convention, *supra* note 2, art. 20, 31 I.L.M., at 830-31.

tion to developing nations may also be necessary to further global efficiency.⁸²

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.⁸³ 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.⁸⁴

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.⁸⁵ 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.⁸⁶ Given (i) the long-time horizon involved in biodiversity prospecting, (ii) the 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.⁸⁷ 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

⁸² See Michael Gallin, *Annex 3 - Convention on Biological Diversity and Intellectual Property Rights*, in *BIODIVERSITY PROSPECTING: USING GENETIC ENGINEERING RESOURCES FOR SUSTAINABLE DEVELOPMENT* 299 (Walter Reid et al. eds., 1993) (noting in his analysis of Article 21 & 22 of the Convention that "trade in indigenous resources based on intellectual property rights will not be sufficient to finance biodiversity conservation").

⁸³ See John V. Krutilla, *Conservation Reconsidered*, 57 AM. ECON. REV. 777, 780 (1967).

⁸⁴ See Richard A. Brealey & Stewart C. Myers, *Principles of Corporate Finance* (1991) (refer to Chapter 21 - Applications of Option Pricing Theory).

⁸⁵ See MICHAEL P. TODARO, *ECONOMIC DEVELOPMENT IN THE THIRD WORLD* 483 (3rd ed. 1985) (noting that many developing nations have high market rates of interest due to the high premium which many citizens place on current consumption).

⁸⁶ See Laird, *supra* note 77, at 111.

⁸⁷ It is relatively easy to evaluate the economic opportunity cost of foregone development. For example, it has been estimated that the value of converting one hectare of Peruvian rain forest to cattle pasture is equal to \$6,144. Charles M. Peters et al., *Valuation of an Amazonian Rainforest*, 339 NATURE 655, 656 (1989).

of biodiversity than any single country alone will.⁸⁸ 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. 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.

IX. THE BIODIVERSITY CONVENTION AS AN INTERNATIONAL PUBLIC TRUST

The historical notion of a "public trust" has its roots in English common law and is loosely based on earlier Roman law.⁸⁹ 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.⁹⁰ 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.⁹¹

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.⁹² While much of the modern public trust doctrine is ill-defined (some commentators believe it to be a legal fiction⁹³), at base the doctrine is rooted in the notion that a great deal of property that is both publicly

⁸⁸ See TODARO, *supra* note 85; see also Laird, *supra* note 77.

⁸⁹ Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 475 (1970).

⁹⁰ Lloyd R. Cohen, *The Public Trust Doctrine: An Economic Perspective*, 29 CAL. W. L. REV. 239, 250 (1992).

⁹¹ *Id.* at 254 (Cohen notes the irony of how the modern public trust doctrine is being used to frustrate rather than further commercial interests). See also Ved P. Nanda & William K. Ris, Jr., *The Public Trust Doctrine: A Viable Approach to International Environmental Protection*, 5 ECOL. L. Q. 291, 302 (1976).

⁹² See Sax, *supra* note 89.

⁹³ See Richard J. Lazarus, *Changing Conceptions of Property and Sovereignty in Natural Resources: Questions the Public Trust Doctrine*, 71 IOWA L. REV. 631, 715 (1986) (noting that many critics believe that the doctrine has weak historical underpinnings).

and privately owned is bundled with an extensive set of pre-existing communal rights.⁹⁴ 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.⁹⁵ 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.

The Biodiversity Convention has many of the indicia of a public trust.⁹⁶ The purpose of the trust is "to preserve biodiversity."⁹⁷ 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,⁹⁸ however, use of trust property is restricted to those uses which do not materially affect biodiversity. Trust property may be harmed in certain circumstances, but only if the harm is minimized and is "necessary."⁹⁹ The beneficiaries of the trust are the international community and perhaps future generations.¹⁰⁰ 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 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

⁹⁴ See Sax, *supra* note 89, at 478.

⁹⁵ Cohen, *supra* note 90, at 245.

⁹⁶ In fact, during his Earth Day speech when he announced U.S. support for the Biodiversity Convention, President Clinton used the language of trust law to find a duty to preserve nature ("[the bounty of nature] is a gift from God that we hold in trust for future generations. Preserving our heritage, enhancing it, and passing it along is a great purpose worthy of a great people"). Remarks on Earth Day, 29 WEEKLY COMP. PRES. DOCS. 631 (Apr. 26, 1993). See also Nanda & Ris, *supra* note 91 (applying the public trust doctrine to international environmental issues).

⁹⁷ There must be a public trust purpose for a public trust to be found. Lazarus, *supra* note 93, at 651. See Convention, *supra* note 2, art. 1, 31 I.L.M., at 823 (purpose of Convention).

⁹⁸ Lazarus, *supra* note 93, at 653.

⁹⁹ Lazarus, *supra* note 74, at 652. See Convention, *supra* note 2, art. 14, § 1(a), 31 I.L.M., at 827 (calling on parties to evaluate and minimize effect of any proposed action that might impact on biodiversity).

¹⁰⁰ See Convention, *supra* note 2, 31 I.L.M., at 823 (the contracting parties state in the preamble that they are "[d]etermined to conserve and sustainably use biological diversity for the benefit of present and future generations"). See also EDITH BROWN WEISS, IN FAIRNESS TO FUTURE GENERATIONS: INTERNATIONAL LAW, COMMON PATRIMONY, AND INTERGENERATIONAL EQUITY (1989); Edith Brown Weiss, *The Planetary Trust: Conservation and Intergenerational Equity*, 11 ECOL. L. Q. 495 (1984); Edith Brown Weiss, *Developments in the Law - International Environmental Law*, 104 HARV. L. REV. 1521, 1533-1535 (1991).

the preservation of biodiversity.¹⁰¹ 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.¹⁰²

U.S. courts have been hesitant to adopt the modern public trust doctrine, in part because (i) plaintiffs have been unable to demonstrate a prior reservation by the sovereign of certain communal rights in property¹⁰³ and (ii) restrictions on the private use of property often appear like governmental "takings."¹⁰⁴ 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.¹⁰⁵ The Biodiversity Convention also sidesteps the issue of an international "taking" from developing countries as well, because compensation, in the form of multi-lateral payments and intellectual property transfers, (i) exists, (ii) is on-going and (iii) is

¹⁰¹ Cohen, *supra* note 90, at 254 (noting that in contrast to the historical doctrine, modern public trust doctrine severely frowns on the commercial use of trust property and this seemingly undermines the legitimacy of the modern doctrine).

¹⁰² See Lazarus, *supra* note 93, at 712 (noting that the public trust doctrine may not be a particularly effective doctrine for environmental protection because judges often balance competing public interests in applying it). See also Richard Delgado, *Our Better Natures: A Revisionist View of Joseph Sax's Public Trust Theory of Environmental Protection, and Some Dark Thoughts on the Possibility of Law Reform*, 44 VAND. L. REV. 1209, 1227 (1991) (noting that though well-intentioned, Sax's public trust doctrine may get in the way of more far-reaching strategies for environmental protection).

¹⁰³ See *Summa Corp. v. Cal. ex rel. State Lands Comm'n*, 104 S. Ct. 1751, 1758 (1984) (refusing to find a public trust easement over tidelands property owned by persons whose predecessors-in-interest had their interest confirmed without mention of such easement in federal patent proceedings taken pursuant to Act of 1851).

¹⁰⁴ See *Kaiser Aetna v. U.S.*, 444 U.S. 164, 172 (1979) (refusing to find that a governmental regulation which opened an otherwise private pond to public access was immune to a takings challenge).

¹⁰⁵ See Convention, *supra* note 2, art. 8, 31 I.L.M., at 825; Convention, *supra* note 2, art. 14, 31 I.L.M., at 827 (implicitly creating these rights and duties despite language to the contrary (i) in the preamble of the Convention "reaffirming" sovereign rights over biodiversity and (ii) in Article 20, which states that economic and social development and the eradication of poverty are the overriding priorities of developing nations (the so-called "right to development"))).

a prerequisite for the continuing obligation of developing states to preserve biodiversity.¹⁰⁶

The outline of an international public trust clearly exists under the Convention. However, as the next section will show, there is a large flaw in the structure of the Convention - the lack of liability rules - which may seriously diminish its effectiveness.

X. THE NEED FOR LIABILITY RULES TO CREATE AN EFFECTIVE PUBLIC TRUST

Professor Sax has posited that for a public trust doctrine to be effective in protecting the environment, it must be able to meet three criteria.¹⁰⁷ First, there must be "some concept of a legal right in the general public."¹⁰⁸ While the Biodiversity Convention does not contemplate the right of individuals to enforce the Convention,¹⁰⁹ Article 27 does explicitly recognize a cause of action for participating governments and such cause of action (depending on the circumstances) may be resolved via arbitration or the International Court of Justice.¹¹⁰ Second, the doctrine "must be capable of an interpretation consistent with contemporary concerns for environmental quality."¹¹¹ The definition of biodiversity under the Convention is very broad and the Convention is clearly open to evolving interpretations of what constitutes the "preservation of biodiversity." Thirdly, the doctrine must "be enforceable against the government."¹¹² While there is an international dispute resolution mechanism contemplated under Article 27, there is no explicit enforcement mechanism or cause of action under the Convention against a government which destroys its own

¹⁰⁶ Convention, *supra* note 2, art. 20, 31 I.L.M., at 830; *see also* Barton, *supra* note 13, at 774.

¹⁰⁷ Sax, *supra* note 89, at 474.

¹⁰⁸ Sax, *supra* note 89, at 474.

¹⁰⁹ *See* 140 CONG. REC. S14,053 (daily ed. Oct. 4, 1994) (in a letter to the Senate Majority Leader, the Secretaries of the Interior, Agriculture and State clearly state that the Convention does not, "expressly or by implication, create a private right of action under which a private person or group may challenge domestic laws and regulations as inconsistent with the Convention"). Even though the Convention may not create a private cause of action, it is worth noting that several federal statutes already prohibit the destruction of biodiversity by the United States government and that such statutes may serve as the basis for a private cause of action. *See Sierra Club v. Marita*, 843 F. Supp. 1526 (E.D. Wis. 1994).

¹¹⁰ Convention, *supra* note 2, art. 27, 31 I.L.M., at 834; Convention, *supra* note 2, Annex II, 31 I.L.M., at 839.

¹¹¹ Sax, *supra* note 89, at 474.

¹¹² Sax, *supra* note 89, at 474.

(domestic) biodiversity.¹¹³ From both a formalistic and practical perspective, this is clearly where the Convention needs modification.

While developing nation "trustees" may be unable to compel performance (i.e. compensation) from the developed world, these nations have a sufficient remedy under the Biodiversity Convention if the developed world breaches its obligations. Under Article 20, the "extent to which developing country Parties will effectively implement their commitments under this Convention will depend on the effective implementation by developed country Parties of their commitments under this Convention related to financial resources and transfer of technology. . ."¹¹⁴ If the developed world does not fully provide these resources, then developing nations need only partially perform their obligation to preserve biodiversity and may develop those areas which they are no longer obligated to preserve. This is clearly a sufficient rescissory remedy because, post-breach, the developing world will be in the same economic position that they were before the Convention.¹¹⁵

In contrast, the developed world cannot enforce the Biodiversity Convention against the developing world and there is no sufficient remedy for the non-performance of developing nations. Article 3 specifically reaffirms the right of sovereign nations to exploit their resources pursuant to their own environmental policies and Article 20, paragraph 4 recognizes that the paramount duty of developing nations is economic and social development and the eradication of poverty (the so-called "right to development").¹¹⁶ Based on the language of these Articles, only the most environmentally-wasteful, economically-inefficient development programs would yield to an action brought under the Convention. The only penalty which developing nations currently face under the Convention for neglecting their trusteeship

¹¹³ See Lee P. Breckenridge, *Protection of Biological and Cultural Diversity: Emerging Recognition of Local Community Rights in Ecosystems Under International Environmental Law*, 59 TENN. L.REV. 735, 743 (1992) (quoting Michael Glennon, *Has International Law Failed The Elephant?*, 84 AM. J. INT'L L. 1, 34 (1990), who states "a global environmental right arises in connection with a global environmental resource. It refers to the right of all states to expect that resources will be protected by the state in which it is found. States are trustees, responsible for the protection of species within their territories. That obligation runs to the international community as a whole; any state should be regarded as suffering legally cognizable injury when that obligation is breached by another state").

¹¹⁴ Convention, *supra* note 2, art. 20, § 4, 31 I.L.M., at 831.

¹¹⁵ Rescissory damages are "those which contemplate the return of the injured party to the position he occupied before he was induced by wrongful conduct to enter into the transaction." BLACK'S LAW DICTIONARY 273 (6th ed. 1991).

¹¹⁶ Convention, *supra* note 2, art. 3, 31 I.L.M., at 834; Convention, *supra* note 2, art. 20, § 4, 31 I.L.M., at 831. The sovereign right to development is also found in the United Nations Charter.

duties is the withdrawal of future multi-lateral payments and new transfers of technology.¹¹⁷

The withdrawal of future compensation is an insufficient remedy for the developed world. Payments made by the developed world should be viewed as installment payments made over a period of time for the preservation of biodiversity, not as annual rents paid to forestall the destruction of biodiversity in a given year. There is no meaningful benefit to the developed world if, for example, after receiving five years of compensation, a developing nation decides (via development) to destroy a portion of its biodiversity. As noted above, exploiting the pharmacological value of biodiversity takes many years of testing and research.¹¹⁸ Therefore, only if biodiversity is preserved over the long-term will the international community benefit from its preservation and benefit from compensation paid under the Biodiversity Convention.

A meaningful liability structure needs to be created if the Biodiversity Convention is to be effective. Under the ideal structure, developing countries would still be able to destroy biodiversity in certain circumstances but would have to make restitution¹¹⁹ to the developed world. At a minimum, such restitution should equal part or all of the prior compensation received. By requiring restitution, this legal structure would force those nations which destroy biodiversity to fully internalize the cost of its destruction and, as a result, a more optimal amount of biodiversity would be preserved.¹²⁰ As noted above, the Convention expressly contemplates instances where biodiversity will be destroyed. However, absent a strong liability structure, there will be a relatively small price to pay for such destruction and the goal of efficient preservation will be seriously undermined.

The Biodiversity Convention under Article 14, paragraph 2 already contemplates that a liability structure be established for those states who destroy (even if unintentionally) the biodiversity of other signatories.¹²¹ By striking the phrase "except where such liability is a purely internal matter" from Article 14, paragraph 2, the international

¹¹⁷ Although conceivably other international measures beyond the four corners of the Convention, such as sanctions, could be imposed.

¹¹⁸ Sittenfeld & Gomez, *supra* note 58, at 75.

¹¹⁹ Restitution, as a legal concept, has several different meanings. See DAN B. DOBBS, DOBBS LAW OF REMEDIES, § 4.1(1) (2nd ed. 1993). Restitution in this context means placing the developed world back in the position they were in prior to the breach.

¹²⁰ By requiring restitution, the Convention would eliminate the possibility of developing nations enjoying unjust enrichment.

¹²¹ Convention, *supra* note 2, art. 14, § 2, 31 I.L.M., at 828.

community could explicitly create the foundation for a binding liability structure.¹²²

XI. ISSUES RELATED TO THE EFFICIENCY & EFFECTIVENESS OF THE BIODIVERSITY CONVENTION

As this Comment has endeavored to demonstrate, the overall structure of the Biodiversity Convention - which includes the creation of a sovereign property right in biodiversity coupled with an international public trust limiting the exercise of this sovereign right - is efficient in theory from a global perspective. Beyond modifying the Convention to provide for a liability structure, several other steps need to be taken for efficient and effective preservation. These issues include (i) sufficient funding for the Convention, (ii) appropriate allocation of compensation to developing nations and (iii) appropriate forms of compensation.

A. Sufficient Funding for the Convention

For the Biodiversity Convention to be effective, the developed world must provide compensation to the developing world which is sufficient to incent those nations to meaningfully preserve biodiversity. Therefore, *total compensation* (via multilateral payments, transfers of intellectual property rights and private payments by biotechnology companies for access to and exploitation of biodiversity) *plus other benefits of habitat conservation* (like tourism, non-invasive harvesting, etc.),¹²³ *should be at least equal to the option cost of biodiversity from a developing nation perspective*, in those instances where (i) the option value of biodiversity does not exceed the option cost from a developing nation perspective and (ii) the option value of biodiversity from a global perspective is greater than the option cost from a developing nation perspective.¹²⁴ Clearly, there are problems

¹²² See Convention, *supra* note 2, art. 14, § 2, 31 I.L.M., at 828. Conceivably, this modification to the Convention could create liability on the part of developed nations like the United States which destroy biodiversity. However, under the proposed liability structure, damages would equal zero for nations like the United States which do not receive compensation under the Convention.

¹²³ Economists have estimated other values which result from the preservation of habitat. In one study, it was concluded that the present value of benefits associated with the sustainable harvest of fruit, latex and lumber from one acre of rain forest in Peru was equal to \$6,820. Peters, *supra* note 87, at 656. See also JOHN A. DIXON & PAUL B. SHERMAN, *ECONOMICS OF PROTECTED AREAS: A NEW LOOK AT BENEFITS AND COSTS* (1990).

¹²⁴ From an algebraic perspective, if OV(G) equals the option value from a global perspective, TC equals total compensation to a particular developing country, OB equals other benefits from habitat conservation to a particular developing country, OV(DN) equals the option value

of accurately calculating the various costs and benefits associated with the preservation of biodiversity from both a global and a local perspective. For example, it is very difficult to estimate the magnitude and timing of future biotechnology discoveries. While these problems are substantial in nature, they must be addressed if the Biodiversity Convention is to provide adequate incentives for the efficient preservation of biodiversity.

In AGENDA 21, the United Nations Conference on Economic Development (UNCED) estimates that the cost of implementing just the monitoring provisions of the Biodiversity Convention will exceed five billion dollars per annum during the period 1993-2001.¹²⁵ The cost of fully implementing the Convention - including the establishment of a multi-lateral fund and transfers of technology - has not yet been estimated, but could easily double UNCED's current cost estimate.¹²⁶

The parties to the Convention recently decided to utilize the Global Environment Facility (GEF) as a temporary funding mechanism for the Convention.¹²⁷ The GEF will not only finance projects aimed at protecting biodiversity, but will also support efforts to deal with climate change, pollution of international waters and ozone depletion.¹²⁸ For its first three years of operation, international donors have agreed to provide two billion dollars, of which the United States pledged four hundred and twenty million dollars.¹²⁹

To date, the United States Congress has allocated just ninety million dollars to the GEF.¹³⁰ As noted above, if the United States and

of biodiversity for a particular developing nation and $OC(DN)$ equals the option cost for a particular developing nation, then in those instances where (i) $OV(DN) \leq OC(DN)$ and (ii) $OV(G) \geq OC(DN)$, compensation should be given such that following equation, $OV(G) \geq TC + OB \geq OC(DN)$, is true.

¹²⁵ AGENDA 21 & THE UNCED PROCEEDINGS 430 (Nicholas A. Robinson et al. eds., 1992).

¹²⁶ See Gallin, *supra* note 82, at 299 (noting in his analysis of Article 21 & 22 of the Convention that "the cost of preserving biodiversity may be tens of billions of dollars"); Gerald Piel, *Agenda 21: Sustainable Development*, SCI. AM., Oct. 1992, at 128 (estimating that the cost of all of the Rio treaties may exceed six hundred billion dollars per annum, of which one hundred and twenty-five billion dollars will be supplied by developed countries).

¹²⁷ *Global Environmental Facility To Continue As 'Interim' Financing Source For Projects*, INT'L ENVTL. REP. (BNA), Dec. 14, 1994, at 1019.

¹²⁸ Nicholas Van Praag, *The Global Environmental Facility: Instrument Establishing - Introductory Note*, 33 I.L.M. 1273, 1273 (1994).

¹²⁹ *Id.* at 1274.

¹³⁰ Act of Aug. 23, 1994, Pub. L. No. 103-306, 108 Stat. 1608 (1994). This allocation does not include any amounts which might be required for the United States to protect its own biodiversity. Such amounts could be considerable, in light of what conceivably could be required to protect U.S. biodiversity. See Charles C. Mann and Mark L. Plummer, *The High Cost of Biodiversity*, 260 SCIENCE 1868 (June 25, 1993).

other developed nations fail to fully perform under the Convention, the developing world is excused from performance as well.¹³¹ Moreover, if the Convention is not properly funded, it is understandable that many developing nations may choose the benefit of economic development over the burden of preserving biodiversity. In summary, absent proper compensation, inefficient conservation of biodiversity from a global perspective will occur.

B. APPROPRIATE ALLOCATION OF COMPENSATION

Compensation under the multi-lateral fund contemplated in Article 21 should be allocated to developing nations based on biodiversity measures. The issue of how resources are to be allocated under the Convention has yet to be decided.¹³² For efficient preservation of biodiversity to occur, funding priority should go to those areas that (i) have the largest quantity of biodiversity, (ii) have highly unique forms of biodiversity and/or (iii) are facing the greatest development pressures. Developed nations must ensure that compensation is allocated via these or similar biodiversity measures and not by other, non-biodiversity measures such as population or land area.¹³³

C. APPROPRIATE FORMS OF COMPENSATION

In a world without transaction costs, the most efficient means of providing compensation for the preservation of biodiversity is through cash payments. By using cash, the costs of preserving biodiversity are clearly understood and the recipients are able to maximize their utility by choosing how to spend these payments.¹³⁴ The Biodiversity Convention, in addition to mandating monetary transfers to a multi-lateral fund, also calls for transfers of intellectual property rights relevant (i) to the conservation and sustainable use of biodiversity ("conservation technology") or (ii) to the use of genetic material ("genetic engineering technology") under Article 16.¹³⁵ There is an obvious efficiency justification for some conservation technology transfers, but there is

¹³¹ Convention, *supra* note 2, art. 20, § 4, 31 I.L.M., at 831.

¹³² See Convention, *supra* note 2, art. 21, § 2, 31 I.L.M., at 831.

¹³³ See WALTER V. REID ET. AL., BIODIVERSITY INDICATORS FOR POLICYMAKERS (1993) (proposing twenty-two indicators to help planners establish biodiversity priorities).

¹³⁴ See Posner, *supra* note 64, at 467-468 (discussing the utility or disutility of making unconditioned cash payments to welfare recipients).

¹³⁵ Convention, *supra* note 2, art. 16, §§ 1, 3, 31 I.L.M., at 829. "Conservation technologies" is a broad concept which may include anything from high-yielding seeds to energy co-generation facilities.

no apparent efficiency rationale for any genetic engineering technology transfers.

The efficiency justification for the transfer of conservation technologies is that significant transaction costs may exist in the dissemination of cash payments to those local actors who have the power to take actions which reduce the pressure to developed fragile habitats.¹³⁶ Transaction costs include (i) identifying local actors and (ii) monitoring whether compensation given to local actors goes toward measures that promote conservation. Given the large number of parties who could take conservation actions directly or indirectly, transactions costs may be extremely high.

A more efficient approach in situations where transaction costs are high may be to transfer conservation technologies to the developing world directly. By transferring these rights, the cost of conservation technologies to the local end user will be lower than before and as a result, more conservation technology will be demanded and more preservation will occur. To minimize negative incentive effects, however, appropriate payments from the multi-lateral fund should be made to the owners of transferred conservation technology.¹³⁷ Further, the transfer of conservation technology should only occur when (i) transaction costs in disbursing such technology are high and (ii) the net benefit of the transfer (after taking into account compensation to the technology's owner) is positive. It seems clear, however, that one way or another conservation technologies need to get into the hands of local users if the Convention's dual goals of economic development and biodiversity preservation are to be achieved.¹³⁸

In contrast to the transfer of certain types of conservation technology, there is no efficiency justification for the transfer of genetic engineering technology beyond perhaps encouraging "buy-in"¹³⁹ among developing nation elites (scientists, industrialists, etc.), who will benefit the most from these transfers. Significant transaction costs do not exist in providing access to genetic engineering technol-

¹³⁶ See POSNER, *supra* note 64, at 535-36 (contending that more pressure exists for the creation of "efficient" rules when transaction costs are high).

¹³⁷ This approach is consistent with Article 16, paragraph 2 of the Convention which calls for transfers of technology on "fair and most favourable terms. . . .consistent with adequate and effective protection of intellectual property rights [and]. . . . where necessary, in accordance with the financial mechanism established by Articles 20 and 21." Convention, *supra* note 2, art. 16, § 2, 31 I.L.M., at 829.

¹³⁸ See Alfred C. Aman, Jr., *The Earth as Eggshell Victim: A Global Perspective on Domestic Regulation*, 102 YALE L. J. 2107, 2121 (1993).

¹³⁹ "Buy-in" in this context means an enthusiasm for the Convention which leads to a greater compliance with its spirit and terms.

ogy, because there are not a large number of parties involved. Developing nation governments and corporations can negotiate directly with the technology owners for rights to use such technology if they wish.

The inclusion of Article 16, paragraph 3 (which calls for the transfer of genetic engineering technology) in the Convention disproportionately benefits the more economically advanced nations of the developing world, such as Brazil, which have the infrastructure to make use of these transfers.¹⁴⁰ The inclusion of this requirement reflects the continuing role of dependency theory in the developing world, which continues to find adherents despite recent economic success stories (such as Chile) which have largely rejected this model in favor of a more free market approach.¹⁴¹ Dependency theorists believe (i) that the third world's development has been characterized by the export of raw materials to the industrialized world for processing, (ii) that this economic relationship has perpetuated the unequal income distributions and the overall levels of poverty which exist in the third world and (iii) that it is important to break this dependent relationship by doing more of the value-added processing in the third world.¹⁴² Provisions of the biodiversity treaty which require genetic engineering transfers to the third world are in line with traditional dependency thinking.

The United States should attempt to have Article 16, paragraph 3 stricken from the Convention because: (i) transfers of genetic engineering technology do not directly impact the preservation of biotechnology; (ii) it is not in the national interest to give up America's "first mover" advantages in this area;¹⁴³ (iii) developing nations can currently license this technology if they wish; and (iv) compensating own-

¹⁴⁰ The nations of the developing world are a heterogeneous group with widely differing levels of per capita income and industrialization. Some biodiversity-rich nations, like Brazil, are considered "newly industrializing" nations (per capita income equals \$5,000), while other nations like Zaire are considered "low-income" countries (per capita income equals \$500). CENTRAL INTELLIGENCE AGENCY, *THE WORLD FACTBOOK* 1994 57, 439.

¹⁴¹ The seminal work in the area of dependency theory is FERNANDO HENRIQUE CARDOSO & ENZO FALETTO, *DEPENDENCY AND DEVELOPMENT IN LATIN AMERICA* (Marjory M. Urquidí trans., 1979).

¹⁴² See Andre Frank, *Development of Underdevelopment*, in *PERSPECTIVES ON WORLD POLITICS* (Michael Smith et al. eds., 1981).

¹⁴³ ARTHUR A. THOMPSON, JR. & A.J. STRICKLAND III, *STRATEGY FORMULATION AND IMPLEMENTATION: TASKS OF THE GENERAL MANAGER* 122 (1992) (noting that a number of commercial advantages accrue to corporations (and nations) who are the first to enter into a line of business). In biotechnology, the United States has first mover advantages. Goldman, *supra* note 46, at 698.

ers of genetic engineering technology would divert funds away from the Convention's more important conservation initiatives.

XII. CONCLUSION

The political struggle within the United States over the Biodiversity Convention in part is the result of differing notions of economic efficiency and wealth maximization. Certain segments of the biotechnology industry argue that granting a property right in raw genetic material represents a tax on genetic research, which reduces the amount of research conducted and number of new drugs found. This short-term view is only economically optimal from the perspective of the biotechnology industry because, given (i) the millions of un-researched species in the world, (ii) the fact that the biotechnology industry can currently research only a small fraction of these species in any given year, and (iii) the long time horizon between the research and commercialization of new drugs, the loss of even half of the world's biodiversity probably would not financially affect these companies greatly.

In contrast, natural resource economists believe that the lack of a property right in genetic material results in the underpreservation of biodiversity and, hence, the non-optimal exploitation of this resource. Economists view the lack of property rights in raw genetic material as a "commons" problem, albeit a non-traditional one. By granting a sovereign property right, the benefit of preserving biodiversity is internalized within developing nations (who are already bearing the full cost of preservation) and, as a result, more biodiversity is preserved and the net value of biodiversity, from a global, Kaldor-Hicks perspective, is enhanced.

Granting a sovereign right in genetic material, coupled with appropriately structured multi-lateral compensation, can maximize the value of biodiversity from a global perspective. Absent compensation and in spite of having internationally-recognized property rights, some nations may still not find it in their financial interest to preserve biodiversity given the grave financial and demographic pressures which they face. To these nations, the option value of biodiversity may be negative (or, put differently, the opportunity cost of preserving biodiversity may exceed the benefit of preservation). However, from a global, more long-term perspective, the option value of biodiversity may be positive and, thus, global subsidies to developing countries via the compensation structure of the Convention may be efficient.

By offering multi-lateral compensation to the developing world in exchange for the preservation of biodiversity, the Biodiversity Convention creates the outline of an international public trust between the developing countries as trustees and the international community as beneficiaries. Significant *indicia* of a public trust exist, including: a definable purpose, enforceability on subsequent owners of trust property, restrictions on use of trust corpus, etc. In addition, two of the three requirements for the effective use of a public trust doctrine, as noted by Professor Sax, - a legal right in the general public and the ability to interpret the trust in a manner consistent with contemporary concerns for environmental quality - are met.¹⁴⁴ Only an enforcement mechanism (against developing country trustees which fail to carry out their duties) is currently missing from the Convention and this omission seriously undermines the otherwise binding language of the Convention.

To remedy this omission and to create the basis for an effective international public trust, the United States (prior to ratification) must ensure that there is a "reciprocity of responsibility" between developed and developing countries under the Convention. Currently, under the Biodiversity Convention, the duty of developing countries to preserve biodiversity is contingent on developed countries providing "sufficient" compensation and such duty is subordinated to each nation's so-called "right to development."¹⁴⁵ For the Convention to work, however, liability rules must be created for developing nations which receive appropriate compensation but which do not appropriately preserve biodiversity and the so-called "right to development" must be limited in its scope. If an effective liability structure is not put in place and if the "right to development" is not limited, then (i) compensation under the Biodiversity Convention will represent little more than penalty payments by developed nations for past economic development and (ii) conservation in developing countries will remain purely voluntary.¹⁴⁶

In an ideal world, total compensation to each developing country plus other benefits of habitat conservation should be at least equal to the option cost of biodiversity from a developing nation perspective in

¹⁴⁴ Sax, *supra* note 89, at 474.

¹⁴⁵ Convention, *supra* note 2, art. 20, § 4, 31 I.L.M., at 831.

¹⁴⁶ See Jason M. Patlis, Note, *The Multilateral Fund of the Montreal Protocol: A Prototype for Financial Mechanisms in Protecting the Global Environment*, 25 CORNELL INT'L L.J. 181, 229 (1992) (arguing that developed countries benefitted from artificially low costs of development because of environmental externalities and thus should be required to make payments to developing countries to compensate them for the cost of maintaining the world's environment).

those instances where preservation would not otherwise occur and where the value of preservation to the global community is significant. Dispersing *appropriate* levels of compensation to developing nations will be difficult, as issues of compensation magnitude, timing and allocation must be addressed.¹⁴⁷ However, a rigorous analysis of these and other issues must be made if conservation efforts under the Biodiversity Convention are to be more than just a "shot in the dark."¹⁴⁸

Several steps should be taken by the Clinton Administration to enhance the efficacy and efficiency of compensation under the Convention. First, multi-lateral funds should be allocated to developing countries using biodiversity measures (such the amount and/or diversity of species in a nation) rather than typical aid measures like population or geographic size. Second, a list of conservation-related technologies needs to be developed. In order to balance the efficient preservation of biodiversity with the protection of intellectual property rights and in light of financial constraints, only conservation technologies which (i) *face* significant transaction costs in their disbursement to developing country users and (ii) *provide* a net positive benefit for the preservation of biodiversity (after reimbursing the owners of these technologies) should be transferred. Third, in order to maintain incentives for the development of conservation-related technologies, the multi-lateral fund should make payments to the owners of those technologies which are transferred to the developing world. Finally, Article 16, paragraph 3 should be stricken from the Convention, as mandatory transfers of genetic-engineering technology do not meaningfully foster the efficient conservation of biodiversity or further U.S. interests. As well, genetic-engineering technology transfers would siphon limited resources away from other important conservation initiatives and would be unfair to those corporations which enjoy first mover advantages in the biotechnology industry.

In closing, many aspects of the Biodiversity Convention (and in particular, the grant of a sovereign property right in unmodified genetic material) further the goal of efficiently preserving biodiversity. However, as this Comment has endeavored to show, absent (i) a strong financial commitment by the developed world, (ii) certain clarifications related to the Convention's implementation and (iii) the establishment of an effective liability structure to properly balance the

¹⁴⁷ See discussion *infra* part XI.

¹⁴⁸ See Barton, *supra* note 13, at 775 (noting that the United Nations Economic Commission for Latin America has already called for the pricing of biodiversity).

costs of development against conservation, the Biodiversity Convention could easily founder.