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The Interface between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology

by

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THE INTERFACE BETWEEN INTERNATIONAL INTELLECTUAL PROPERTY AND ENVIRONMENTAL PROTECTION: BIODIVERSITY AND BIOTECHNOLOGY

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In industrialized and developing countries alike, the interface between international intellectual property and environmental protection is widely perceived as one of fundamental conflict. To many, two recently adopted international conventions, one designed to strengthen international intellectual property protection and the other to promote international biodiversity protection, appear to promote two profoundly conflicting visions for the future of "this fragile earth, our island home."[1]

The Trade-Related Aspects of Intellectual Property Rights ("TRIPS") Agreement, part of the Final Act of the Uruguay Round of Multilateral Trade Negotiations,[2] concluded on December 15, 1993. It seeks to strengthen international intellectual property protection in order to promote world trade. TRIPS also seeks to stimulate rapid international economic development that will likely produce a virtual technological transformation of human society—and perhaps much of the natural world. In contrast, the United Nations Framework Convention on Biological Diversity ("Biodiversity Treaty"),[3] concluded on June 5, 1992, in Rio de Janeiro, Brazil, seeks to preserve the natural world and maintain society's traditional, essentially agrarian, relationship to it. It also seeks to promote the concept of sustainable development.

The debate over TRIPS and the Biodiversity Treaty has exposed a series of fault lines dividing technology-rich industrialized countries located in the temperate zone of the Northern Hemisphere, and the biodiversity-rich developing countries located primarily in the tropics and Southern Hemisphere. Part I of this Article will describe two of the most visible North-South conflicts, and Part II will examine the treaty provisions that have given rise to these conflicts. Part III will examine the two specific issues that are at

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1. THE BOOK OF COMMON PRAYER 370 (1977).

2. Agreement on Trade-Related Aspects of Intellectual Property Rights, Including Trade in Counterfeit Goods, Dec. 15, 1993, 33 I.L.M. 81 (1994) [hereinafter TRIPS Agreement].

3. United Nations Convention on Biological Diversity, June 5, 1992, S. TREATY DOC. NO. 103-20 (1993) [hereinafter Biodiversity Treaty].

the root of these North-South conflicts, and will conclude with a more cooperative vision of the interface between international intellectual property and environmental protection.

I. THE NORTH-SOUTH CONFLICT OVER INTELLECTUAL PROPERTY AND ENVIRONMENTAL PROTECTION

A. Objections by the United States to the Biodiversity Treaty

Shortly before the United Nations Conference on Environment and Development in Rio de Janeiro (the "Earth Summit"), then President George Bush announced that the United States would not sign the Biodiversity Treaty in part because the convention would impair American intellectual property rights. The State Department released a contemporaneous statement that complained that the draft created during negotiations held by the United Nations Environment Program in Nairobi, Kenya, was seriously flawed in a number of respects. Specifically, it focused on intellectual property rights "as a constraint to the transfer of technology rather than as a prerequisite."[4] According to a representative of the U.S. Patent and Trademark Office who participated in the negotiations at Nairobi, the United States was "basically steamrolled" in those negotiations.[5] The resulting Biodiversity Treaty as offered in Rio de Janeiro presented a serious risk of interfering with intellectual property principles that the United States sought to promote in the TRIPS component of the ongoing Uruguay Round of GATT negotiations.[6]

Although the Clinton administration eventually did sign the Biodiversity Treaty on June 4, 1993,[7] it did so only after a number of U.S. pharmaceutical and biotechnology firms and organizations that were previously opposed to the Biodiversity Treaty changed their position. These companies feared that continued opposition to the treaty might simply exclude U.S. companies from opportunities to explore genetic resources in developing countries, and exclude the United States from future negotiations to interpret the exact meaning of the treaty. Accordingly, these organizations joined a business-environmental coalition urging President Clinton to sign the Biodiversity

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4. Convention on Biological Diversity, *in* 3 U.S. DEP'T ST. DISPATCH 423 (1992).

5. *See Treaties: PTO, Biotech Group Explain Objections to Earth Summit's Biodiversity Treaty*, 44 Pat. Trademark & Copyright J. (BNA) 120 (June 11, 1992).

6. For a discussion of the larger question of the interface between international trade and environmental protection, see Robert Housman & Durwood Zaelke, *Trade, Environment, and Sustainable Development: A Primer*, 15 HASTINGS INT'L & COMP. L. REV. 535 (1992).

7. *See Public Supports U.S. Signature of Biodiversity Treaty at United Nations Today; Study Says 78 Percent Support President's Action*, U.S. NEWSWIRE, June 4, 1993, *available in* 1993 WL 7130279.

Treaty and issue a simultaneous interpretive statement making it clear that the United States construes key sections of the treaty in a way that protects intellectual property rights.[8] When the United States signed the treaty, the Clinton administration issued a statement promising to address intellectual property issues in a forthcoming interpretive document.[9] The White House eventually stated that proposed legislation for ratification of the treaty would spell out the administration's interpretation of the treaty, reflecting the major concerns about the need to protect intellectual property rights.[10] After this statement, the Biodiversity Treaty essentially dropped off the U.S. political and legislative radar screen. Congress has not ratified the treaty, nor has the Clinton Administration put the treaty forward.

B. Objections in India to the TRIPS Agreement

A few months after the U.S. policy reversal on the Biodiversity Treaty, and just as the long-stalled Uruguay Round of GATT negotiations was finally concluded, the developing world reacted to the U.S. efforts to strengthen international intellectual property protection throughout the Uruguay Round. In India the reaction was so vehement that not even an earthquake that had rocked the center of the country in October, 1993, "prevented half a million farmers from turning out in the central Indian city of Bangalore, to protest against the patenting of agricultural products."[11] The Karnataka State Farmers Association, headed by a charismatic scholar-activist, M. D. Nanjundaswamy, organized the protest. The Association said that the farmers were "demonstrating for collective, not individual control over seeds and plants," and specifically targeted the U.S.-based chemical company, W.R. Grace, as the focus of their protest.[12]

The immediate source of the Indian farmers' complaint with W.R. Grace was the medicinal neem tree of India, referred to as "the village pharmacy." Some environmentalists, accusing W.R. Grace of "gene piracy," offered the

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8. *See, e.g., Genentech Joins Coalition in Favor of Biodiversity Treaty*, BUS. WIRE, Apr. 15, 1993; *Biodiversity Industry Wants U.S. to Sign Treaty by Deadline Even if Statement Unfinished*, 16 Int'l Env't Rep. (BNA) 416 (June 1, 1993).

9. *See As it Signs Rio Treaty, United States Calls for Global Patent Protection for Biotech*, Int'l Trade Rep. (BNA) 961 (June 9, 1993). The plan on the part of the United States and the European Community to issue an interpretive statement unleashed a storm of protest. *See, e.g., Environment: Biodiversity Pact Change "Threatens Ecology"* INTER PRESS SERVICE GLOBAL INFO. NETWORK, July 16, 1993, *available in* 1993 WL 2538431.

10. *See White House to Submit Biodiversity Bill to Congress*, REUTERS TEXTLINE, Oct. 27, 1993, *available in* LEXIS, World Library, Txtlne File.

11. John Tanner, *India: U.S. Giant, Peasants Battle for "Blessed Tree"*, INTER PRESS SERVICE GLOBAL INFO. NETWORK, Oct. 12, 1993, *available in* 1993 WL 2534808.

12. *See id.*

neem tree as merely the latest "example of how the developing world [could] end up paying for the preservation of world biodiversity and yet be robbed of the chance [to] economically [benefit from it]."[13]

Known to Hindus as "the curer of all ailments" and to Muslims as "the blessed tree," the fast-growing evergreen tree, a botanical cousin of mahogany, provides bark, flowers, and seeds used in traditional medicines. Twigs from the neem tree are used by Indian peasants as antiseptic toothbrushes, and oil is used in India as a natural insecticide, a contraceptive, and in soap. Neem timber is resistant to termites. A 1992 report issued by the National Research Council in the United States describes how neem could function as "a tree for solving global problems."[14]

A chemical called "azadirachtin," a natural insect repellant contained in the seeds of the neem tree, is attracting the particular interest of international chemical companies such as W.R. Grace, as well as scientific institutes in India. W.R. Grace currently holds U.S. patents on a process for extracting the chemical in the form of a stable emulsion or solution. Furthermore, it has entered into a joint venture with an Indian company involving a plant in Karnataka that processes neem seeds. In India, farmers simply smash the seeds, soak them in water overnight, skim the emulsion off the top, and throw it on their crops.[15] The process used by W.R. Grace gives the emulsion a shelf-life and enables it to be transported to remote areas inhospitable to the neem tree itself.[16]

One concern of environmentalists is that W.R. Grace is building upon the traditional knowledge of Indian farmers and not rewarding that knowledge in any way. "'Without the Indian peasants knowledge of the medicinal and pesticidal properties of [the tree], neem would just be another tree to Grace,' Vandana Shiva, director of the Research Foundation for Science and Ecology in New Delhi, was quoted as saying."[17] Another major concern is that, although current Indian law does not allow patenting of agricultural products, the TRIPS agreement obliges signatories to provide protection for plant varieties through the use of patents or an effective *sui generis* system of protection. Environmentalists fear that the TRIPS agreement will eventually take the control of neem seeds away from community groups and give it to large corporations. "'Once a company starts developing a product like this the supply becomes more restricted,'" said Nicholas Hildyard of the *British*

13. *Id.*
14. NATIONAL RESEARCH COUNCIL, NEEM: A TREE FOR SOLVING GLOBAL PROBLEMS (1992).
15. *See* Tanner, *supra* note 11.
16. *See id.*
17. *Id.*

Ecologist magazine.[18]

The demonstrations over the neem tree and W.R. Grace proved to be but a part of a wider, progressively violent, round of anti-GATT protests in India. In 1993, after ransacking the Bangalore offices of U.S.-based Cargill Company, members of the Karnataka State Farmers' Association reportedly demolished part of a multi million dollar seed processing plant owned by Cargill in the Karnataka town of Bellary. Immediately after the adoption of the Marrachech Treaty in the Spring of 1994, scores of anti-GATT activists reportedly ransacked and burned a subsidiary of the U.S. multinational Union Carbide in Bangalore, to protest the new world trade order.[19] Charges of arson were believed to have been filed against fifteen members of the farmers organization. The Association's founder, M. D. Nanjundaswamy, was quoted as saying that the attack on Union Carbide was aimed at "physically destablishing multinational companies" in India, and analogized his movement to the one launched by Mahatma Gandhi against foreign clothes during India's struggle for independence.[20]

Unlike the controversy over the Biodiversity Treaty in the United States, the uproar over W.R. Grace's neem patent, and "gene piracy" in general, is far from subsiding. In 1996, for example, a number of environmental activists and international environmental groups filed petitions with the U.S. Patent and Trademark Office and European Patent Office, seeking to invalidate the W.R. Grace patent, claiming that its novelty "exists mainly in the context of the ignorance of the West."[21] At the same time, international environmentalists have issued insistent calls for the recognition and development of traditional resource rights for indigenous peoples and local groups.[22]

In order to evaluate the concerns of international environmentalists, Indian farmers, and those of the United States over the interface between international intellectual property and environmental protection, it is first necessary to examine in some detail the specific provisions of the Biodiversity Treaty and the TRIPS Agreement that have given rise to the North-South controversy.

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18. *Id.*

19. *See Anti-GATT Activists Ransack Union Carbide Office*, AGENCE FRANCE PRESSE, Apr. 16, 1994, *available in* 1994 WL 9531059 (reporting the earlier attack on Cargill, as well as the more recent attack on Union Carbide).

20. *Id.*

21. *See generally* Shayana Kadidal, *Subject-Matter Imperialism? Biodiversity, Foreign Prior Art and the Neem Patent Controversy*, 37 IDEA 371, 375 (1997).

22. *See, e.g., infra* note 79 and accompanying text.

II. THE BIODIVERSITY TREATY AND THE TRIPS AGREEMENT

A. The Biodiversity Treaty

The United Nations Convention on Biological Diversity is but one of a matched pair of conventions that were opened for signature at the Earth Summit. The companion Framework Convention on Climate Change requires countries (primarily those in the industrialized world) to limit net emissions of greenhouse gases and facilitate transfer of environmental technology to the developing world. The Biodiversity Treaty, in turn, obligates countries (primarily those in the developing world) to conserve, sustainably use, and guarantee access to genetic resources, in return for a fair and equitable sharing of benefits arising out of the utilization of those resources.[23]

Article 1 of the Biodiversity Treaty states that its three objectives are (1) the conservation of biological diversity, (2) the sustainable use of its components, and (3) the fair and equitable sharing of the benefits arising out of the utilization of genetic resources through such means as (a) appropriate access to genetic resources, (b) appropriate transfer of relevant technologies, and (c) appropriate funding.[24] Article 3 states as a general principle that States have a "sovereign right to exploit their own resources pursuant to their own environmental policies, and a responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."[25]

Articles 4 and 5 specify the jurisdictional scope of the Convention and obligate parties to the Convention to cooperate in the conservation and sustainable use of biological diversity. Articles 6 through 14 set forth various measures for promoting the conservation and sustainable use of biodiversity, the first and second objectives of the Convention. Articles 15 through 21, in turn, address the three essential components needed to assure the fair and equitable sharing of benefits arising out of the utilization of genetic resources, the third and final objective of the Convention.[26]

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23. For a general discussion of the limited accomplishments of the Earth Summit and the difficulties encountered there, see Sir Geoffrey Palmer, *The Earth Summit: What Went Wrong at Rio?*, 70 WASH. U. L.Q. 1005 (1992). For an analysis and the complete text of the Biodiversity Treaty, see Michael Gollin, *The Convention on Biological Diversity and Intellectual Property Rights*, *in* BIODIVERSITY PROSPECTING: USING GENETIC RESOURCES FOR SUSTAINABLE DEVELOPMENT, 289-302 (1993).

24. *See* Biodiversity Treaty, *supra* note 3, at art. 1.

25. *Id.* at art. 3.

26. *See id.* at art. 15-21.

Specifically, Article 15 requires parties to the Convention "to facilitate access to genetic resources for environmentally sound uses."[27] Together with the measures contained in Articles 6 through 14 providing access to genetic resources is the primary obligation of biodiversity-rich, technology-poor parties to the Convention.[28]

In return, Article 16 spells out the obligation to provide and/or facilitate access to, and transfer of, technologies that are either relevant to the conservation and sustainable use of biological diversity, or make use of genetic resources.[29] Articles 17 through 19 obligate parties to facilitate the exchange of information, promote technical and scientific cooperation, and provide for the handling of biotechnology and distribution of its benefits.[30] Articles 20 and 21 require parties to provide financial support and incentives for activities intended to achieve the objectives of the Convention.[31] Together, Articles 16 through 21 spell out the obligations of technology-rich/biodiversity-poor parties to the Convention. The remaining articles of the Convention deal with various other housekeeping matters concerning the implementation of the Convention.[32]

Article 16 is the article most explicitly concerned with the interface between intellectual property and environmental protection. It details what constitutes appropriate access to, and transfer of, technology in five paragraphs. Article 16(1) states that both access to and transfer of technology, including biotechnology, among the parties to the Convention are essential elements for the attainment of the objectives of the Convention. It further directs that the parties to the Convention undertake to provide and/or facilitate access for or transfer of technologies that (a) are relevant to the conservation and sustainable use of biological diversity or (b) make use of genetic resources and do not cause significant damage to the environment.[33]

Article 16(2) specifies that:

> access to and transfer of technology . . . to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed, and, where necessary, in accordance with the financial

27. *Id.* at art. 15.
28. *See id.* at art. 6-14.
29. *See id.* at art. 16.
30. *See id.* at art. 17-19.
31. *See id.* at art. 20-21.
32. *See id.* at art. 22-42 and Annex. I & II.
33. *See id.* at art. 16.

> mechanism established by Articles 20 and 21. In the case of technology subject to patents and other intellectual property rights, [however, Article 16(2) specifies that] such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights[, but goes on to state that t]he application of this paragraph [is to] be consistent with [the remaining three paragraphs of Article 16.][34]

Article 16(3) requires:

> each contracting party [to] take legislative, administrative or [other policy] measures . . . with the aim that [those] parties, in particular those that are developing countries, which provide genetic resources are[, in turn,] provided access to and transfer of technology which makes use of those resources, on mutually agreed terms, including technology protected by patents and other intellectual property rights.[35]

The paragraph goes on to state, however, that such measures must be in accordance with international law and consistent with the remaining two paragraphs of Article 16.[36]

Article 16(4) requires each party to take measures with the aim that the private sector, as well as the government parties themselves, both (a) facilitate access to and/or joint development and transfer of technology referred to in Article 16(1) for the benefit of both governmental institutions and the private sector of developing countries, and (b) abide by the obligations included in the first three paragraphs of Article 16.[37]

Finally, Article 16(5) states that parties to the Convention, "recognizing that patents and other intellectual property rights may have an influence on the implementation of [the] Convention, 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 [the] objectives" of the Convention.[38]

The United States was concerned, primarily because of the language of Article 16, that the Convention focused on intellectual property rights "as a constraint to the transfer of technology rather than as a prerequisite."[39] The

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34. *Id.* at art. 16(2).
35. *Id.* at art. 16(3).
36. *See id.* at art. 16(3).
37. *See id.* at art. 16(4).
38. *Id.* at art. 16(5).
39. *See supra* note 4 and accompanying text.

U.S. biotechnology industry voiced a two-fold objection to the Convention, alleging that it (1) provides a basis for the parties, particularly developing countries, to reduce intellectual property protection, and (2) opens the door to compulsory licensing arrangements by them that go against established norms.[40]

However, in retrospect—particularly in light of the eventual successful conclusion of the Uruguay Round of GATT negotiations—it appears that those supporters of the Biodiversity Treaty who accused the United States of "reading demons" into the text[41] were correct. As a leading U.S. commentator on the Biodiversity Treaty has noted, "any country that interprets Article 16 as requiring involuntary transfer of technology must be prepared for the counter-argument that the similar language in Article 15 requires involuntary transfer of genetic resources, a result no source country would happily accept."[42]

This commentator points out that the access to genetic resources required by Article 15, as well as any transfers pursuant to paragraphs two, three, and four of Article 16 on any terms beyond those that are "fair and most favourable" (i.e. commercially reasonable and non-discriminatory), are all to be carried out as "mutually agreed" or "on mutually agreed terms."[43] Article 16(2), for example, calls for transfers of technology on concessional and preferential terms only "where mutually agreed," and further states that in the case of technology subject to patents and other intellectual property rights, access and transfers must be "consistent with the adequate and effective protection of intellectual property rights."[44]

Similarly, Article 16(3) specifies that the access to and transfer of, technologies that use genetic resources to countries that provide those genetic resources must be carried out "on mutually agreed terms."[45] Although such technologies are to include those "protected by patents and other intellectual property rights," access to and transfers of such technologies are to be carried out "in accordance with international law" as well as in a manner consistent with paragraphs 4 and 5.[46] Article 16(4), in turn, qualifies the obligation to

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40. *See Objections to Earth Summit's Biodiversity Treaty*, *supra* note 5.

41. *See* Rebecca L. Margulies, *Protecting Biodiversity: Recognizing International Intellectual Property Rights in Plant Genetic Resources*, 14 MICH. J. INT'L L. 322, 337 (1993) (quoting Dianne Dumanoski & John Mashek, *U.S. is Isolated in Opposing Biodiversity Treaty*, BOSTON GLOBE, June 6, 1992, at 4).

42. Gollin, *supra* note 23, at 295.

43. *Id.* at 296-97.

44. Biodiversity Treaty, *supra* note 3, at art. 16(2).

45. *Id.* at art. 16(3).

46. *Id.*

"take . . . measures, as appropriate, with the aim that the private sector facilitates access to, joint development and transfer of technology,"[47] by stating that in this regard parties to the Convention are to abide by the obligations contained in paragraphs one, two, and three—including, presumably, all of the qualifications contained in those paragraphs, such as the requirement that transfers be on "fair and most favourable" or otherwise "mutually agreed" terms.

Finally, with respect to Article 16(5), the negotiating history shows that the paragraph was merely adopted as a compromise between the two extreme views: one, that intellectual property rights are essential for technology transfer, and two, that they should be ignored.[48] Thus, the paragraph is said to represent an agreement to disagree for the time being on whether particular intellectual property rights should be strengthened or weakened. The unresolved issue was arguably deferred until, and eventually resolved by, the successful conclusion of the Uruguay Round of GATT negotiations.[49]

As we have seen, some U.S. opponents of the Biodiversity Treaty complained that the treaty provided a basis for developing countries to reduce intellectual property protection and opened the door to compulsory licensing arrangements by them that go against established norms.[50] Yet they ignored the fact that the only established international norm governing compulsory licensing prior to the adoption of the TRIPS agreement in 1993—namely Article 5(2) of the Paris Convention—had itself opened the door to compulsory licensing arrangements.[51] Even in the United States, patents and copyrights are subject to various compulsory licensing provisions. The Copyright Act of 1976, for example, contains no less than four separate compulsory licensing provisions, one of which was added by amendment of the Act as recently as 1988.[52] A specific example of

47. *Id.* at art. 16(4).

48. *See* Gollin, *supra* note 23, at 295.

49. *See id.*

50. *See supra* notes 5, 40, and accompanying text.

51. Article 5(2) of the Paris Convention states that "Each country of the Union shall have the right to take legislative measures providing for the grant of compulsory licenses to prevent the abuses which might result from the exercise of the exclusive rights conferred by the patent, for example, failure to work." *See* Paris Convention for the Protection of Industrial Property, opened for signature Mar. 20, 1883, last revised at Stockholm, July 14, 1967, 21 U.S.T. 1583, 828 U.N.T.S. 305 [hereinafter Paris Convention]. The TRIPS Agreement, by contrast, effectively eliminates the ability of member countries to prescribe compulsory licensing for the mere failure to work a patent locally. *See infra* note 59 and accompanying text.

52. *See* 17 U.S.C. §§ 111(d), 115, 116, 119(b) (1988). These statutes discuss secondary transmissions by cable systems, phonorecords of nondramatic musical works, coin-operated phonorecord players, and statutory licensing for secondary transmissions by satellite carriers for private home viewing.

environmental compulsory licensing can be found in section 308 of the Clean Air Act, which provides for compulsory licensing of patents upon certification by the Attorney-General that (1) use of the patent is necessary to meet emission standards set by other provisions of the Act; (2) the patent is not otherwise available to potential licensees; (3) no reasonable alternative means of achieving these reduced levels exist; and (4) to deny such licensing would promote a lessening of competition.[53] Finally, the Plant Variety Protection Act empowers the government to compel a plant breeder to license a novel plant variety to others at a "reasonable royalty," if "necessary to ensure an adequate supply of fiber, food, or feed . . . [when] the owner is unwilling or unable to supply the public needs for the variety at a price which may reasonably be deemed fair."[54]

Until the adoption of the TRIPS Agreement, not only were there few established international norms for compulsory licensing of intellectual property, there were also virtually no established international norms delineating what constituted adequate and effective protection of intellectual property rights. The 1883 Paris Convention for the Protection of Industrial Property (i.e., patents and trademarks) and the 1952 Universal Copyright Convention are more important for having established the principle of non-discriminatory treatment of foreign nationals with respect to whatever intellectual property protection a member country chooses to provide, than for having established any particular minimum standards for the protection of intellectual property. Indeed, it was the very absence of existing international norms for adequate and effective patent protection that led the United States to insist that convention parties consider this topic during the Uruguay Round of GATT negotiations.[55]

Conversely, now that the Uruguay Round of GATT negotiations has successfully concluded, the TRIPS Agreement arguably establishes precisely the kind of international minimum standards for adequate and effective intellectual property protection, including standards for the compulsory licensing of patented technology,[56] that the United States was so concerned about during the debates over the Biodiversity Treaty. Accordingly, we must now turn to an examination of those provisions of the TRIPS Agreement.

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53. *See* 42 U.S.C. § 1857f-1 (1970).

54. 7 U.S.C. § 2404 (1988). For a more detailed discussion of plant variety protection in the United States, see *infra* text following note 95.

55. *See, e.g.*, Richard A. Morford, *Intellectual Property Protection: A United States Priority*, 19 GA. J. INT'L & COMP. L. 336, 339-40 (1989).

56. *See* TRIPS Agreement, *supra* note 2, art. 31.

B. The TRIPS Agreement

TRIPS Agreement sets forth specific standards concerning the availability, scope and use of intellectual property rights.[57] It includes articles detailing what constitutes adequate patent and trade secret protection.

For example, Article 27(1) of the TRIPS Agreement states that, subject to various qualifying provisions contained in Article 27(2) and (3), "patents [are to] be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application."[58] Article 27(1) also emphasizes that "patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced."[59]

Article 27(2) states that

> members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by domestic law.[60]

Article 27(3) states that

> members may also exclude from patentability (a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals, and (b) plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by

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57. *See generally* Jerome H. Reichman, *The TRIPS Component of the GATT's Uruguay Round: Competitive Prospects for Intellectual Property Owners in an Integrated World Market*, 4 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 171 (1993).

58. TRIPS Agreement, *supra* note 2, at art. 27(1).

59. By forbidding discrimination on the basis of whether products are imported or locally produced, Article 27(1) of the TRIPS Agreement effectively supercedes Article 5 A.(2) of the Paris Convention for the Protection of Industrial Property, which grants member countries of the Paris Union "the right to take legislative measures providing for the grant of compulsory licenses to prevent the abuses which might result from the exercise of the exclusive rights conferred by the patent, for example, failure to work." Paris Convention, *supra* note 51, at art. 5A.(2). Although this article of the Paris Convention appears to recognize the failure to work a patent locally as a valid instance of patent misuse, Article 27 (1) specifically prevents WTO member countries from adopting such legislation. The TRIPS Agreement also places significant restraints on compulsory licensing legislation generally. *See infra* notes 64-65 and accompanying text.

60. TRIPS Agreement, *supra* note 2, at art. 27(2).

> patents or by an effective *sui generis* system or by any combination thereof.[61]

This latter proviso in Article 27(3) was the principle target of the protests by the Karnataka State Farmers Association in India.[62]

Article 28 includes among the exclusive rights that a patent shall confer upon its owner the right to assign (i.e. transfer) the patent and to conclude licensing contracts. Article 30 states that "members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties."[63] Article 31 states that, "where the law of a member [country] allows for other use of the subject matter of a patent without the authorization of the right holder, including use by the government or third parties authorized by the government"[64] (i.e., compulsory licensing), twelve detailed and burdensome standards must be met. These standards are at least as demanding as the standards set forth in the U.S. Clean Air Act for the compulsory licensing of air pollution technology.[65]

In addition to the articles obligating members to provide adequate and effective patent protection and limiting the circumstances in which compulsory licensing of patented technology can be authorized, Article 39 of the TRIPS Agreement requires members to protect undisclosed information (i.e., trade secrets), and data submitted to governments or government agencies, in essentially the same manner that such information and data is currently protected in the United States.[66] Information must be protected if it (1) is secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among or readily

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61. *Id.* at art. 27(3).

62. *See supra* notes 11-12, 18 and accompanying text.

63. TRIPS Agreement, *supra* note 2, at art. 30.

64. *Id.* at art. 31.

65. For a summary of the provisions contained in the Clean Air Act, see *supra* note 53 and accompanying text. For a discussion of the most important requirements contained in Article 31, see *infra* text accompanying and following notes 109-10.

66. Article 39 specifies that natural and legal persons shall have the possibility of preventing information lawfully within their control from being disclosed to, acquired by, or used by others with their consent in a manner contrary to honest commercial practices. *See* TRIPS Agreement, *supra* note 2, at art. 39. A note accompanying Article 39 states that for purposes of this provision, "a manner contrary to honest commercial practices" shall mean at least practices such as breach of contract, breach of confidence and inducement to breach, and includes the acquisition of undisclosed information by third parties who knew, or were grossly negligent in failing to know, that such practices were involved in the aquisition. *Id.*

accessible to persons within the circles that normally deal with the kind of information in question, (2) has commercial value because it is secret, and (3) has been subject to reasonable steps under the circumstances by the person lawfully in control of the information, to keep it secret.

Article 39, together with obligations contained in Articles 27 through 31, arguably meet the concerns expressed by the United States during the debates over the Biodiversity Treaty. The only remaining question is whether the concerns expressed by developing countries during and after the Uruguay Round of GATT negotiations have also been met.

As the demonstrations by the Karnataka State Farmers Association in India illustrate, developing countries have essentially two complaints about efforts on the part of the industrialized world to strengthen international intellectual property protection. The first stems from the perception that, while raw genetic resources from wild and domesticated tropical ecosystems of developing countries, and traditional knowledge of peoples indigenous to those ecosystems, are being transferred freely to developed nations, the commercially valuable substances and technology derived from these resources by developed countries, as well as the environmental technology developed by these same countries, are prohibitively expensive because of the intellectual property protection afforded them. The developing world views the industrialized world as freely engaging in gene piracy and appropriating traditional knowledge of indigenous peoples, while simultaneously demanding that developing countries cease pirating the industrialized world's intellectual property, at least some of which may be based on the very genes and traditional knowledge that the industrialized world itself has pirated.[67]

A second and more fundamental complaint of developing countries is that the very premises of intellectual property protection are weighted in favor of technological innovation that has come to characterize the industrialized world, and against farmers in developing countries who have contributed for generations to the preservation of species and to the improvement of them through an incremental, informal, and highly collective form of agricultural innovation that has contributed to genetic diversity, and yet is currently threatened by genetically engineered monocultures that tend to erode genetic diversity. Traditional agricultural innovation, like traditional knowledge of

67. As bandied about in the complaints of the North and South alike, the term "piracy" is a loaded, and potentially misleading, term, as it implies the existence of an established rule of international law, somewhat analogous to the prohibition against piracy on the high seas. In fact, until the promulgation of the Biodiversity Treaty and the TRIPS Agreement, no such international norm existed with regard either to intellectual property or gene piracy.

indigenous forest dwellers, does not fit comfortably into the fundamental conceptions and requirements of intellectual property rights, which have traditionally protected individual human innovations (as opposed to the mere discovery or collective manipulation of naturally occuring phenomena) and conditioned protection on such criteria as inventiveness, or at least novelty, uniformity, and stability. Indeed, traditional agricultural innovation may be threatened, along with the very biodiversity that it has helped maintain, by a system of intellectual property protection that tends to reward the development of new and genetically improved, but highly uniform, and therefore potentially vulnerable, monocultures.

In response to both of these concerns, Article 16(5) of the Biodiversity Treaty recognized "that patents and other intellectual property rights may have an influence on the implementation of this Convention," and obligated parties to the Convention to "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."[68] As we have seen, however, this provision amounts to little more than an agreement to disagree for the time being over the precise nature of the interface between international intellectual property and environmental protection.[69]

Thus, the two specific legal issues concerning the interface between international intellectual property and environmental protection appear to be whether the other paragraphs of Article 16 of the Biodiversity Treaty adequately speak to the first concern of developing countries that intellectual property rights be made to support the objective of promoting the fair and equitable sharing of the benefits arising out of the utilization of genetic resources; and whether and to what extent the effort in the TRIPS Agreement to strengthen international protection of intellectual property rights will promote or undermine the objective of the Biodiversity Treaty to conserve biodiversity and promote its sustainable use. The final part of this Article will address each of these questions.

III. THE INTELLECTUAL PROPERTY/ENVIRONMENTAL PROTECTION INTERFACE

A. Sharing the Benefits of Genetic Resources

Notwithstanding the violent reactions of the farmers in India to the TRIPS Agreement, a different, and more cooperative vision of the future of

68. Biodiversity Treaty, *supra* note 3, at art. 16(5).
69. *See supra* notes 48-49 and accompanying text.

international intellectual property and environmental protection slowly appears to be taking shape. Embraced by the business-environmental coalition that was instrumental in changing the U.S. position on the Biodiversity Treaty, a consensus is developing among scientists, world bodies, anthropologists, and conservationists, that the best way for developing countries to capture the benefits of biodiversity is through a system of intellectual property, environmental, and contractual protection designed to harmonize the goals of development and conservation by building an international framework for sustainable biodiversity prospecting.[70] Arguably, this is precisely what Article 16 of the Biodiversity Treaty is attempting to accomplish.[71]

A seminal example of the kind of venture envisioned by Article 16 is the 1991 agreement between Costa Rica's Institutio Nacional de Biodiversidad ("INBio"), a private, non-profit organization with close ties to the Costa Rican government, and the U.S.-based pharmaceutical firm Merck & Company, Ltd. ("Merck"). In this agreement, INBio agreed to provide Merck with chemical extracts from wild plants, insects, and micro-organisms from Costa Rica's conserved wildlands for Merck's drug-screening program, in exchange for a renewable two-year research and sampling budget of $1,135,000, and royalties on any resulting commercial products.[72]

INBio was created as a part of a broader Costa Rican conservation program, organized on the premise that permanent preservation of biodiversity depends on the benefits obtained from it. The stark choice, in the words of an INBio staff member, is to "use it or lose it."[73]

Costa Rica's conservation program consists of three consecutive but overlapping steps. Each step is necessary but not sufficient for biodiversity conservation, and each meets one of the three stated objectives of the Biodiversity Treaty. The first step is to save samples of the country's biodiversity through the establishment of a system of protected wildlands. The second step is to know what that biodiversity consists of and where it is located in these wildlands. The third step is to put that biodiversity to

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70. *See, e.g.*, John Vidal, *The Gene Rush*, TORONTO STAR, July 10, 1993.

71. *See supra* Section II.A.

72. *See* Vidal, *supra* note 70. *See also supra* note 40 and accompanying text.

73. Dr. Ana Sittenfeld, *Tropical Medicinal Plant Conservation and Development Projects: The Case of the Costa Rican National Institute of Biodiversity (INBio), in* MEDICINAL RESOURCES OF THE TROPICAL FOREST: BIOVERSITY AND ITS IMPORTANCE TO HUMAN HEALTH 334, 335 (Michael J. Balick et al. eds., 1996). The paper was originally presented at the Rainforest Alliance's Periwinkle Project Symposium on Tropical Forest Medical Resources and the Conservation of Biodiversity, held at Rockefeller University, New York, Jan. 24-25, 1992. For a general discription of this symposium, see CHRISTOPHER JOYCE, EARTHLY GOODS: MEDICINE-HUNTING IN THE RAINFOREST 142-49 (1994).

sustainable work for society.[74]

The first step was achieved in Costa Rica through government establishment of a System of Conservation Areas that comprise nearly twenty-seven percent of the country. To bring about the second and third steps, Costa Rica established INBio, which became formally incorporated on October 24, 1989. INBio currently has a full-time administrative and scientific-technical staff of sixty-six persons at its headquarters on the outskirts of San Jose, the capital of Costa Rica, and also benefits from part-time and short-term consultants and volunteers from Costa Rica, and foreign volunteer taxonomists and other professionals. Although the initial funding for the organization came from government and private foundation grants, INBio must eventually become self-supporting.[75]

In order to carry out a basic National Biodiversity Inventory, INBio is forming an army of "parataxonomists," lay people of rural extraction who are trained to collect specimens and gather information.[76] The specimens and information gathered by these parataxonomists are then analyzed and organized by INBio curators and international scientists for eventual use by the government or private sector. This widespread screening of Costa Rican biodiversity for chemical and biotechnological resources that might be used in medicine, agriculture, and industry is designed to enable biodiversity to pay for itself.

The Merck-INBio agreement is just one of a growing number of cooperative biodiversity prospecting ventures around the world. A 1993 publication,[77] for example, reported that Japan recently launched a major biodiversity research program in Micronesia; that the U.S. National Institutes for Health is screening wild species from around the world for compounds active against Human Immunodeficiency Virus ("HIV") and cancer; and that both Indonesia and Kenya are establishing inventory programs similar to INBio's and exploring possible biodiversity prospecting activities.[78] This same publication offers suggestions to governments, non-governmental organizations, scientists, and industry for designing effective and equitable

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74. For a discussion of the objectives of the Biodiversity Treaty, see *supra* text following note 23. For a detailed discussion of Costa Rica's conservation program and INBio, see WORLD RESOURCES INSTITUTE, BIODIVERSITY PROSPECTING: USING GENETIC RESOURCES FOR SUSTAINABLE DEVELOPMENT Chaps. 2 & 3 (1993). *See also* DAVID R. WALLACE, THE QUETZAL AND THE MACAW: THE STORY OF COSTA RICA'S NATIONAL PARKS (1992).

75. See WALLACE, *supra* note 74, at 59.

76. For a detailed discription of one of these parataxonomists, see JOYCE, *supra* note 73, at 118-21.

77. *See* WORLD RESOURCES INSTITUTE, *supra* note 74.

78. *See id.* at 2.

biodiversity prospecting programs, paying particular attention to the experience of INBio in Costa Rica.[79]

More recently, INBio is said to have concluded a second agreement to supply Bristol-Myers-Squibb with a set of samples different from those it collects for Merck, in return for a smaller advance payment but a higher rate in future royalties.[80] Also capitalizing on biodiversity prospecting are a number of commercial ventures, including a company called Shaman Pharmaceuticals, a small California company, which describes itself as an ethnobotanical drug company that bases its drug exploration primarily on plants used in traditional medicines by indigenous peoples.[81] In less than two years, the company reportedly had three compounds in development as drugs, and seventy more in the pipeline from over one hundred plants brought in by Shaman's collectors. At a January, 1992, meeting of the Rainforest Alliance, the environmental group Shaman announced the company's first commercial success, an antiviral agent called SP-303 that targets respiratory diseases.[82]

The company is vague about what plant SP-303 is derived from, apparently treating the information as a valuable trade secret, but says that it grows wild, like a weed, and can be found in Ecuador, Peru, Paraguay, Columbia, and Mexico.[83] Another of the company's more promising products is an anti-fungal agent derived from a species commonly used as a folk remedy in Peru and parts of Mexico. The agent derives from resin in at least two species of trees of the genus, *Virola,* in the tree family

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79. *See also* DARRELL A. POSEY & GRAHAM DUTFIELD, BEYOND INTELLECTUAL PROPERTY: TOWARD TRADITIONAL RESOURCE RIGHTS FOR INDIGENOUS PEOPLES AND LOCAL COMMUNITIES (1996).

In 1995, the author was privileged to sit in on negotiations conducted among parties to the International Cooperative Biodiversity Group ("ICBG") Project, composed of Washington University, the Museum of Natural History of the National University of San Marcos, the Peruvian University Caytano Heredia, the Central Organization of Aguaruna Communities of the Upper Maranon, the Federation of Native Aguaruna Communities of the Nieva river, and the Aguaruna Federation of the Domingusa River, in affilation with the Confederation of Amazonian Nationalities of Peru. The basic document governing the ICBG Project is a 1994 Biological Collecting Agreement among the parties that acknowledges a separate License Option Agreement between Washington University and G.D. Searle & Co., a U.S. pharmaceutical company.

As a result of the 1995 negotiations, the 1994 License Option Agreement was amended, and the representatives of the Aguaruna and Huambisa communities of Peru and Searle entered into a new Know-how Licensing Agreement governing disclosure of the knowledge, innovations, practices, expertise, and secrets of these communities with regard to the use of biological resources for medicinal purposes. A redacted copy of the basic Biological Collecting Agreement, the 1996 Amendment Agreement, and the Know-how License Agreement are on file with the author.

80. *See* JOYCE, *supra* note 73.

81. *See id.* at 146-47, 270-71; *see* John Vidal, *supra* note 70.

82. *See* JOYCE, *supra* note 73, at 146-47.

83. *See id.*

Myristicaceae, which also includes nutmeg and mace. The company has entered into prospecting contracts with Eli Lilly and Merck, which give Shaman patent ownership rights while the pharmaceutical companies received the right to market drugs derived from compounds that Shaman discovers.[84]

Perhaps the most ambitious biodiversity prospecting venture yet is the five-year, eight million dollar program being carried out by the U.S. National Cancer Institute ("NCI") to screen 10,000 substances against 100 cancer cell lines and HIV.[85] NCI is taking an eclectic approach to biodiversity prospecting, funding both ethnobotanists associated with the New York Botanical Garden, and "eco-rationalists" associated with the Missouri Botanical Garden in St. Louis, who favor using clues from the forests' own organisms to track down drug candidates. Together with a third group from the University of Illinois, these non-profit research institutions have agreed to concentrate their search efforts for plants in Central and South America, Africa, and Asia, respectively. In addition, NCI has retained several marine biologists to search for new compounds from the ocean, coral reefs, and seaweed thrown up on remote beaches.

The reason for this surge of biodiversity prospecting activity is simple. About one-quarter of all prescription drugs in the United States contain as their active ingredient a compound extracted or derived from plants. Sales of these plant-based drugs amounted to an estimated $15.5 billion in 1990.[86] In Europe, Japan, Australia, Canada, and the United States, the market value for prescription and over-the-counter drugs based on plants in 1985 was estimated at $43 billion. Around the world, almost 121 prescription drugs are made from higher plants, almost half of which come from the tropics, and seventy-four percent of which were discovered by following up on native folklore claims.[87]

Less clear is what indigenous peoples and biodiversity-rich developing nations in general will receive in the way of benefits from this surge of biodiversity prospecting activity. The reason for concern over the question, however, is abundantly clear. One of the more notorious recent examples from a 350 year history of uncompensated takings is the widely reported windfall that the U.S. pharmaceutical company, Eli Lilly, netted thirty years ago from the rosy periwinkle of Madagascar. In 1954, an Eli Lilly

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84. *See* WORLD RESOURCES INSTITUTE, *supra* note 74, at 104.

85. For a detailed description of this program, see JOYCE, *supra* note 73, Chap. 12; *see also* WORLD RESOURCES INSTITUTE, *supra* note 74, at 7.

86. *See* JOYCE, *supra* note 73, at 108.

87. *See id.*; *see also* WORLD RESOURCES INSTITUTE, *supra* note 74, at 7.

phytobiologist extracted two cancer-fighting alkaloids, vinblastine and vincristine, from the flower. By the time the patents on the drugs ran out, Eli Lilly had earned hundreds of millions of dollars from the sale of the drug without providing any compensation to the impoverished and environmentally endangered country of Madagascar.[88] While representatives of the U.S. biotechnology industry concede that such stories are now a thing of the past, it remains to be seen whether there will actually be a fair and equitable sharing of the benefits derived from the utilization of genetic resources.

NCI, for example, offers a letter of intent to countries where its plant-hunters engage in biodiversity prospecting, promising that if a plant becomes a drug, the source country, or an institution in that country will have the initial opportunity to supply the bulk material.[89] NCI will also help train scientists from the source country and will share details of its scientific findings. But any patents on any chemical compound or the process for making it will belong to NCI. Moreover, should NCI allow a drug company to develop a compound into a drug or use it as a starting point to synthesize a drug, NCI merely promises to use its "best effort" to assure that the source country shares in the company's profits.

Many of NCI's plant-hunters are reportedly embarrassed by the terms of the letter of intent.[90] These same plant hunters reportedly succeeded in persuading NCI to tighten up a related "materials transfer agreement" that drug companies would sign to gain access to NCI's repository. Originally, the provision implied that any extracts that did not screen positively in NCI's screening program would be distributed to any and all drug companies to do with as they pleased. Eventually, NCI agreed to require all who obtained access to the repository to follow the letter of intent. NCI acknowledges that source countries want more firm guarantees of profit-sharing, but points out that to the extent NCI holds a patent on a compound or process, it has the power to choose and license companies that bid to develop drugs from that compound or process.[91]

Recently, NCI and the New York Botanical Garden signed their first collecting arrangement with an indigenous group, the Awa people of northwest Ecuador. The Garden will pay the Awa federation several thousand dollars for the right to study medicinal botany with their shamans,

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88. *See* Richard Stone, *The Biodiversity Treaty: Pandora's Box or Fair Deal?* 256 SCIENCE 1624, June 19, 1992.

89. *See* JOYCE, *supra* note 73, at 255-56.

90. *See id.* at 256.

91. *See id.*

who will also be compensated for collaborating.[92]

Meanwhile, Shaman Pharmaceuticals, though it decided that for the time being it would not set royalties for any particular indigenous group and will not reveal exactly how much compensation it intends to offer, says that compensation will be in proportion to each group's contribution and how much money a particular drug makes. In late 1993, Shaman secured the confidence of one of South America's largest indigenous federations and with the council of Peru's Aguarana and Huambisa peoples, who agreed to help Shaman collect plants for pharmaceutical investigation.[93]

While it is still too early to determine whether these biodiversity prospecting activities will pay off and whether the compensation to indigenous groups and developing countries will in fact be fair and equitable, the limited experience of the past five years nevertheless seems promising.

B. The Effect of Intellectual Property Protection on Biodiversity

A more fundamental question raised in the North-South debate over the interface between international intellectual property and environmental protection concerns the effect that international intellectual property protection will have on biological diversity. Opponents of intellectual property protection have raised a number of arguments emphasizing the negative impact that intellectual property protection, especially plant variety protection, will have on plant diversity. Although the debate thus far has focused primarily on the protection of domesticated plant varieties, the arguments are equally applicable with respect to the effect of intellectual property protection on wild plant varieties and on domesticated and wild animal varieties as well. The arguments can be divided into those relating to the conditions for protection and those relating to the effects of protection.[94]

Currently, plant variety protection is either provided by a country's patent law or by a *sui generis* form of protection of the sort referred to in the TRIPS Agreement, and embodied in the International Convention for the Protection of New Varieties of Plants (commonly called the UPOV Convention), which was adopted in 1961 by various industrialized countries, and further revised in 1972, 1978, and 1991, but as yet has not been adopted by any countries from the developing world.[95] In the United States, plant variety protection is

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92. *See id.* at 266.

93. *See id.* at 266-67.

94. For a detailed discussion of the effect of intellectual property on biodiversity, see Bernhard Bergmans, *Industrial Property and Biological Diversity of Plant and Animal Species*, J. PAT. [& TRADEMARK] OFF. SOC'Y 600-09 (1990).

95. *See generally* Carlos M. Correa, *Biological Resources and Intellectual Property Rights*, 5

provided by a combination of utility patent protection for biotechnological inventions, plant patent protection for new and distinct asexually reproducible plant varieties, and *sui generis* protection for sexually reproduced plant varieties.[96]

Opponents of plant variety protection assert that the conditions for obtaining protection require such uniformity and stability in essential traits as to induce plant homogeneity, which causes a loss of diversity and creates a greater risk of catastrophic vulnerability to diseases. Moreover, more attention is said to be paid to the mere existence of differences in essential traits than to their importance for the later use of the variety. This tends to induce merely cosmetic alterations, rather than real improvements or true diversification.[97]

The effect of plant variety protection thus creates a negative influence on plant diversity by directing research and breeding techniques, as well as marketing methods toward what is capable of being protected and commercially profitable, rather than what is socially valuable. Commercial breeding activities consist of cheap product differentiation, devoid of any real diversification or improvement. Only public institutions carry out the fundamental research and breeding that makes up for the loss of diversity, and yet, because protected varieties are widely marketed, existing varieties are progressively abandoned. This situation is apparently worsened by oligopolistic market structures in which a few large, multinational companies sell the same varieties worldwide, including in developing countries, where they replace more diversified indigenous varieties.[98]

In order to evaluate the strength of these arguments, it is first necessary to differentiate biodiversity according to the biological level at which it occurs. Thus, one must distinguish botanical diversity, representing the number of species in the plant kingdom and their characteristics; specific diversity representing the number and nature of varieties belonging to species; varietal diversity, representing differences between plants of the same variety; and individual diversity, representing the degree of hetero- or homozygosity of an individual plant.[99]

Because diversification is an ongoing process, it is also necessary to distinguish the effects of plant variety protection according to three different

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EUR. INTELL. PROP. REP. 154-57 (1992). Discussion of the UPOV Convention in this section is based primarily on this source.

96. *See supra* note 54 and accompanying text.

97. *See* Bergmans, *supra* note 94, at 601-02.

98. *See id.* at 602.

99. *See id.* at 603.

measures of diversity: potential diversity, representing whatever could exist theoretically as a result of spontaneous variation or human intervention; actual diversity, representing all that actually exists somewhere at a given time, whether known or unknown to humankind; and effective diversity, representing what is actually and significantly used or exploited as a natural resource by humankind. Potential diversity merely represents the absolute limits of diversification, even if human intervention, and the influence of plant variety protection, were wholly positive. With respect to actual diversity, it is clear that even if uniformity is imposed as a requirement for plant variety protection, it could have adverse effects only on varietal and individual diversity, which may occur in any event as a result of many other factors even in the absence of plant variety protection. For example, the "Green Revolution" in rice production has occurred primarily in developing countries having no plant variety protection regime.[100]

Conversely, creation of new plant varieties by definition increases the actual diversity of species, and if genetic barriers can be eliminated through genetic engineering, there will arguably be an increase of botanical diversity as well. Again, however, other factors might lead to such increases in specific and botanical diversity, even in the absence of plant variety protection. In reality, however, most varietal improvements are restricted to a few common species.[101] Moreover, because the most recent revision of the UPOV Convention now allows newly discovered, as well as newly bred varieties to be protected, plant variety protection will not necessarily result in the increase of specific diversity at all.[102] Finally, even if new varieties are produced, not all new varieties necessarily will prove to be useful to agriculture or horticulture.

Biodiversity thus must be examined with respect to the impact of plant variety protection on the effective exploitation of existing plants. It is now clear, as an unintended result of the Green Revolution, that the massive use of a single variety, or of a few varieties, can in fact destroy botanical and specific diversity among domesticated plants. Even if new, higher performance varieties are continually created, moreover, there may be a shift from one monoculture to another. This does not create diversity and may result in the disappearance of existing varieties.[103]

As we have seen, however, this phenomenon has occurred primarily in developing countries without plant variety protection, suggesting that it is the

100. *See id.* at 603-05.
101. *See id.* at 604.
102. *See* Correa, *supra* note 95, at 155.
103. *See* Bergmans, *supra* note 94, at 605.

end user or consumer, and not the producer of plant varieties or the availability of plant variety protection, that ultimately decides what varieties will be used. Of course, the end user or consumer can only choose among varieties actually available, and thus the role of the producer remains important, particularly in an oligopolistic market.[104] But oligopoly is the product of too little competition, rather than of too much plant variety protection. Only if plant variety protection contributes to oligopoly market conditions, by creating substantial barriers to entry, or is used anticompetitively by oligopolies, can it have an adverse impact on biodiversity. The primary barrier to entry created by intellectual property law, however, is not *sui generis* plant variety protection, but rather patent protection that is too strong and too wide.[105]

As we have seen, under Article 27 of the TRIPS Agreement, members are allowed to provide for the protection of plant varieties either by patents or by an effective *sui generis* system.[106] While the latest revision of the UPOV Convention has broadened the scope of protection that member countries can provide and given it a more patent-like character than is currently reflected in the U.S. Plant Variety Protection Act,[107] the Convention nevertheless allows members to qualify plant variety protection with both a narrow "farmer's privilege," permitting "farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting on their own holdings," and a broader privilege to use protected varieties for experimental purposes and for breeding other varieties, though a breeder's rights are to extend to any "essentially derived varieties."[108]

Article 31(b) of the TRIPS Agreement, moreover, explicitly permits member countries to authorize compulsory licensing of patents when a proposed user has made efforts to obtain authorization from the right holder on reasonable commercial terms and conditions and such efforts have not been successful within a reasonable period of time.[109] Reading this provision in conjunction with Article 8(2) of the TRIPS Agreement, which permits measures to prevent the abuse of intellectual property rights by right holders or the use of practices that unreasonably restrain trade or adversely affect the international transfer of technology, demonstrates that Article 31 envisions compulsory licensing as the principle remedy for the misuse of intellectual

104. *See id.* at 602.
105. *See id.* at 607.
106. *See supra* notes 60-62 and accompanying text.
107. *See* Reichman, *supra* note 57, at 196.
108. *See* Correa, *supra* note 95, at 156.
109. For a general discussion of Article 31, see *supra* note 64-65 and accompanying text.

property rights.[110] In recognition of this, Article 31(k) states that member countries are not obligated to meet certain other compulsory licensing conditions set forth in Article 31, where such licensing is designed to remedy a practice determined after judicial or administrative process to be anti-competitive.

Thus, while the concerns of environmentalists and farmers in India over the adverse effects that massive use of a few protected monocultural varieties might have on biodiversity are well taken, it is not plant variety protection, but the absence of competition that poses this danger. Indeed, some experts believe that, because the latest revision of the UPOV Convention extends the field of application to the entire plant kingdom and not just species of interest to individual countries, and extends protection to newly discovered as well as newly bred varieties, greater use of the UPOV Convention framework to stimulate commercial exploitation of botanical resources would in fact give developing countries unique competitive opportunities. Also, enhancing the value of natural species would promote the conservation of their natural genetic endowment for future exploitation.[111] In short, plant variety protection of the sort envisioned by the TRIPS Agreement and the UPOV Convention might very well have a positive influence on the conservation and sustainable use of biodiversity.

Thus, as we have seen, contrary to the widespread belief in the industrialized and developing worlds alike, the interface between international intellectual property and environmental protection need not be one of fundamental conflict. Indeed, a proper understanding of the interface between the Biodiversity Treaty and the TRIPS Agreement demonstrates that adequate and effective international intellectual property protection can in fact promote the conservation and sustainable use of biodiversity.

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110. *See* Reichman, *supra* note 57, at 205.
111. *See id.* at 197 (citing Correa, *supra* note 95).