Protecting Farmer Innovations: The Convention on Biological Diversity and the Question of Origin

by

Cary Fowler

Originally published in JURIMETRICS
41 JURIMETRICS 477 (2001)

PROTECTING FARMER INNOVATION: THE CONVENTION ON BIOLOGICAL DIVERSITY AND THE QUESTION OF ORIGIN

Cary Fowler*

ABSTRACT: The objectives of the Convention on Biological Diversity (CBD) are "the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources . . . ." The CBD states that access is provided on the basis of "prior informed consent" and under "mutually agreed terms." Only countries that are "countries of origin" are empowered to give this consent and agree to terms. The definition of "countries of origin," however, lacks clarity and scientific rigor as applied to domesticated and cultivated species. Agricultural biodiversity is the product of innovation whether in farmer-selected crop varieties or the latest biotechnologically produced gene construct. How such innovations and associated technologies will be protected and derivative benefits apportioned has been the subject of controversy for centuries. The CBD aimed, in part, to address this question. The particular strategy employed by the CBD, however, is not likely to be successful, given the difficulties that will surely be encountered in identifying "countries of origin" for plant genetic resources for food and agriculture.

CITATION: Cary Fowler, Protecting Farmer Innovation: The Convention on Biological Diversity and the Question of Origin, 41 Jurimetrics J. 477–488 (2001).

In 1930, the United States adopted the Townsend-Purnell Plant Patent Act[1] to protect asexually reproducing varieties of domesticated plants such as apple,

---

*Cary Fowler is Honorary Fellow and Senior Advisor to the Director General, International Plant Genetic Resources Institute, Rome, Italy; Associate Professor, Center for International Environment & Development Studies, Agricultural University of Norway, Aas, Norway.

1. Ch. 950, 66 Stat. 804 (1952) (codified as amended at U.S.C. §§ 161–64 (2000)).

pear, and rose.[2] Since then, patent or patent-like protection has been expanded through legislation and court decisions to include sexually reproduced plant varieties,[3] micro-organisms,[4] genes and gene complexes,[5] characteristics,[6] and products.[7] The law of trade secrets, contracts, and torts also has been used to protect plant germplasm.[8] Biological inventions have thus taken their place as objects with intellectual property rights protection in most developed countries and in an increasing number of developing ones. Not surprisingly, applications for such inventions have risen sharply in recent years as scientists have employed the new tools of biotechnology.[9]

While legal opportunities for protecting biological innovations have expanded significantly in recent decades, international negotiations have made less visible progress in recognizing or compensating countries and farming communities that generate the genetic resources that, through recombination and manipulation, become new crop varieties. The fact that most agricultural crops were domesticated in what are now termed "developing countries"[10]—and the fact that much of the genetic diversity of these crops comes from developing countries—has added to the political heat in United Nations debates.[11]

The Convention on Biological Diversity (CBD), adopted in 1992, reaffirmed national sovereignty over genetic resources, ending the prevalent view that plant genetic resources used for food and agriculture were the "common heritage of mankind" available for all to use.[12] Through the CBD, developing countries enunciated their desire for qualitatively different relationships between suppliers and recipients of genetic resources. In related negotiations on agro-biodiversity

---

2. These plants are multiplied asexually for the commercial market by grafting or other cloning techniques. The Plant Patent Act, however, excludes potato and other tuber crops.

3. *See* Plant Variety Protection Act of 1970, 7 U.S.C. §§ 2321–2583 (2000).

4. Diamond v. Chakrabarty, 447 U.S. 303, 308-09 (1980).

5. *Ex parte* Hibberd, 227 U.S.P.Q. (BNA) 443 (U.S. Patent & Trademark Office Bd. of Patent Appeals & Interferences 1985).

6. *Imazio Nursery, Ind. v. Dania Greenhouses*, 69 F.3d 1560 (Fed. Cir. 1995), limited the rights of holders of plant patents under the 1930 law to excluding only those who have derived their material directly from the patent holder's stock. Independent creation is permissible, and breeders seeking rights in a new variety with a novel trait must seek protection under utility patent statutes. *See* Richard H. Kjeldgaard & David R. Marsh, *Recent United States Developments in Plant Patents*, 2 MOLECULAR BREEDING 95 (1996).

7. *See Hibberd*, 227 U.S.P.Q. at 443.

8. *See generally* Jeffrey Ihnen & Robert Jondle, *Protecting Plant Germplasm: Alternatives to Patent and Plant Variety Protection*, *in* INTELLECTUAL PROPERTY RIGHTS ASSOCIATED WITH PLANTS (Crop Sci. Soc'y of Am. ed., 1989).

9. *Who Owns the Knowledge Economy?*, ECONOMIST, Apr. 8, 2000, at 17.

10. *See* JACK HARLAN, CROPS AND MAN xi, 253 (Am. Soc'y of Agronomy ed., 1975).

11. CARY FOWLER & PAT MOONEY, SHATTERING: FOOD, POLITICS AND THE LOSS OF GENETIC DIVERSITY 174–200 (1990).

12. The principle of "common heritage" is embodied in a 1983 nonbinding "International Undertaking on Plant Genetic Resources" of the Food and Agriculture Organization of the United Nations, *International Undertaking on Plant Genetic Resources for Food and Agriculture*, U.N. Food & Agriculture Organization, 22d Sess., Annex, Res. 8/83, http://www.fao.org/ag/cgrfa/IU.htm.

at the UN Food and Agriculture Organization (FAO), these countries argued that while reward systems exist for modern plant breeders, none exist to compensate those who made the greater contribution—the prior art—upon which new crops varieties are based. Genetic resources, they contend, are not raw materials, but are refined products improved through centuries of selection and breeding by farmers.

This Article examines how the CBD determines which country has sovereignty over particular biological materials and thus is in the position to negotiate terms of access and sharing of benefits. These provisions are the crux of countries' efforts to control what until recently was regarded as a "public good." I argue that the CBD vests considerable authority in the "country of origin," but that the definition of the term is neither legally precise nor scientifically robust. The access provisions may work for some genetic resources (those that have pharmaceutical applications, for example), but they will be difficult to implement and enforce for domesticated and cultivated species. In the case of plant genetic resources used for food and agriculture, countries may be better served by considering multilateral, rather than transaction-based approaches to access and benefit-sharing.

I. HISTORICAL BACKGROUND

Genetic resources are materials with "actual or potential value"[13] of plant, animal, microbial, or other origin, that contain functional units of heredity. In agricultural crops, the genetic material typically is located in seeds. Remarkable intra-species diversity exists within crops. There are an estimated 80,000 distinct varieties of rice, for example, many as different from others as a beagle is from a Great Dane.[14] The seeds of these varieties constitute the "raw material" for future plant breeding and are the biological basis for agriculture. But, unlike some biological resources, plant genetic resources for food and agriculture are not exactly raw materials. They bear the imprint of human beings. Beginning at least as early as the Neolithic period some 12,000 years ago, human beings have been influencing, shaping, and guiding the evolution of these species. Through mass selection and other means, they had already been developing crops and crop varieties for thousands of years when, in 1900, the rediscovery of Mendel's laws of heredity laid the foundations for more conscious and skilled plant breeding. Our Neolithic ancestors domesticated the plants used as major crops by humans today, and they generated a massive amount of useful genetic diversity. Their

13. United Nations Conference on Environment and Development: Convention on Biological Diversity, *done* June 5, 1992, art. 2, S. Treaty Doc. No. 103-20, at 8, 31 I.L.M. 818, 824, *available at* http://www.biodiv.org/doc/legal/cbd-en.pdf [hereinafter Convention on Biological Diversity].

14. FOOD & AGRIC. ORG. OF THE UNITED NATIONS, THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE 466 (1998).

genetic accomplishments were arguably greater than the contribution made by professional plant breeders in more recent years.[15]

Much of this work was done in what are now called developing countries. Human population patterns, migration, and the last Ice Age thwarted domestication efforts in northern climates. Thus, most major agricultural crops originated from plants that are native to developing countries.

Modern plant breeders have a number of legal means through which they can claim ownership of their inventions of new plant varieties, traits, and the like.[16] In contrast, farmers have had few opportunities to control their innovations.[17] Yet, modern innovations are based on previous innovations.[18]

Before the 1992 Earth Summit, where the CBD was to be adopted by governments, negotiators worked in an increasingly acrimonious environment. They were aware that valuable plant genetic resources had been transferred over the centuries from "South to North"[19] with little benefit to the developing countries of the South. Multinational pharmaceutical companies were "bioprospecting" for cancer cures, taking not only the biological resources of "medicinal plants," but also the knowledge of traditional and indigenous peoples about those plants.[20] Charges of "biopiracy" were in the air. As activist Vandana Shiva put it, "The 'value added' in one domain is built on the 'value robbed' in another domain. . . . The problem is that in manipulating life forms you do not start from nothing, but from other life forms which belong to others—maybe through customary law."[21] The concept of "common heritage," which under-

---

15. *Plant Variety Protection Amendments: Hearings on H.R. 999 Before the Subcomm. on Dep't Investigations, Oversight & Research of the House Comm. on Agric.*, 96th Cong. 130 (1979) (statement of Kenneth A. Dahlberg, Associate Professor of Political Science, Western Michigan University).

16. *See supra* text accompanying notes 1–10.

17. Farmers' innovations are not simply historic relics, but are ongoing. *See generally* GENES IN THE FIELD: ON-FARM CONSERVATION OF CROP DIVERSITY (Stephen B. Brush ed., 2000); VIRGINIA D. NAZAREA, CULTURAL MEMORY AND BIODIVERSITY (1998). Farmer-bred varieties, which still account for a tremendous amount of crop acreage in developing countries (and for certain domestic crops such as artichokes), do not usually meet the requirements for intellectual property protection. They may have a high use value and be truly novel, but they are seldom "distinct, uniform, and stable," the three key criteria for a plant breeders rights certificate. International Convention for the Protection of New Varieties of Plants of December 2, 1961, as Revised at Geneva on November 10, 1972, on October 23, 1978, and on March 19, 1991, art. 5 para. 1, S. Treaty Doc. No. 104-17, at 13, *available at* http://www.upov.int/eng/convntns/1961/content.htm.

18. "The same 'prior art' questions patent examiners routinely consider before issuing patents arise in determining ownership of new crop varieties.

19. *See generally* LUCILE H. BROCKWAY, SCIENCE AND COLONIAL EXPANSION: THE ROLE OF THE BRITISH ROYAL BOTANIC GARDENS (1979); ALFRED W. CROSBY, ECOLOGICAL IMPERIALISM: THE BIOLOGICAL EXPANSION OF EUROPE, 900-1900 (1986).

20. *See generally* BIODIVERSITY PROSPECTING: USING GENETIC RESOURCES FOR SUSTAINABLE DEVELOPMENT (Walter V. Reid et al. eds., 1993).

21. Vandana Shiva, The Seed and the Spinning Wheel: Biotechnology, Development and Biodiversity Conservation, Paper Presented at the International Conference on Conservation of Genetic Resources for Sustainable Development (Sept. 10–14, 1990).

pinned a long-established system of easy access to biological resources, was under attack.

At the last diplomatic negotiating session leading up to the Earth Summit, delegates recognized that agricultural biodiversity is distinctive, it should not be treated in the same way—as, for instance, a rare endemic species with pharmaceutical potential. While finalizing the text of the CBD, the delegates passed a resolution recognizing "the need to seek solutions to outstanding matters concerning plant genetic resources" and, in particular, to access to ex-situ collections acquired before (and therefore outside the provisions of) the CBD.[22] The resolution also urged that "ways and means should be explored to develop complementarity and cooperation between the CBD and the Global System for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Sustainable Agriculture" under the Food and Agriculture Organization (FAO).[23]

The FAO set about negotiating an instrument on plant genetic resources for food and agriculture consistent with the CBD. After six years, the effort continues. If these negotiations fail, or if an agreement includes only a limited number of crops, then despite the reservations of the CBD negotiators, the CBD will continue to govern some or all plant genetic resources for food and agriculture.

The CBD affirms "that States have sovereign rights over their own biological resources,"[24] and it posits significant authority in the "country of origin."[25] This paper asks two questions which should be on the minds of everyone involved in the FAO and CBD processes:

1. In regard to genetic resources, how does the CBD define the subject matter, distinguish between different types of biodiversity, and assign rights?
2. Can the CBD's definition of "country of origin" be effectively used as a legal and scientific basis for determining which countries have sovereignty over particular plant genetic resources for food and agriculture?

Below, I address a range of definitional, scientific, and practical issues associated with the use of the Convention's definition of "country of origin."

II. DEFINITIONAL ISSUES

The Convention's article on access states that "the genetic resources being provided . . . are only those that are provided by Contracting Parties that are

---

22. United Nations Environment Programme: Resolutions of the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity, *adopted* May 22, 1992, Resolution 3, 31 I.L.M. 842, 846–47, *available at* http://www.unep.org/unep/program/natres/biodiv/irb/download/unep07be.exe [hereinafter Resolution 3 of the Nairobi Final Act].

23. *Id.* at 847.

24. Convention on Biological Diversity, *supra* note 13, preamble, S. Treaty Doc. No. 103-20, at 16, 31 I.L.M. at 822.

25. *See id.* at preamble, art. 9 para. 1, S. Treaty Doc. No. 103-20, at 16, 20, 31 I.L.M. at 822, 826.

countries of origin of such resources."[26] Article 2 defines "[c]ountry of origin of genetic resources" as "the country which possesses those genetic resources in *in-situ* conditions."[27] It defines "[i]n-situ conditions" as "conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties."[28]

These definitions distinguish between resources that exist in ecosystems and natural habitats and those that are domesticated or cultivated species. The CBD offers a particularly broad definition for the latter: they are "species in which the evolutionary process has been influenced by humans to meet their needs."[29] Because "landscapes that have not experienced important human influences have been the exception for hundreds if not thousands of years,"[30] a large number of species—including many not generally considered to be domesticated—will meet the CBD definition.

While the CBD offers a definition of "domesticated or cultivated species," it does not offer any guidance as to what "distinctive properties" might mean.[31] Is the distinctive property an allele, a trait, or a genotype? What would make it distinctive? Must it be distinctive from all other properties of all genetic resources? From the properties of all other species? From the properties of other genetic resources within its own species, genera, or gene pool?[32] Does "distinctive" mean noteworthy or unique?[33]

Since the CBD covers "only those [genetic resources] that are provided by Contracting Parties that are countries of origin of such resources," its requirements that access be given based on "prior informed consent" and "mutually

---

26. *Id.* at art. 15 para. 3, S. Treaty Doc. No. 103-20, at 22, 31 I.L.M. at 828 (emphasis added).

27. *Id.* at art. 2, S. Treaty Doc. No. 103-20, at 18, 31 I.L.M. at 823.

28. *Id.* at art. 2, S. Treaty Doc. No. 103-20, at 18, 31 I.L.M. at 824.

29. *Id.*

30. S.T.A. Pickett & Richard S. Ostfeld, *The Shifting Paradigm in Ecology*, *in* A NEW CENTURY FOR NATURAL RESOURCES MANAGEMENT 261, 267 (Richard L. Knight & Sarah F. Bates eds., 1995).

31. Convention on Biological Diversity, *supra* note 13, art. 2, S. Treaty Doc. No. 103-20, at 18, 31 I.L.M. at 824.

32. Even the definition of species, and what exactly might be contained within a given species, is subject to controversy and change. *See* ERNST MAYR, THE GROWTH OF BIOLOGICAL THOUGHT: DIVERSITY, EVOLUTION, AND INHERITANCE 251–97 (1982).

33. The implications of each would be radically different. A distinctive feature of tomatoes is that most of them have red fruit. Here, distinctive means "common" "ubiquitous in one plant but not others." It suggests an inquiry into where the species developed its common or noteworthy properties. This interpretation might aid those who would like to empower countries in the Vavilov Centers of Origin (defined *infra* note 40). But, it is unlikely that many parties would seek access to common traits. Instead, one is more likely to seek access to rare traits not found in the public domain. This, of course, is problematic in terms of the original desire of certain actors to control their genetic resources, because they end up controlling rare traits while foregoing claims to the common, typically used, and valuable ones.

agreed terms" apply *only* to countries of origin.[34] Furthermore, they apply only to resources provided after the coming into force of the Convention.[35] Since a sizeable percentage of existing diversity—more than six million samples of plant genetic resources used for food and agriculture—are now stored, *ex situ*, in gene banks,[36] the Convention might effectively apply only to those materials that contain properties that arose *and* are accessed after its adoption. The FAO has noted a "decrease in international collecting activities."[37] Given current levels of access,[38] it would appear that opportunities to assert rights as a country of origin will be few.[39]

In summary, the CBD governs only those genetic resources provided by the "country of origin." Access to their resources is available only on the basis of "prior informed consent" and "mutually agreed terms." But the Convention defines "country of origin" in two different ways—one in relation to essentially "wild" materials, and one in relation to "domesticated or cultivated species." The latter definition, which applies to plant genetic resources for food and agriculture is unclear.

III. SCIENTIFIC CONSIDERATIONS

It has long been known that crops have "centers of diversity," and N.I. Vavilov postulated in 1926 that these regions corresponded to centers of origin.[40] Vavilov was successful in identifying regions of impressive diversity, and these regions often equaled areas of origin.[41] However, the legally oriented approach of the CBD is different. Vavilov asked where crops were domesticated,[42] but the

---

34. Convention on Biological Diversity, *supra* note 13, art. 15 para. 4–5, S. Treaty Doc. No. 103-20, at 23, 31 I.L.M. at 828.

35. Resolution 3 of the Nairobi Final Act, *supra* note 22, 31 I.L.M. at 846–47; *see also* LYLE GLOWKA ET AL., A GUIDE TO THE CONVENTION ON BIOLOGICAL DIVERSITY (Int'l Union for the Conservation of Nature Envtl. Policy & Law Paper No. 30 1994).

36. FOOD & AGRIC. ORG. OF THE UNITED NATIONS, *supra* note 14, at 98.

37. *Id.* at 86.

38. For example, the research centers of the Consultative Group on International Agricultural Research (CGIAR) currently hold more than 500,000 samples, yet they presently add only 2,000 a year to their collections. Furthermore, most of the materials held by the CGIAR are held "in trust" for the international community under the terms of a 1994 agreement with the Food and Agriculture Organization of the United Nations. These samples, and the genetic material contained in them, are effectively in the public domain and are likely to remain so.

39. *See generally* TIMOTHY M. SWANSON & R.A. LUXMOORE, INDUSTRIAL RELIANCE UPON BIODIVERSITY: A DARWIN INITIATIVE PROJECT (Word Conservation Monitoring Ctr. Biodiversity Series No. 7, 1997) (demonstrating that companies acquire less than 3% of their germplasm from "in situ" conditions from previously uncollected genetic materials).

40. N.I. VAVILOV, ORIGIN AND GEOGRAPHY OF CULTIVATED PLANTS 14–21 (Doris Löve trans., V.F. Dorofeyev ed., Cambridge Univ. Press 1992) (1926).

41. Jack R. Harlan, *Agricultural Origins: Centers and Noncenters*, 174 SCIENCE 468, 468 (1971).

42. Vavilov's "centers of origin" are actually regions containing a high level of diversity of a number of crops—not of individual crops, not of distinctive properties. Harlan, *supra* note 41, challenged this concept and proposed a series of "centers" and "non-centers" of diversity.

CBD standard requires knowledge of where the particular properties of the crop (or species, or genetic resource) first arose. Vavilov's theory focused on *crops* and on *regions*; the CBD focuses on *properties* and *countries*. The latter requires a considerably higher level of precision. Nevertheless, both depend on a detailed knowledge of history that, for the most part, must reach back beyond the founding of the nation-state itself. When did wheat acquire its particular properties? When, and where, did the Golden Delicious apple become golden?

Most crops originated long ago, in Neolithic times or earlier. There is no complete or detailed history of food crops, and no history of their distinctive traits or properties, of which there might be thousands.[43] New properties arise through mutation, and some might be discovered, but rarely will such new properties, of certain origin, be valuable and necessary in plant breeding. Much of the world's diversity in major crops already has been collected.[44]

Since both a farmer's variety and a species can have numerous properties, it seems possible to have *multiple* countries of origin. The color of a bean may have arisen in one country, and its disease-resistance across the border. Either might have emerged in a dynamic fashion within farming communities spanning several countries. Thus, not only might an individual trait have multiple countries of origin, an individual sample might have multiple traits, each with different or multiple countries of origin.

Indeed, were a country to claim to be the origin of either color or resistance, it might be asked, "Which *shade* of the color?" or "Which *degree* of resistance?" And, of course, it would be asked, "What is your evidence?" Many properties come in infinite gradations. Many, perhaps most, developed over time and over territory encompassing more than one country. Some properties might have multiple geographic and temporal origins. Through mutations, they may arise again in the future, a contingency the CBD does not appear to address. Proving the historical origin—pinpointing both the time and place of each event—is well beyond the grasp of today's science.

In short, the CBD's definition of "country of origin" might be suitable for regulating access to a medicinal species found in the middle of the rainforest, it is not suitable for agricultural crops. This material has enormous intra-species

---

43. The International Plant Genetic Resources Institute (IPGRI) has published sets of "descriptors" for a large number of crops. These descriptors are intended to aid in information gathering and management. The 50-page descriptor for Grapevine (*Vitis* spp.), to cite but one example, does not, and cannot, detail all the qualities or properties of grapes. Some important properties are difficult to describe or quantify—taste, for example. The genus contains about 60 species. The distribution of the wild progenitor of modern grape vines (V. *vinifera* subsp. *sylvestris*) covers "a vast area from the Iberian peninsula and the north African countries, across the Mediterranean region, the Caucasus and the Caspian sea region and further east to central Asia. It also grows along the Danube and Rhine in central Europe." Its country of origin? *See* G. LADIZINSKY, PLANT EVOLUTION UNDER DOMESTICATION (1998).

44. FOOD & AGRIC. ORG. OF THE UNITED NATIONS, THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE 90–91 (1998).

diversity, for it has been spreading around the globe for millennia, evolving and adapting to new conditions.

IV. PRACTICAL CONSIDERATIONS

If access is to be regulated by the sovereign country of origin, considerably more historical information will be needed than is now available. While most gene banks maintain databases including information on source countries for their materials, few maintain information on the country of origin as defined by the CBD. Certainly, none would contain information on where the separate properties of each accession arose.

During preparation for the Fourth International Technical Conference on Plant Genetic Resources in 1996, "the lack of characterization and evaluation data was the most commonly expressed reason for the underutilization of accessions held in national collections."[45] Many countries lack basic "passport" information for many of their accessions, and even more countries lack characterization and evaluation data—data that contribute substantially to the usefulness and value of a sample. Assertions of sovereignty over genetic resources without information satisfying CBD's definition of "country of origin" are problematic and ineffective. Of course, many of the materials held in gene banks of arguable "countries of origin" already have been accessed and are stored outside the countries in other gene banks available for exchange and use beyond the scope of the CBD. The materials the CBD will likely cover are still in the farmers' fields, still undergoing a process of innovation and development. Ironically, little is known of these materials. No comprehensive information systems exist. Potential "buyers," therefore, are not likely to know what there is to access or where it can be obtained. Countries of origin, likewise, are unlikely to know exactly what they have sovereignty over.

Improving information systems would require an army of scientists—from taxonomists and geneticists to crop historians. Funding is unlikely to materialize in the context of a bilateral system. Eventually, using such information to negotiate terms of access would require an even larger army of lawyers. For example, the world's largest and most complete collection of rice, at the International Rice Research Institute (IRRI) in the Philippines, is composed of more than 80,000 samples from 111 countries. The collection includes 8,454 samples from Indonesia, 799 samples from Sierra Leone, and 849 samples from Brazil. For any one country to have access to the same range of rice diversity through bilateral arrangements, it would be necessary to conclude agreements with 110 countries. For all countries represented in the IRRI collection to have access to this material, a total of 12,210 bilateral agreements might be necessary.[46]

---

45. *Id.* at 122.

46. If negotiations at FAO on a multilateral system for plant genetic resources for food and agriculture fail, it is likely that the Convention would come to cover only those materials accessed

Even if all the distinctive properties could be catalogued, and their country or countries of origin fixed, establishing their value would be difficult. Negotiations on "mutually agreed terms" for access will certainly focus on the value of the resource. While the CBD established a framework for a market in genetic resources, it could not establish the market itself. Indeed, had the conditions for a market in plant genetic resources for food and agriculture existed prior to the CBD, a market would have been established, for the CBD did not give countries sovereignty over their genetic resources. Rather, it *reaffirmed* their sovereignty.

A typical crop breeding program might involve more than a few land races (traditional farmers' varieties) as well as a number of advanced breeding lines. The popular VEERY line of wheat is the product of 3,170 different crosses involving 51 parents from at least 26 countries.[47] Imagine the complexity of ascertaining the genetic contribution (qualitatively or quantitatively)[48] or the economic value[49] of a particular parent in a breeding program with multiple land races and breeding lines.

For an individual plant breeder, the hurdles would be high. One would need to identify each trait of the material and to ascertain its historical origin to identify the country of origin. The breeder would then need to negotiate with each country, possibly without knowing the projected genetic contribution or economic value, or even whether the material would end up in the final variety. Whether such a system meets the CBD's stated goal of facilitating access to or promoting sustainable utilization of genetic resources is doubtful.

It is commonly, but incorrectly assumed, that the country of origin under the CBD is the country in which a particular sample was collected. In the simplest possible interpretation for domesticated species, however, the CBD requires that the origin of the material's "distinctive properties" be identified. The country in

---

after its coming into force, and not to pre-existing gene-bank collections. Much more material is acquired from gene banks than from the field today. Were countries to restrict access to in-situ material (or demand negotiations and transaction-based benefit-sharing), this could reduce the availability of materials from gene banks, resulting in bigger losses than gains. *See* Cary Fowler et al., *Unequal Exchange? Recent Transfers of Agricultural Resources and Their Implications for Developing Countries*, 19 DEV. POL'Y REV. 181 (2001).

47. These are "source" countries, not necessarily "countries of origin." The number of countries of origin (at least of the distinctive properties) could be much higher.

48. No generally accepted methodologies exist for determining the contribution.

49. No generally accepted methodologies exist for determining the economic value of a particular accession or trait; moreover, there is no history of monetary-based transactions for plant genetic resources for food and agriculture. That genetic resources are valuable in agriculture is not debatable; no market exists to determine their monetary value. With agro-biodiversity, technical constraints before and after the CBD probably prevent the very types of transactions and access-related benefit sharing that the CBD allows.

which these distinctive properties arose is the country of origin. This is the country whose informed consent must be obtained.

Even if we had a complete biological history of the myriad properties of agricultural crops, we would doubtless find that individual accessions would involve multiple properties and countries of origin. Negotiating with numerous countries for a single accession is likely to be impractical, particularly when one considers the difficulty and lack of experience in placing a value on the contributions of individual accessions in complex varietal pedigrees.

Due to scientific and practical problems associated with the definition of "country of origin" in the CBD, it is unlikely that the Convention can be easily, efficiently, or regularly followed in regards to access and benefit-sharing for domesticated and cultivated species. Efforts to apply the CBD's definition to agro-biodiversity will likely lead to uncertainty, bureaucratic cautiousness, reductions in access and use, and high transaction costs—all without significant benefits to countries of origin.[50] Given the fact that all countries depend on crops (and genetic resources) that originated elsewhere,[51] the CBD's definition of "country of origin" as applied to plant genetic resources for food and agriculture will rarely serve the interest of any individual country.

Some developing countries have had high hopes that the CBD might redress past patterns in which their farmers' achievements and technologies were appropriated and exploited without recognition or recompense. The lack of a viable market for plant genetic resources for food and agriculture, coupled with the difficulties that will be encountered in employing the concept of "country of origin," are likely to frustrate these hopes. The problem with treating plant genetic resources for food and agriculture as "common heritage" was that no formal mechanism existed for ensuring that the flow of germplasm between

---

50. Regulations, legislation, and proposed legislation provide ample evidence that countries are establishing elaborate and complicated mechanisms to control access to biodiversity. *See, e.g., Declaration and Draft Model Law on Community Rights and Access to Biological Resources,* Organization of African Unity Scientific, Technical, and Research Commission (Mar. 1998), http://users.ox.ac.uk/~wgtrr/OAU-decl.htm; Régimen Común sobre Acceso a los Recursos Genéticos [Common Regime on Access to Genetic Resources], Commission of the Cartagena Agreement Andean Community dec. 391 (July 2, 1996), *available at* http://www.comunidadandina.org/english/Dec/d391e.htm (English version); Implementing Rules and Regulations on the Prospecting of Biological and Genetic Resources, Dep't of Env't & Natural Res. Admin. Order No. 96-20 (June 21, 1996) (Phil), *available at* http://216.15.202.3/docs/philippines-bioprospectingEO247-96.doc; Exec. Order No. 247 (May 18, 1995) (Phil.), http://users.ox.ac.uk/~wgtrr/rp.htm. Ironically, most legislation would require the negotiation of benefit-sharing arrangements prior to access of genetic materials. Given the peculiarities of the CBD's definition of "country of origin," it will be difficult to identify the "distinctive properties" in a sample and then determine their country or countries of origin *prior* to having access to the materials for scientific examination. Even if benefit-sharing arrangements are made contingent, or based on a formula (a percentage of royalties, for example), it is possible that the terms will have been negotiated either with a country that is not the country of origin, or with only one of a number of countries of origin.

51. Ximena Flores Palacios, Contribution to the Estimation of Countries' Interdependence in the Area of Plant Genetic Resources (Comm'n on Genetic Res. for Food & Agric. Background Study Paper No. 7, Rev. 1 (1998)).

countries was balanced with an equitable sharing of benefits. It is easier to imagine a multinational agreement that would create appropriate international benefit-sharing mechanisms than it is to believe that the CBD's "country of origin" approach will create certainty of title and functioning markets for plant genetic resources for food and agriculture.

The breakdown of negotiations at the FAO on such an agreement is a distinct possibility. A better understanding of biology and agricultural history would have benefitted those who fashioned the CBD's link between sovereignty and access and drafted its definition of "country of origin."