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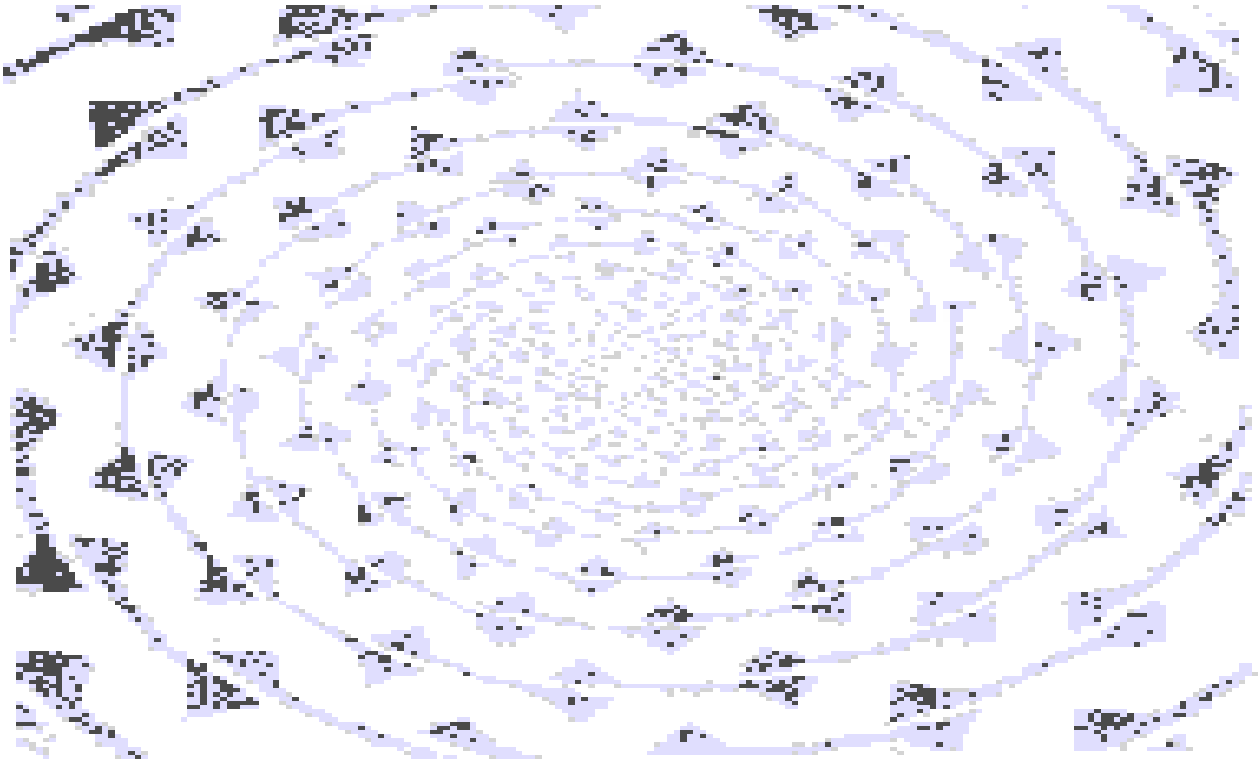

The Right of Everyone to Enjoy the Benefits of Scientific Progress and the Right to Food: From Conflict to Complementarity

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The Interdisciplinary Research Cell in Human Rights (CRIDHO) has been created within the Centre for Legal Philosophy (CPDR), an extra-department Institute of the University of Louvain, by scholars seeking to understand the development of fundamental rights by relying on other disciplines, especially economics and political philosophy. The CRIDHO works on the relationship between market mechanisms and fundamental rights, both at the level of interindividual relationships as at the level of the relationships between States in the European or international context.

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ABSTRACT

In the area of seed policies, the dominant paradigm of agricultural development favors the strengthening of intellectual property rights in order to promote and reward innovation by the private sector, combined with the provision of improved seed varieties to farmers in order to help them produce higher yields. But this model may leave out precisely those who need most to be supported, because they are the most vulnerable, living in the most difficult environments. In contrast to dominant approach, this article argues that the poorest farmers would be the primary beneficiaries of an alternative policy, that would favor the maintenance and enhancement of agrobiodiversity by rewarding the farmers for their own innovations, and by treating genetic resources as a public good that should be made accessible to all, as has been the case traditionally in farmers' seed systems. There are other ways of putting science at the service of farmers, that may be more effective in reducing rural poverty. This article assesses in this light the complex relationship between the right to adequate food and the right of everyone to enjoy the benefits of scientific progress and its applications. Both rights are recognized by the International Covenant on Economic, Social and Cultural Rights. They need to be made more mutually supportive in the future, if research in agriculture is to truly serve the needs of the poor.

KEYWORDS

Right to Science. - Seeds. - Intellectual Property Rights. - Plant Breeders' Rights. - International Treaty on Plant Genetic Resources for Food and Agriculture.

The Right of Everyone to Enjoy the Benefits of Scientific Progress and the Right to Food: From Conflict to Complementarity

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I. Introduction

Approximately one billion people are hungry today, up from 923 million at the beginning of 2008, 854 million in 2005, and 820 million in 1996.[1] At least 2.5 billion individuals today lack the essential micronutrients that are needed to lead a healthy and active life.[2] Deficiencies of vitamin A and zinc still rank among the leading causes of death through disease in developing countries.[3] Between one fifth and one quarter of child deaths can be attributed to low birthweight and childhood underweight.[4]

Three facts are striking about global hunger. First, hunger is the result of poverty, and not of there being too little food produced. Indeed, the number of the hungry has risen at the same time that the levels of aggregate cereals production are breaking record after record, and despite the fact that, on a worldwide basis, increases in annual grain production consistently exceeded demographic growth.[5] Second, the majority of the hungry live in rural areas and depend on small-scale farming for their subsistence : the reason why poverty in the rural areas remains so widespread is because the kind of farming they practice

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[1] *See* Food & Agriculture Organization of the UN, The State of Food Insecurity in the world: Economic Crises—Impacts and Lessons Learned 11 (2009) [hereinafter FAO] (estimating the number of hungry people at 1.02 billion). In 2010, the figure was considered to be slightly lower, thanks to the recovery of the global economy after the financial and economic crisis of 2008 and 2009 (see Food & Agriculture Organization of the UN, The State of Food Insecurity in the world: Economic Crises—Addressing food insecurity in protracted crises 9 (2010)). However, However, at the end of 2010, the figure is probably above the mark of one billion because of the impacts of the food price spikes of all staple foods except rice.

[2] A third of the 8.8 million children deaths worldwide is attributable to malnutrition : see Robert E. Black, Lindsay H. Allen, Zulfiqar A. Bhutta, Laura E. Caulfield, Mercedes de Onis, Majid Ezzati, Colin Mathers and Juan Rivera, *Maternal and child undernutrition: global and regional exposures and health consequences*, *LANCET*, vol. 371 (2008): 243–260. .

[3] Together, vitamin A deficiency and zinc deficiency in new-born children and infants explain 9 per cent of the under-5 deaths. *Id.* at 253.

[4] It was estimated in 2004 that 35% of child deaths could be attributed to childhood underweight and maternal low body-mass index leading to intrauterine growth restriction and low birthweight : *see* Steven M. Fishman, Laura E. Caulfield, Mercedes de Onis, et al., *Childhood and maternal underweight*, in: Majid Ezzati et al. (eds), COMPARATIVE QUANTIFICATION OF HEALTH RISKS: GLOBAL AND REGIONAL BURDEN OF DISEASE ATTRIBUTABLE TO SELECTED MAJOR RISK FACTORS (Geneva, World Health Organization, 2004) at 39-161. The figure would now be around 22%, as the prevalence of stunting has declined in most regions. See Robert E. Black, et al., 'Maternal and child undernutrition: global and regional exposures and health consequences', cited supra, at 254..

[5] The figures of global are reaching all-time high levels when cereals harvests in 2009, for instance, only modestly fell short of the record high levels of 2008, when 2287 million tons were produced.*Seed Policies and the Right to Food: Enhancing Agrobiodiversity, Encouraging Innovation, Report by Special Rapporteur on the Right to Food, Olivier De Schutter*, U.N. GAOR, 64th Sess., at 2, U.N. Doc. A/64/170 (2009).

has not been supported as it should.[6] Third, climate change, which translates in more frequent and extreme weather events such as droughts and floods and less predictable rainfall, is already having a severe impact on the ability of certain regions and communities to feed themselves, and it is destabilizing markets. The challenge before us, then, is not simply how to produce more food. It is how to produce it in ways that increase the incomes of the poorest producers—smallholders in developing countries who often work in difficult environments and lack access to high-quality soil and irrigation systems. And it is to produce it in ways that build the resilience of agriculture to climate change. This requires more diversity on farms and more crop heterogeneity : because of the 'portfolio effect' it allows, diversity of species mitigates risks from extreme weather events, as well as from the invasion of new pests, weeds and diseases, that shall result from global warming.

It is against this broader background that the relationship between the right to adequate food and the right of everyone to enjoy the benefits of scientific progress and its applications, as guaranteed by the Universal Declaration of Human Rights[7] and the International Covenant on Economic, Social and Cultural Rights,[8] should be assessed. There is a natural tendency to think of these rights as mutually supportive and, in particular, to see scientific progress—and the right of farmers to enjoy the benefits of its applications—as a condition of food security. In a trivial sense, this is obvious: without science, food cannot be produced. But we must move beyond this truism. In order to achieve decisive victories in the fight against hunger and malnutrition, we must ask which form of scientific progress should be promoted and access to which kinds of knowledge and technologies should be facilitated.

Section II describes the choices that states face in seeking to promote agricultural production. Each option can have significant impacts on the right to adequate food. In particular, this section argues, states should take into account that the strengthening of intellectual property (IP) rights can dramatically alter the balance in the relationships between those who retain the knowledge and the technologies, and those who need to use them. Section III discusses how increased doubts about the appropriateness of promoting science and technology in agriculture through property rights have led to successive shifts between a “proprietary” view of plant genetic resources for food and agriculture that sees such resources as being owned by the individual or by the community and a view of these genetic resources as a global commons, which should be shared on a multilateral basis.

Against this background, two approaches to agricultural development are contrasted. The classical (currently dominant) approach is discussed in section IV. In this approach, access of farmers to “improved” varieties of seeds is promoted, in particular, by providing incentives, such as granting patents on plants or extensive plant breeders’ rights, to professional plant breeders or seed companies to develop new varieties. However, this approach presents a number of disadvantages. It may lead farmers to depend on seeds supplied by a small number of economic actors, as the sector of input-providers is increasingly concentrated. The attempts to make "improved" seeds more easily accessible, as well as seed regulations, can have the perverse effect of threatening the ability of farmers’ seed systems to expand or even to be maintained —despite the advantages such farmers’ seed systems present, in terms of the preservation of

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[6] In total, at least 1.5 billion individuals depend on small-scale farming for their livelihoods. They live mostly from subsistence agriculture on less than two hectares of land. WORLD BANK, WORLD DEVELOPMENT REPORT 2008—AGRICULTURE FOR DEVELOPMENT 3 (2007). Among them, a significant proportion, most of whom are net buyers of food, are hungry. It is estimated that smallholders represent approximately half of the one billion hungry people in the world. *See* U.N. Millennium Project, *Halving Hunger: It Can be Done, Summary Version of the Report of the Task Force on Hunger* 6 (2005).

[7] Universal Declaration of Human Rights, G.A. Res. 217A (III), U.N. Doc. A/RES/217(III) (10 Dec. 1948), art. 27.

[8] International Covenant on Economic, Social and Cultural Rights, *adopted* 16 Dec. 1966, G.A. Res. 2200 (XXI), U.N. GAOR, 21st Sess., U.N. Doc. A/6316 (1966), 993 U.N.T.S. 3 (*entered into force* 3 Jan. 1976) [hereinafter ICESCR], art. 15(1)(b).

agro biodiversity and crop genetic diversity, and despite the fact that such seed systems are particularly important to cash-strapped farmers working in difficult environments. The strengthening of IP rights, unless countries use the flexibilities they are allowed, risks blocking further research not authorized by the patent-holder or, depending on the regime chosen by the country concerned, the plant breeder. Finally, agricultural research led primarily by the private sector, encouraged to invest by the incentive of IP rights, will direct research to serve the needs of high-value markets, rather than those of the poorest and most marginalized farmers in developing countries.

Section V seeks to present certain elements of an alternative approach that could be complementary to the classical approach. It is important, of course, to ensure that the breeders protected through a strong regime of IP rights are not allowed to abuse their monopoly power, so as to make farming unaffordable to the poorest farmers. But an alternative approach should also seek to encourage and support farmers' seed systems, on which the majority of poor farmers in developing countries still rely and which governments generally have neglected in their public policies in support of agriculture. Such an approach would aim to improve the protection of local (or farmers') varieties, sometimes referred to as "landraces," against the risks of uniformization and homogenization entailed by the introduction and diffusion of improved varieties. It would amend seed certification schemes to allow such local varieties to be exchanged or traded. It would support community seed banks and seed fairs in order to favor the distribution of these varieties. This alternative approach may include participatory plant breeding to encourage the development of varieties that best correspond to the needs of farmers under local conditions, as well as farmer field schools. It also may put as much emphasis on the transmission and sharing of knowledge as on the supply of technologies. Altogether, it would achieve at the level of seed policies what is already being done in the regulation of access to genetic resources at a global level : recognizing that progress is cumulative and that an excessive protection of monopoly rights over genetic resources can stifle progress in the name of rewarding it, it would aim to promote innovation by rewarding the farmers who maintain and enhance agrobiodiversity. Today's dominant approach in agricultural innovation risks allowing a commercial seed system to crowd out farmers' seed systems, on which most farmers in developing countries still depend, and which have a vital role to play in future food security : the alternative approach proposed aims, instead, at allowing such farmers' seed systems to prosper.

Section VI draws certain conclusions from the example of the role of science and technology in food and agriculture that encourages a critical discussion about the exact significance of the right to enjoy the benefits of scientific progress and its applications. This right, it is argued, cannot be construed on a false representation of science as following a unilinear trajectory. On the contrary, scientific progress may take different paths, each of which produces different impacts. The right to enjoy the benefits of scientific progress and its applications should be seen not as an end in itself. Rather, it is a means for the broader goals of human development and the full realization of human rights. Access to the benefits of scientific progress should therefore not be separated from the direction of scientific progress itself.

II. Different Paths of Scientific Progress in Agricultural Production

A. Technology in the Service of Increases in Agricultural Production

Which kinds of scientific research or technologies should be promoted to make the most important contribution to the realization of the right to food? International human rights instruments either beg this question or they appear to share the view that there is simply one trajectory of scientific progress, which is benevolent by definition. Thus, the International Covenant on Economic, Social and Cultural Rights, the most explicit formulation of the right to food in international law, provides that states should,

individually and through international cooperation,

> improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilization of natural resources.[9]

Similarly, under the Convention on the Rights of the Child, states are committed to "combat disease and malnutrition, including within the framework of primary health care, through, *inter alia*, the application of readily available technology and through the provision of adequate nutritious foods and clean drinking-water . . . ."[10] Article 12 of the Protocol of San Salvador, which complements the American Convention on Human Rights by adding a list of economic, social, and cultural rights, provides that, "in order to promote the exercise of [the right to adequate nutrition] and eradicate malnutrition, the States Parties undertake to improve methods of production . . . ."[11]

All of these formulations present technology as part of the solution to the problems of hunger and malnutrition,[12] which it is, in the obvious sense, as referred to above; but they pay insufficient attention to the choices to be made in the direction of scientific progress and the very different uses that can be made of science. Yet, technology, per se, is neither good nor bad. Whether or not it contributes to the right to adequate food depends on which technology is promoted and how it is disseminated and used. This article argues that scientific progress should be seen as an instrument, rather than as an end in itself. It takes the view that the introduction and spread of certain technologies may not be best suited to the needs of certain categories of users. We therefore must read the "right to benefit from scientific progress and its applications" in light of what we want to achieve. Which technologies there should be a right to should depend on the impact of such technologies on human development. It would be unjustified to treat all technologies as equivalent because their contribution to the full realization of the right to adequate food differs widely and depends on the specific conditions in which they are applied. States have choices to make about how to invest in agricultural development. The consequences of these choices matter. They must be guided by the requirements of the right to adequate food.

B. The Nature of States' Choices in Encouraging Agricultural Production

The question of which path of agricultural development should be promoted cannot be further avoided. It has become particularly topical since the global food price crises of 2007-2008 and 2010-2011. These crises are leading to a renewed and welcomed interest in agricultural development, and they are confronting governments and the international community with important choices as to the direction of this development. The nature of these choices can be briefly summarized. Agricultural development—the support governments give to agricultural production—may take a variety of forms, including both the

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[9] *Id.* art. 11(2)(a).
[10] Convention on the Rights of the Child, *adopted* 20 Nov. 1989, G.A. Res. 44/25, U.N. GAOR, 44th Sess., art. 24(2)(c), U.N. Doc. A/44/49 (1989), 1577 U.N.T.S. 3 (*entered into force* 2 Sept. 1990).
[11] Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights (Protocol of San Salvador), O.A.S.T.S. No. 69 (1988), (*entered into force* 6 Nov. 1999), *reprinted in* BASIC DOCUMENTS PERTAINING TO HUMAN RIGHTS IN THE INTER-AMERICAN SYSTEM, OEA/Ser.L.V/II.82 doc.6 rev.1 at 67 (1992).
[12] *See* Kerstin Mechlem & Terri Raney, A*gricultural Biotechnology and the Right to Food, in* BIOTECHNOLOGIES AND INTERNATIONAL HUMAN RIGHTS 131 (Francesco Francioni ed., 2007).

provision of certain public goods (such as storage facilities, irrigation, communications infrastructures, extension services, and the building of cooperatives among small producers and farmer field schools) and the provision of inputs (seeds, fertilizers, and pesticides).[13] Developing agriculture by ensuring that farmers, particularly small-scale farmers, have access to improved varieties of seeds has been a central component of a model of agricultural development sometimes called the "Green Revolution" model, although this label now is often assigned a broader and vaguer meaning.[14] Support to these farmers often takes the form of the provision of inputs, particularly seeds and fertilizers, but also including pesticides, because high prices of inputs and the lack of access to credit are two of the reasons why small-scale farmers are poor and cannot move beyond subsistence farming.

One may think of this kind of support as ensuring that the farmers "benefit from the applications of scientific progress," to paraphrase Article 15(1)(b) of the Covenant on Economic, Social and Cultural Rights.[15] Yet, supporting farmers by the provision of inputs, particularly by the provision of improved varieties of seeds that promise better yields, can create its own problems.[16] First, although commercial seed varieties may improve yields in the short term, their higher performance often has been a response to inputs (fertilizers) and to water availability, making it difficult for farmers unable to access such inputs and conditions to reap their benefits. Those who acquire inputs with their own means, often encouraged to do so during an initial period of subsidized inputs, may find themselves trapped in the vicious circle of debt as a result of a bad harvest and consequent impossibility to reimburse input loans. This may occur particularly when farmers have switched to mono-cropping, leading to revenues that may be higher in certain seasons but less stable across the years and diminish resilience in the face of climate change.[17]

The risks of dependency are significantly increased by the strengthening of the role of IP rights in the food system.[18] The development of a commercial breeding sector separate from farming and the emergence, more recently, of a biotechnological sector, has led to increased demands for the protection of rights of breeders and inventors of biotechnologies, demands that have now penetrated at the global level. The shift from agricultural research as a public good that provides farmers with seeds incorporating advanced traits to the granting of temporary monopoly privileges to plant breeders and patent-holders

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[13] Christopher B. Barrett & Emelly Mutambatsere, *Agricultural Markets in Developing Countries*, *in* THE NEW PALGRAVE DICTIONARY OF ECONOMICS (Lawrence E. Blume & Steven N. Durlauf eds., 2d ed. 2008).

[14] Jagtar S. Dhiman et al., *Improved Seeds and Green Revolution*, 11 J. OF NEW SEEDS 65 (2010) (describing the role of the Punjab Agricultural University in the development of improved varieties/hybrids of crops, and in the supply of these varieties to farmers).

[15] ICESCR, *supra* note 8, art. 15(1)(b).

[16] *See, e.g.*, ZOË GOODMAN, TRADE HUMAN RIGHTS EQUITABLE ECONOMY, SEEDS OF HUNGER: INTELLECTUAL PROPERTY RIGHTS ON SEEDS AND THE HUMAN RIGHTS RESPONSE (May 2009).

[17] There exists a correlation between the switch to specialized and uniform varieties on one hand and increased variability in productivity on the other hand, see Donald N. Duvick, *Variability in U.S. Maize Yields*, *in* VARIABILITY IN GRAIN YIELDS: IMPLICATIONS FOR AGRICULTURAL RESEARCH AND POLICY IN DEVELOPING COUNTRIES (Jock R. Anderson & Peter B.R. Hazell eds., 1989); Peter B.R. Hazell, *Sources of Increased Variability in Indian and U.S. Cereal Production*, 66 AM. J. AGRI. ECON. 302 (1984); Peter B.R. Hazell, *Sources of Increased Variability in World Cereal Production Since the 1960s*, 36 J. AGRI. ECON. 145, 158 (1985) (finding that the increase in aggregate production variability is predominantly due to increased yield variability and to a simultaneous loss in offsetting patterns of variation in yields between crops and regions, changes associated with the more widespread adoption of improved seed/fertilizer intensive technologies).

[18] *See in particular* Audrey R. Chapman, *The Human Rights Implications of Intellectual Property Protection*, 5 J. INT'L ECON. L. 861, 872 (2002); Hans Morten Haugen, *Patent Rights and Human Rights: Exploring their Relationships*, 10 J. WORLD INTELL. PROP. 97, 106 (2007); Laurence R. Helfer, *Toward a Human Rights Framework for Intellectual Property*, 40 U.C. DAVIS L. REV. 971, 998-99 (2007); Laurence R. Helfer, *Human Rights and Intellectual Property: Conflict or Coexistence?*, 22 NETH. Q. HUM. RTS. 167 (2004).

through the tools of intellectual property, is essentially defended as a means to reward, and thus incentivize, research and innovation in plant breeding. But it may also produce a number of undesirable consequences. First, it will necessarily lead to transfers of resources from technology users to technology producers, both within states and between states.[19] It may reinforce the domination of a limited number of Northern firms in the global food system because they will control access to improved varieties of seeds and biotechnological innovations by farmers—a consequence which may be particularly problematic for cash-poor smallholders in developing countries. It may direct research towards the needs of farmers in industrialized countries, while neglecting those of poor farmers in developing countries.

Second, commercial seed varieties may be less suited to the specific agro-ecological environments in which farmers work, and for which landraces (traditional farmers' varieties) may be more appropriate. Today, governments in developing countries are increasingly confronted with the coexistence of two separate seeds systems. On the one hand, commercial varieties are developed by professional breeders (whether or not through the use of biotechnologies, in order to propose genetically modified varieties) whose investments are protected by IP rights. On the other hand, in traditional seeds systems, farmers still preserve, exchange, or sell seeds that they have chosen on their own fields, often selecting local varieties best suited to very specific environments. The development of a commercial seed sector in which seed providers are protected by strong IP rights may put in jeopardy the farmers' seed systems, on which most farmers in developing countries still rely and which, for these farmers, are a source of economic independence and resilience in the face of threats such as pests, diseases, or climate change. Women play a key role in these systems. Most of the seeds and germplasm used in smallholder agriculture is produced, selected, and saved by women, and women predominantly grow and preserve underutilized species that local communities use to supplement their diets.[20] The replacement of farmers' seed systems with commercial seed systems may, therefore, shift decision-making about which crops to grow and sell to men. How governments achieve a balance between the support they provide to each of these systems is, therefore, a vitally important question for the future.

Finally, the expansion of surfaces cultivated with commercial seeds accelerates crop diversity erosion, as an increasing number of farmers grow the same crops, using the same improved varieties on their fields.[21] For thousands of years, reasonable levels of production were achieved thanks to the management by farming communities of a vast portfolio of genetic diversity. Stability in the level of protection was achieved thanks to the coexistence of an array of plants presenting different traits, making them resistant to specific diseases, drought, or variations in temperature. This crop genetic diversity is now under severe threat. As a result of the pressure towards more uniform crops and species-specific learning—the species about which knowledge has developed become more attractive to cultivate—all

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[19] Haugen, *supra* note 18, at 113

[20] "[I]n Yemen, women grow . . . crops, such as groundnuts, pumpkins, leafy vegetables, cowpeas, cucumbers and sweet potatoes . . . rais[ing] biodiversity and improv[ing] food security on the farm. . . . Andean women choose a variety of potato that has the characteristics they want for cooking. Rwandan women are reported to grow more than 600 varieties of beans and Peruvian Aguaruna women plant more than 60 varieties of manioc." (internal citations omitted). Gabriela Mata & Adél Anna Sasvári, *Integrating Gender Equality and Equity in Access and Benefit-Sharing Governance Through A Rights-Based Approach, in* RIGHTS-BASED APPROACHES: EXPLORING ISSUES AND OPPORTUNITIES FOR CONSERVATION 254 (Jessica Campese et al. eds., 2009). These authors estimate that up to 90% of the planting material used in smallholder agriculture is saved by women.

[21] The FAO Report on the State of the World's Plant Genetic Resources, based on more than 150 country reports, prepared for the International Technical Conference on Plant Genetic Resources held in Leipzig, Germany, 17-23 June 1996, concluded that the spread of modern, commercial agriculture and the introduction of new varieties of crops has been the main cause of the loss of genetic diversity. FAO, THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE 33 (1997).

efforts have been put into the development of a limited number of standard, high-yielding varieties, so that barely more than 150 species are now cultivated. Most of mankind now lives off no more than twelve plant species, with the four biggest staple crops (wheat, rice, maize and potato) taking the lion's share.[22] It is estimated that about 75 percent of plant genetic diversity has been lost as farmers worldwide have abandoned their local varieties for genetically uniform varieties that produce higher yields under certain conditions.[23] In addition, genetic diversity within crops is decreasing. For instance, from 1992 to 1993 in the United States, 71 percent of the commercial corn crop came from six varieties, 65 percent of the rice from only four varieties, 75 percent of the potato crop came from four varieties, 50 percent of the soybean crop from six varieties, and 50 percent of the wheat from nine varieties.[24] In Sri Lanka, 2,000 varieties of rice were cultivated in 1959; in 1992, there were fewer than 100 with 75 percent descending from a common stock. In Bangladesh and Indonesia respectively, 62 and 74 percent of the rice varieties descend from a common stock.[25]

Such wide-scale genetic erosion increases vulnerability to sudden changes in climate and to the appearance of new pests and diseases.[26] For example, after the fungus *Helminthosporium maydis* destroyed much of the standing maize crop in the southern part of the United States in 1970, leading to losses to consumers and farmers totaling some $2 billion,[27] it was necessary to breed a variety resistant to this pest by using genetic resources borrowed from other parts of the world. Varieties ignored for long periods of time due to their negative agricultural characteristics can later be found to contribute to agricultural developments because of their specific traits, such as their resistance to certain pests or, for example, their higher nitrogen-fixing capacities. Preserving those varieties is thus, quite literally, vital.

C. The Role of the Right to Adequate Food in Guiding States' Choices

In order to ensure that choices regarding which technologies to promote and which form of agricultural development to favor contribute effectively to the realization of the right to food, efforts should be directed not simply toward increasing overall production, but rather toward supporting modes of

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[22] José Esquinas-Alcázar, *Protecting Crop Genetic Diversity for Food Security: Political, Ethical and Technical Challenges*, 6 NATURE 946, 947 (2005). *See also* P.C. Mangelsdorf, *Genetic Potentials for Increasing Yields of Food Crops and Animals*, 56 PROC. NAT'L ACAD. OF SCI. U.S.A. 370, 374 (1966); TIMOTHY SWANSON, GLOBAL ACTION FOR BIODIVERSITY 52 (2005) (originally published in Earthscan Publ., London, 1997).

[23] Danielle Nierenberg & Brian Halweil, *Cultivating Food Security*, *in* STATE OF THE WORLD 2005: REDEFINING GLOBAL SECURITY (2005).

[24] World Conservation Monitoring Centre, Global Biodiversity: Status of the Earth's Living Resources 427 (1992) [hereinafter Global Biodiversity]; Stephen R. Gliessmann, Agroecology: The Ecology of Sustainable Food Systems 193 (2d ed. 2006).

[25] GLOBAL BIODIVERSITY, *supra* note 24 at 427.

[26] *See* Geoffrey Heal et al., *Genetic Diversity and Interdependent Crop Choices in Agriculture*, 26 RESOURCE & ENERGY ECON. 175, 179 (2004) (noting that, while a drop in the genetic diversity in food crops increases the risk of attacks by pathogens, farmers may not take this into account when making crop choices, leading to levels of diversity which are suboptimal). Genetic diversity is also important to food security for other reasons, less relevant in the context of this paper. *See, for an overview*, U.N. ENV'T PROGRAMME (UNEP), THE ENVIRONMENTAL FOOD CRISIS: THE ENVIRONMENT'S ROLE IN AVERTING FUTURE FOOD CRISES 65-76 (2009).

[27] JACK RALPH KLOPPENBURG, JR., FIRST THE SEED: THE POLITICAL ECONOMY OF PLANT BIOTECHNOLOGY 93 (1988).

production that raise the incomes and the resilience of the poorest farmers and do not jeopardize food security in the future. This follows from the obligations of states regarding the right to adequate food. Article 11 of the International Covenant on Economic, Social and Cultural Rights imposes on states three levels of obligations in the realization of the right to food. First, states have an obligation to *respect* existing access to adequate food. This requires that states do not take any measures that result in preventing such access.[28] The introduction of legislation or other measures that create obstacles to the reliance of farmers on informal seed systems may violate this obligation, since it would deprive farmers of a means of achieving their livelihood. Guideline 8.1 of the Food and Agriculture Organization of the United Nations (FAO) Voluntary Guidelines on the progressive realization of the right to adequate food in the context of national food security provides that states should "protect the assets that are important for people's livelihoods."[29] Second, states have an obligation to *protect* the right to food. This obligation would be violated if a state failed to regulate the activities of patent-holders or plant breeders, and did not prevent them from violating the right to food of the farmers who depend on the inputs they commercialize to be able to continue to farm.[30] Thus, the Committee has recommended to India to provide "state subsidies to enable farmers to purchase generic seeds which they are able to re-use, with a view to eliminating their dependency on multinational corporations."[31] The FAO Voluntary Guidelines on the right to food also note that "[s]tates should, within the framework of relevant international agreements, including those on intellectual property, promote access by medium- and small-scale farmers to research results enhancing food security."[32] Finally, states have an obligation to *fulfill* the right to food. This means, *inter alia*, that they must facilitate it by proactively strengthening people's access to and utilization of resources and means to ensure their livelihood, including food security.[33] The FAO Guidelines recommend that "[s]tates should promote agricultural research and development, in particular to promote basic food production with its positive effects on basic incomes and its benefits to small and women farmers, as well as poor consumers."[34] Which form such research should take, however, remains unspecified.

III. Intellectual Property Rights in Agriculture

The previous section argues that, far from "scientific progress" being unilinear, its direction depends on the choices made by states between different ways of supporting agriculture, and that governments should be guided in making such choices by their obligations to realize the right to food. However, any assessment of the impacts of technological choices on the right to food should take into account the recent

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[28] *General Comment No. 12: The Right to Adequate Food*, U.N. ESCOR, Comm. on Econ., Soc. & Cult. Rts., 20th Sess., ¶ 19, U.N. Doc. E/C.12/1999/5 (1999).

[29] FAO, VOLUNTARY GUIDELINES TO SUPPORT THE PROGRESSIVE REALIZATION OF THE RIGHT TO ADEQUATE FOOD IN THE CONTEXT OF NATIONAL FOOD SECURITY (2005) [hereinafter FAO VOLUNTARY GUIDELINES]. These guidelines were discussed within the FAO's Committee on World Food Security between 2002 and 2004, and were finally approved by the FAO Council on 23 November 2004. Although of a voluntary nature, they form a highly authoritative statement, the result of an inclusive intergovernmental process, about the policies states should pursue in order to realize the right to adequate food.

[30] *General Comment No. 12*, *supra* note 28, ¶ 19.

[31] *Committee on Economic, Social and Cultural Rights, Concluding Observations: India*, U.N. ESCOR, Comm. on Econ. Soc. & Cult. Rts., 40th Sess., ¶ 69, U.N. Doc. E/C.12/IND/CO/5 (2008).,

[32] FAO VOLUNTARY GUIDELINES, *supra* note 29, Guideline 8.5.

[33] *General Comment No. 12*, *supra* note 28, ¶ 15.

[34] FAO VOLUNTARY GUIDELINES, *supra* note 29, Guideline 8.4.

strengthening of IP rights in the food system, since this may significantly change the balance between different paths.

Domestic legislation and policies in this area are increasingly influenced by the changing framework of international law.[35] The past fifteen years have witnessed an important strengthening of IP rights at the global level. This took place at the request of developed countries and for the benefit of companies from these countries : Ha-Joon Chang remarks dryly that '[u]nlike trade in goods and services, where everyone has something to sell, [intellectual property rights are] an area where developed countries are almost always sellers and developing countries buyers. Therefore, increasing the protection for intellectual property rights means that the cost is mainly borne by the developing nations'. At the same time however, efforts have been made to reaffirm the sovereignty of states over their genetic resources, as a means to reward the contributions of states and communities to the preservation of biodiversity. Even more recently, the importance to food security of the accessibility of plant genetic resources for food and agriculture has been recognized. To this end, an ambitious multilateral system for access and benefit-sharing has been put in place to reconcile the needs of innovation and the protection of crop genetic diversity. These developments are briefly reviewed below, in order to assess the significance of the rise of IP rights in agriculture on the nature of the choices that states face in the area of agricultural development.

A. The Expansion of Intellectual Property Rights

The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) requires World Trade Organization Members to adopt wide-ranging minimum standards of intellectual property protection in a number of areas, including copyright, trademarks, patents, and plant variety protection, all of which will have considerable implications across the food system. In principle, TRIPs requires that a minimum patent protection of twenty years be available for all inventions, whether of products or processes, in almost all fields of technology. However, protection is optional for plants and animals (other than microorganisms), as well as for essentially biological processes used in the production of plants or animals (other than microbiological processes). WTO Members must nevertheless "provide for the protection of plant varieties either by patents, by an effective *sui generis* system, or by any combination thereof."[36]

Patents provide the right-holder with a twenty-year monopoly on any use of the patented invention. They may apply to seeds, plant cells, or DNA sequence. The importance of patents in plants has grown with the recent rise of agricultural biotechnology, particularly of transgenic crops that have been commercialized since 1996 and have grown rapidly since.[37] Farmers cultivating patented seeds do not have any rights over the seeds they plant. They are considered to be licensees of a patented product and they frequently are requested to sign agreements not to save, re-sow, or exchange the seeds that they buy from patent-holders. Patents are the most far-reaching form of protection that can be granted.

Plant varieties may be protected, alternatively, through the recognition of plant breeders' rights.

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[35] For a discussion of the freedom that States retain to choose the IP rights regime best suited to their needs, see LAURENCE R. HELFER, FAO, INTELLECTUAL PROPERTY RIGHTS IN PLANT VARIETIES: INTERNATIONAL LEGAL REGIMES AND POLICY OPTIONS FOR NATIONAL GOVERNMENTS (2004).

[36] Agreement on Trade-Related Aspects of Intellectual Property Rights, 15 Apr. 1994, 1869 U.N.T.S. 299, art. 27, ¶ 3 (b) (1994) [hereinafter TRIPS Agreement].

[37] FAO, THE STATE OF FOOD AND AGRICULTURE 2003-04: AGRICULTURAL BIOTECHNOLOGY (2004) *available at* ftp://ftp.fao.org/docrep/fao/006/Y5160e/Y5160e00.pdf; *See also* THE GENE REVOLUTION: GM CROPS AND UNEQUAL DEVELOPMENT (Sakiko Fukuda-Parr ed., 2007).

The International Convention for the Protection of New Varieties of Plants, developed under the auspices of the *Union Internationale pour la protection des obtentions végétales* (UPOV), was initially adopted in 1961. It was revised subsequently in 1972 and, more substantially, in 1978 and 1991. At the time of writing (June 2009), it had sixty-seven member states, including all large commercial powers with the notable exception of India.[38] The UPOV Convention protects the rights of plant breeders provided they develop plant varieties which are new, distinct, uniform, and stable.[39] These criteria are lower than for the delivery of patents, since it is not required from plant breeders in UPOV-compliant legislations that, in addition, they comply with the criteria of non-obviousness (requiring an inventive step) and of utility (industrial applicability). Because of its requirement of uniformity and stability, however, the UPOV convention does not allow the protection of farmers' varieties, which are inherently unstable and in permanent evolution.

All countries joining the UPOV convention after 1999 are, in principle, obliged to accede to the 1991 version. Although it does contain a number of flexibilities, this more recent version strengthens the protection of original plant breeders' rights in four ways. First, it extends the duration of the protection from a minimum of fifteen years to a minimum of twenty years (from twenty years to twenty-five years for vines and trees). Second, it increases the number of acts for which prior authorization of the breeder is required. In addition to the production for the purposes of commercial marketing and the sale and marketing of propagating material of the variety, "production or reproduction; conditioning for the purpose of propagation; offering for sale; selling or other marketing; exporting; importing; and stocking for any of the purposes mentioned [above]," are all prohibited without the authorization of the breeder.[40] Third, these prohibitions extend beyond the reproductive or vegetative propagating material, to the harvested material obtained through the illegitimate use of propagating material and so-called "essentially derived" varieties.[41] The 1991 version of the UPOV convention thus preserves the breeders' exemption—i.e., the right of breeders to use protected varieties as a source of variation for the creation of new varieties—but the exemption is narrower, since a plant breeder seeking to commercialize a new variety "B" must seek the authorization of the breeder of the variety from which variety "B" was essentially derived.[42] Fourth, the 1991 version of the UPOV convention restricts the so-called "farmer's privilege," by removing the possibility for states to allow farmers to exchange or sell seeds saved from the harvest of protected varieties. Article 15 of the 1991 UPOV convention only allows restricting breeders' rights "in order to permit farmers to use for propagating purposes, *on their own holdings*, the product of the harvest

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[38] However, Brazil, Canada, China, and South Africa, in contrast to the US and EU are parties to the 1978 version of the UPOV convention, and not to the 1991 version. *See* International Convention for the Protection of New Varieties of Plants, Members of the International Union for the Protection of New Varieties of Plants, *available at* http://www.upov.int/export/sites/upov/en/about/members/pdf/pub423.pdf.

[39] International Convention for the Protection of New Varieties of Plants art. 5(1), 2 Dec. 1961, 33 U.S.T. 2703, 815 U.N.T.S. 109 (*revised* 23 Oct.1978), [hereinafter UPOV Convention].

[40] *Id*. art. 14(1).

[41] *Id*. arts. 14(2), 14(5).

[42] *Id*. Art. 14(5) of the Convention defines an "essentially derived variety" as a plant variety that:

> (i) . . . is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety, (ii) is clearly distinguishable from the initial variety and (iii) except for the differences, which result from the act of derivation, conforms to the initial variety in the expression of the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety."

which they have obtained by planting . . . the protected variety."[43]

Clearly, WTO Members who do not wish to grant patents on plant varieties are *not* obliged to choose, instead, to grant plant variety protection (PVP) under the UPOV convention.[44] Article 27 of the TRIPS agreement deliberately did not refer to the UPOV convention when it was drafted.[45] WTO Members are, therefore, allowed to opt for a *sui generis* form of protection best suited to their specific circumstances. In particular, if they feel that the farmers' privilege is unduly restricted under the 1991 version of the UPOV convention, they may choose not to adhere to UPOV. They may opt instead for a *sui generis* protection for plant varieties that would, for instance, allow them to preserve the well-established practices of saving, sharing, and replanting seeds, as well as the equally traditional practices of local farming communities to conserve and sustainably use biological diversity, including through the selection and breeding of plant varieties. Indeed, it was one of the recommendations of the Commission on Intellectual Property Rights, established at the initiative of the United Kingdom in 2002, that countries should tailor their PVP to their specific needs.[46]

Nevertheless, in practice, developing countries increasingly have been led to adopt UPOV-compliant domestic legislation.[47] This may be the result of technical advice provided to developing countries, which often consists in recommending the adoption of UPOV-compliant domestic legislation, without taking into account the specific needs of the countries concerned or, for instance, differentiating between crops.[48] In addition, developing countries sometimes may not have the required expertise to draw up domestic legislation which is truly *sui generis* and corresponds to their development needs. Finally, a number of developing countries have been pressured to adopt national legislation that is in compliance with the 1991 version of the UPOV convention as part of trade or investment agreements they have concluded.[49] Some free trade agreements require the introduction of patent protection for plants, animals, and biotechnological innovations.[50] Others refer to the need for both parties to ratify the 1991 UPOV

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[43] *Id*. art. 15(2) (emphasis added).

[44] See Philippe Cullet, *Intellectual Property Rights and Food Security in the South*, 7 J. WORLD INTELLECTUAL PROPERTY 261 (2004) ('There have been attempts to interpret the *sui generis* option as being limited to the UPOV model but this is not the case and developing countries have the possibility to devise an alternative model which, for instance, takes into account their other treaty obligations in this field and Articles 7 and 8 of the TRIPS Agreement which grant developing countries to a certain extent the possibility to implement the TRIPS Agreement in a manner which fits their specific situation and needs'). There is no unanimity on this point, however. *See*, describing the range of positions adopted by states, Council for Trade-Related Aspects of Intellectual Property Rights, *Note by the Secretariat: The Protection of Traditional Knowledge and Folklore*, IP/C/W/370/Rev.1 (9 Mar. 2006).

[45] TRIPS Agreement, *supra* note 36, art. 27, ¶ 3(b).

[46] EXECUTIVE SUMMARY, COMMISSION ON INTELLECTUAL PROPERTY RIGHTS, INTEGRATING INTELLECTUAL PROPERTY RIGHTS AND DEVELOPMENT POLICY 63 (2002).

[47] *See* CULLET, *supra* note 45; INTEGRATING INTELLECTUAL PROPERTY RIGHTS, *supra* note 46, at ch. 3.

[48] *See* GOODMAN, *supra* note 16, at 7 (noting that the technical advice provided by UPOV, WIPO, and WTO, promote UPOV-compliant model laws, going beyond the minimum obligations imposed by the TRIPS Agreement, and linking this to the sources of funding of WIPO, 90 percent of which comes from the private sector).

[49] *See* GRAIN, *Bilateral Agreements Imposing TRIPS-Plus Intellectual Property Rights on Biodiversity in Developing Countries* (Mar. 2008), *available at* http://www.grain.org/rights_files/TRIPS-plus-March-2008.pdf. *See also Intellectual Property in Investment Agreements: The TRIPS-plus Implications for Developing Countries*, South Centre Analytical Note, SC/TADP/AN/IP/5, May 2005 (describing how North- South investment agreements are increasingly being used to expand the protection and enforcement of IP rights in developing countries).

[50] *See* Agreement on Trade, Development and Cooperation Between the European Community and Its Member States, of the One Part, and the Republic of South Africa, of the Other Part, signed on 11 Oct. 1999 (OJ L 311 of 4

convention, or to adopt legislation complying with that instrument.[51] It should come as no surprise that, in bilateral relationships, developing countries are led to make concessions following demands which, in multilateral settings such as the WTO, they were able resist. Because their share of world exports is much smaller than that of commercial partners such as the United States or the European Union, the leverage the latter can exercise is far more important, and this cannot be compensated, in bilateral negotiations, with the formation of coalitions among developing countries.

Initiatives have been developing to resist this trend. The Organization of African Unity (now the African Union) has developed an African Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources,[52] which aims to achieve a balance between the protection of breeders and the preservation of local farmers' rights in the interest of the sustainable use of biodiversity. When India enacted the Protection of Plant Varieties and Farmers Rights Act (PPVFRA) in 2001, in order to comply with the minimum standards imposed under the TRIPS agreement,[53] it sought to protect plant varieties, while at the same time enabling farmers to save, re-sow, exchange, and sell new plant varieties developed by farmers and breeders. But these examples remain relatively isolated.

Dec. 1999, at 3), art. 46(7) (defining intellectual property rights as comprising "patents, including biotechnical inventions"). The role of intellectual property rights on plant varieties in the relationships between the European Community and other ACP countries is more ambiguous. The Cotonou Agreement (The ACP-EC Partnership Agreement) *signed* 23 June 2000 (*revised* 25 June 2005), art. 46, ¶ 6, refers to the need for the parties to cooperate, upon mutually agreed terms, in particular for the strengthening of the protection of intellectual property rights. These include "patents, including patents for bio-technological inventions and plant varieties or other effective *sui generis* systems." (*Id*. ¶ 5). Ultimately, the question is the form of the technical advice provided by the EC as regards the drafting of regulations by the ACP States in this area. The issue has arisen also in the negotiation of Economic Partnership Agreements (EPAs). In its resolution of 20 June 2007 on the Millennium Development Goals—the midway point (2007/2103(INI), P6_TA(2007)0274) ¶ 94, the European Parliament has requested that issues related to intellectual property rights be removed from the negotiations of the EPAs, which are currently in the course of being finalized.

[51] *See, e.g*., United States-Chile Free Trade Agreement, U.S.-Chile, art. 17.1, ¶ 3, 6 June 2003, 42 I.L.M. 1026 (2003); United States-Morocco Free Trade Agreement, U.S.-Morocco, art. 15.1, ¶ 2, 15 June 2004, 44 I.L.M 544 (2005); Central America-Dominican Republic-United States Free Trade Agreement, art. 15.1, ¶ 5, 5 Aug. 2004, *available at* http://www.ustr.gov/trade-agreements/free-trade-agreements. (requiring that all states ratify the 1991 UPOV convention by 1 January 2006, although Costa Rica (1 June 2007) and Nicaragua (1 Jan. 2010) benefit from further deadlines); United States-Peru Trade Promotion Agreement, U.S.-Peru, art. 16.1, ¶ 3, 12 Apr. 2006, *available at* http://www.ustr.gov/trade-agreements/free-trade-agreements. An earlier example is the Agreement between the United States and the Hashemite Kingdom of Jordan on the Establishment of a Free Trade Area, U.S.-Jordan, art. 4, ¶ 1, 24 Oct. 2000, 41 I.L.M. 63 (2002). (in addition, art. 4 ¶ 17 of this agreement suggests that patents may have to be available for all technologies, including presumably biotechnologies or plant varieties ("patents shall be available for any invention, whether product or process, in all fields of technology, provided that it is new, involves an inventive step and is capable of industrial application")).

[52] African Union Biosafety Project, *African Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources*, *available at* http://www.africa-union.org/root/au/AUC/Departments/HRST/biosafety/AU_Biosafety_I.htm.

[53] *The Protection of Plant Varieties and Farmers' Rights Act 2001*, GAZETTE OF INDIA, 30 Oct. 2001, NO. DL-33004/2001.

B. The Protection of Biodiversity and the Risk of Misappropriation of Genetic Resources

One of the concerns raised by the extension of the TRIPS minimum standards to life forms is that the patentability of plants or animals could encourage the appropriation of genetic resources without the consent of, or without adequate sharing of the benefits with, the farmers and communities who have developed those resources in the first place. The Convention on Biological Diversity (CBD) was concluded almost twenty years ago, in part, in order to prevent that risk from materializing. The CBD seeks to ensure "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."[54] It was initially signed by 150 governments at the 1992 Rio Earth Summit. It has now achieved almost universal ratification with 193 states parties with the notable exceptions of Somalia and the United States. The CBD requires each party to adopt a number of measures to maintain biological diversity, including *in situ* and *ex situ* conservation measures.[55] Article 15 of the CBD, which addresses access to genetic resources, implements the principle according to which each state has the sovereign right to exploit its own resources pursuant to its own environmental policies.[56] It provides therefore that "the authority to determine access to genetic resources rests with the national governments and is subject to national legislation,"[57] although the parties at the same time "endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention."[58] Access to genetic resources, when it is granted, shall be on mutually agreed terms; it shall be "subject to prior informed consent of the Contracting Party providing [genetic] resources"; and it shall be on the basis of benefit sharing.[59]

There is no agreement on whether the requirements of the CBD could be adequately complied with, and its objectives fulfilled, by contractual agreements between the providers of genetic resources and traditional knowledge and the users.[60] The CBD itself refers to access to genetic resources being provided "upon mutually agreed terms," which suggests that such a solution might be in conformity with its underlying spirit.[61] Such contractual agreements present the advantage of being flexible and, in principle, most responsive to the interests of both parties. Of course, contractual agreements also may lead to unfair outcomes, if the bargaining position of one party is significantly stronger than that of the other party, particularly where genetic resources could be obtained from a number of sources, allowing one party to seek the resources from the territory that provides the most favorable terms. But the risk of negotiations being unbalanced is present in any case, even under a system requiring that those seeking to be granted a patent have to provide evidence that they have acquired the resource in conformity with the national rules of the country of origin of the genetic resource and/or the associated traditional knowledge used. Such national rules, for instance, may be insufficiently robust to protect indigenous or local communities, whose representatives have no access to expert legal advice or severely underestimate the

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[54] Convention on Biological Diversity, art. 1, *signed* 5 June 1992, 1760 U.N.T.S. 79 [hereinafter CBD].
[55] *Id*. arts. 6, 7, 8.
[56] *Id.* art. 15; *see also id*. art. 3.
[57] *Id*. art. 15(1).
[58] *Id*. art. 15(2).
[59] *Id*. arts. 15(4), (5), (7).
[60] The 2006 United States-Peru Trade Promotion Agreement, *supra* note 51, contains an "Understanding regarding biodiversity and traditional knowledge," in which the parties "recognize that access to genetic resources or traditional knowledge, as well as the equitable sharing of benefits that may result from use of those resources or that knowledge, can be adequately addressed through contracts that reflect mutually agreed terms between users and providers."
[61] CBD, *supra* note 54, arts. 15(4), (7).

economic benefits which could be gained from their resources. In addition, it is unclear how reliance on contractual agreements would protect the countries or communities concerned from misappropriation of generic resources and associated traditional knowledge where the bio-prospectors have deliberately sought to circumvent their consent. It may be too bold a presupposition to believe that these countries or communities will be informed of the violation of their rights, and once informed, will be able to take effective action.[62] In that sense, reliance on contractual mechanisms may be just as ineffective as *post hoc* remedies such as opposition to, or re-examination of, grants of patents that have been granted in violation of the principles of the CBD.

Indeed, it is precisely in order to clarify and improve the regime established by the CBD regarding access to genetic resources and benefit-sharing that the Nagoya Protocol was agreed at the tenth conference of the Parties to the CBD held in Nagoya, Japan between 18 and 30 October 2010.[63] The agreement followed eight years of negotiations. Consistent with the objective of the CBD—to ensure that the benefits arising from the utilization and commercialization of genetic resources shall be shared in a fair and equitable way with the party providing such resources "on the basis of mutually agreed terms"[64]—the Protocol requires each party to take all necessary measures to ensure that "benefits arising from the utilization of genetic resources that are held by indigenous and local communities, . . . are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms."[65] The Protocol also identifies a number of considerations that each party should take into account in the development and implementation of its access and benefit-sharing legislation or regulatory requirements.[66] In addition, it provides that each party shall designate a national focal point on access and benefit-sharing that shall provide applicants seeking access to genetic resources with information on the procedures to be followed;[67] and mutual information about the procedures for access and benefit-sharing should be facilitated by a clearing house mechanism.[68] In sum, the Protocol should encourage the parties to set up the regulatory framework and the administrative machinery that should allow the implementation of the access and benefit-sharing mechanism envisaged in the CBD itself, but that remained very poorly operationalized as a result of a lack of adequate measures at domestic level.

But, insofar as access to genetic resources is concerned, the CBD cannot be considered in isolation from other international instruments that have an impact on such access. Indeed, the relationship

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[62] Although there are interesting attempts in this regard. For instance, Peru's Law No. 28216 (Law on Protection of Access to Peruvian Biological Diversity and to the Collective Knowledge of the Indigenous Peoples, 1 May 2004) establishes a National Commission for the Protection of Access to Peruvian Biological Diversity and Collective Knowledge (Commission for Prevention of Acts of Bio-piracy), tasked with surveying patent applications made or patents granted abroad that relate to Peruvian biological resources or collective knowledge of the indigenous peoples of Peru. *See Article 27.3(B) Relationship Between the TRIPS Agreement and the CBD and Protection of Traditional Knowledge and Folklore*, W.T.O. Council for Trade-Related Aspects of Intellectual Property Rights, IP/C/W/447, (2 June 2005).

[63] Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, *opened for signature* 30 Dec. 2010 (*adopted* 29 Oct. 2010) [hereinafter Nagoya Protocol]. On the implementation problems of the CBD and the route of the negotiations that led to the adoption of the Nagoya Protocol, see Evanson Chege Kamau, Bevis Fedder and Gerd Winter, 'The Nagoya Protocol on Access to Genetic Resources and Benefit Sharing: What is New and what are the Implications for Provider and User Countries and the Scientific Community?', 6/3 *Law, Environment and Development Journal* 246 (2010), available at http://www.lead-journal.org/content/10246.pdf.

[64] *Id*. art. 5.

[65] *Id.* art. 5.2.

[66] *Id*. art. 8.

[67] *Id*. art 11.

[68] *Id*. art. 14.

of the CBD to the TRIPS Agreement has proven particularly controversial.[69] It is generally agreed that, in order to ensure that the IP regime they adopt will not be in violation of the CBD, states should, at a minimum, abstain from granting patents relating to biological materials that have been obtained in violation of the requirements of prior informed consent and fair and equitable benefit sharing under the national system of the country of origin of the genetic resources. Imposing such a restriction is entirely compatible with the TRIPs Agreement.[70] But states should, arguably, go beyond that. They should abstain from granting a patent on biological materials without requiring from those applying for the patent that they disclose where the materials originate from and that they provide information about the source and how the access and benefit-sharing requirements imposed in the source country have been fulfilled. This requirement of prior disclosure could be further strengthened by amending the TRIPS Agreement in order to include such an obligation, thus making explicit what currently may be seen as implied by the principle of international cooperation on which the CBD is based. This would increase confidence among bio-prospectors and biodiversity-rich countries and indigenous communities.

Although desirable, the inclusion of disclosure requirements in national patent legislations will not be sufficient to overcome the problem that may result from the disparity of national laws relating to access to genetic resources from the countries of origin of these resources. The only way to ensure that fair outcomes are reached, and that countries or communities are not forced to agree to cede their genetic resources on unfavorable terms, would be to strengthen national legislations defining the conditions according to which access to genetic resources and/or traditional knowledge and benefit-sharing can be achieved, and to do so through an international instrument, in order to avoid that states holding such resources are put in competition against each other.

However, the implementation problems facing the CBD run deeper than this. It has failed to generate sufficient benefits to fund the conservation of biodiversity. And despite the affirmation in the CBD that states parties must provide "facilitated access" to the genetic resources on which they have "sovereign rights," it often has created insuperable obstacles to the access of both researchers and the bio-industry to genetic resources : this explains why the recently adopted Nagoya Protocol is so detailed on the procedural facilitation of access. In contrast, an alternative approach, based on a non-proprietary paradigm, would treat genetic resources for food and agriculture as a global public good. The next section describes this alternative route, that emerged after the limits of what the CBD could achieve became clear.

C. Crop Genetic Diversity as a Global Public Good

At the core of the implementation problems faced by the CBD, is the nature of the genetic resources and traditional knowledge itself. The access and benefit sharing regime introduced by the CBD may be well suited to avoid the misappropriation of genetic resources for medicines. But the proprietary paradigm on which it is based is not adequate for domesticated plant genetic resources, which numerous farmers and farming communities have been involved in creating and maintaining. Crop traits are genetically complex, owing their characteristics to a large number of genetic resources, conserved both within and outside their places of origin.[71] Because of these characteristics, a growing consensus has emerged to treat

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[69] The issue is part of the Doha Development Round of trade negotiations. *See* the Doha Ministerial Declaration *and*, for a review of the positions adopted by WTO Members within the TRIPS Council, WTO doc. IP/C/W/368/Rev.1, ¶ 19 (8 Feb. 2006).

[70] *See* TRIPS Agreement, *supra* note 36, arts. 27, 62.1.

[71] *See* Stephen B. Brush, *Protecting Traditional Agricultural Knowledge*, 17 WASH. U. J. L. & POL'Y 59, 80 (2005); Stephen B. Brush, *Farmers' Rights and Protection of Traditional Agricultural Knowledge*, CGIAR Systemwide

domesticated plant genetic resources as a common pool, rather than as "property" of any particular state or local community. A specific system of management of genetic resources has therefore been set up, which seeks to offer an answer to the implementation problems faced by the CBD.[72]

The International Treaty on Plant Genetic Resources for Food and Agriculture (IT-PGRFA) seeks to establish a multilateral system to facilitate access to plant genetic resources for food and agriculture and to share the benefits in a fair and equitable way.[73] The IT-PGRFA currently has 120 states parties. In addition, the eleven International Agricultural Centers of the Consultative Group on International Agricultural Research (CGIAR) holding *ex situ* collections of PGRFA, as well as the *Centro Agronómico Tropical de Investigación y Enseñanza* (CATIE) and two of the four organizations hosting collections as part of the International Coconut Genetic Resources Network have placed the collections they host under the framework of the Treaty, to be accessed according to the same rules.[74]

The IT-PGRFA is premised on the idea that there exists a strong interdependence between regions in regards to PGRFA. Each region depends, to a large extent (often for more than 50 percent), on PGRFA from other regions. The Treaty, therefore, seeks to establish a novel system of governance for global commons, aimed at ensuring food security, which depends on permanent access to a large pool of genetic resources for the development of new and improved plant resources. Although the Treaty applies to all PGRFA, its most original component—the Multilateral System of Access and Benefit Sharing (MLS)—only applies to the plant genetic resources for food and agriculture listed in annex I to the Treaty that are under the management and control of the states parties and in the public domain,[75] although states are to take appropriate measures to encourage natural and legal persons within their jurisdiction who hold plant genetic resources for food and agriculture listed in annex I to include such resources for food and agriculture in the MLS.[76] This global pool comprises sixty-four food crops that make up more than one million samples of known plant genetic resources. The MLS, which applies to these resources, is based on the idea that while states have sovereign rights over their own PGRFA, they agree to facilitate access to PGRFA for the purpose of "utilization and conservation for research, breeding and training for food and agriculture,"[77] and to share, in a fair and equitable way, the benefits arising from the utilization of these resources. Facilitated access is to be accorded through the Standard Material Transfer Agreement (SMTA) adopted by the Governing Body of the Treaty. Using the SMTA, recipients may use the

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Program on Collective Action and Property Rights Working Paper No. 36, 21-22 (Washington, DC: International Food Policy Research Institute, 2005).

[72] Within the system of the CBD itself, the establishment of a global multilateral benefit-sharing mechanism by Article 10 of the 2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization signals a shift in approach, from a bilateral and contractual system to a multilateral system that sees genetic resources as a global public good where the genetic resources or traditional knowledge straddle national boundaries and therefore cannot be addressed adequately on the basis of the sovereign rights of states and the principle of prior informed consent (the Protocol refers to situations where the question of access to genetic resources occurs "in transboundary situations or for which it is not possible to grant or obtain prior informed consent"). This provision of the Nagoya Protocol remains weak, however, as it does not detail the content of the mechanism it calls upon the parties to set up.

[73] International Treaty on Plant Genetic Resources for Food and Agriculture, *adopted* 3 Nov. 2001, Res. 3/2001, FAO, 31st Sess. art. 1.1 (*entered into force* 29 June 2004) [hereinafter 'IT-PGRFA' or 'International Treaty'].

[74] *Id*. art. 15.

[75] *Id*. art. 11.2.

[76] *Id*. art. 11.3.

[77] *Id*. art. 12.3(a). The MLS does not apply when genetic resources are sought for other uses, such as "chemical, pharmaceutical and/or other non-food/feed industrial uses."

materials for food and agriculture at no cost, or for the minimal costs involved.[78] If, incorporating such materials, they then commercialize a final product that is itself a PGRFA and restrict others from using it for research and breeding,[79] they must pay an "equitable share of the benefits arising from the commercialization of that product"; whenever such a product is available "without restriction to others for further research and breeding", no payment is required, but the recipient who commercializes the product "shall be encouraged to make such payment."[80] The "equitable share" that those commercializing products obtained through the SMTA should contribute has been set by the Governing Body at 1.1 percent of the sales of the product (minus 30 percent), or at 0.5 percent of the sales over a ten-year period of commercialization of the same crop. These royalties are to be paid into a common fund created under the Treaty. Article 13.3 of the IT-PGRFA provides that these benefits arising from the MLS "should flow primarily, directly and indirectly, to farmers in all countries, especially in developing countries, and countries with economies in transition, who conserve and sustainably utilize plant genetic resources for food and agriculture." These royalties shall only be paid to the fund in the next few years. In the interim, it was announced at the third session of the Governing Body convened in Tunis on 1-5 June 2009 that projects in eleven developing countries that conserve food seeds and other genetic material from major crops will receive $50,000 each to support their efforts.[81] In addition, in 2010 the Benefit-sharing Fund of the International Treaty, will invest more than $10 million in projects globally to help ensure sustainable food security by assisting farmers to adapt to climate change through a targeted set of high impact activities on the conservation and sustainable use of plant genetic resources for food and agriculture.[82] These investments are encouraging. But they remain very small sums in comparison to the needs.

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[78] Standard Material Transfer Agreement (SMTA), *adopted* June 2006 by IT-PGRFA,, art. 5, *available at* ftp://ftp.fao.org/ag/agp/planttreaty/agreements/smta/SMTAe.pdf.

[79] IT-PGRFA, *supra* note 66, art. 12.3(d) provides that "Recipients shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System." Despite its emphasis on free flows of germplasm ("open access"), the Treaty therefore seems to allow intellectual property rights on anything that is not "in the form received." Upon ratifying the IT-PGRFA, *supra* note 73, the European Community and its member states have made declarations according to which they interpret Article 12.3(d) of the Treaty as recognizing that "plant genetic resources for food and agriculture or their genetic parts or components which have undergone innovation may be the subject of intellectual property rights provided that the criteria relating to such rights are met." Not all states share this interpretation, however. The Governing Body of the IT is still to adopt a position on this issue, and may do so when, in the next few years, the issue will arise.

[80] *Id*. art. 13.2(d)(ii).

[81] The projects which the fund supports are in Egypt, Kenya, Costa Rica, India, Peru, Senegal, Uruguay, Nicaragua, Cuba, Tanzania, and Morocco. Funded projects include on-farm protection of citrus agro-biodiversity in Egypt, the genetic enhancement and revitalization of finger millet in Kenya and the conservation of indigenous potato varieties in Peru. Norway, Italy, Spain, and Switzerland have contributed the funds for the benefit-sharing scheme, Norway introducing a small tax on the sale of seeds on its domestic market to fund its donation. Indeed, since it can take five to ten years to develop a product for commercialization once genetic materials are initially accessed, such voluntary funding appeared necessary to fill the time gap between the entry into force of the IT-PGRFA in 2004, *supra* note 73, and the flow of funds in accordance with the provisions on benefit-sharing.

[82] The International Treaty on Plant Genetic Resources for Food and Agriculture, *Leading the Field: Keeping Farmers Ahead of the Climate Change Curve*, *available at* ftp://ftp.fao.org/ag/agp/planttreaty/funding/call2010/bsf_flyer10_en.pdf.

IV. Promoting Innovation in Agriculture: the Classical Approach

The choices facing states with regard to the kind of technologies that they should promote and make accessible to farmers should be assessed in light of the developments recalled in the preceding section. There are clear benefits to the development of new varieties of plants. Varieties that offer high yields when the adequate conditions are present and when combined with appropriate inputs can limit the expansion of cultivated land and thus save virgin soils, which are a reservoir of biodiversity; certain varieties can have improved nutritional values or specific disease resistance; and certain crops can be developed which are suitable for saline, dry, or other marginalized soils.

In order to ensure that their farmers benefit from progress in this area, states have implemented seed policies that include two complementary components. First, in order to encourage innovations in agriculture, they have increasingly extended IP rights in the form of patents or plant breeders' rights (PBRs). This provided the main justification for the revision of the UPOV convention in 1991, the implementation of the TRIPs Agreement, and the adoption of TRIPs-plus provisions in bilateral or multilateral free trade agreements. These changes are all ostensibly explained by the need to encourage such innovations by allowing the patent-holder or the breeder to be rewarded for the investment made in the development of a new variety, following a model of commercial plant breeding typical of industrialized countries. Second, in order to support farmers, governments have promoted access to improved varieties of seeds, most often through "packages" including other inputs (fertilizers and pesticides), at subsidized prices or even, in certain cases, without charge. This approach is widespread, in part because it fitted a context in which states were unable to invest more in public agricultural research : instead, they put in place incentives for the private sector to innovate, and they take the credit for providing the farmer with the inputs which are needed for production. But this creates a number of problems. Dependency on Commercial Seeds and Access to Productive Resources for Smallholders

1. The problem of Dependency on Privately Held Resources

A first concern is that, once the subsidized access to seeds is phased out, farmers often have become dependent on the acquisition of improved varieties that may turn out to be unaffordable to them, particularly when such commercial seeds require to be combined with other external inputs in order to reach their full potential.[83] The market for input-providers is increasingly concentrated, leading to a risk that the actors in this market may be tempted to abuse their economic power. This is, of course, a risk that the strengthening of IP rights significantly increases. IP rights are, in effect, a set of rules that allow firms holding patents or plant breeders' rights to set prices at levels far exceeding actual costs and to segment markets by prohibiting lower priced products from moving from one area into others.[84] Particularly where patents are granted, such a monopoly privilege may create an obstacle to the access of farmers to productive resources, as the seeds which are protected may make farming too expensive for them. More scarcity appears to be the price of innovation—certainly a paradoxical, albeit entirely predictable, result

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[83] *See* Niels Louwaars, *Seeds of Confusion: The Impact of Policies on Seed Systems*, at 29, Ph.D. dissertation, Wageningen Universiteit (2007). It should be noted however that, while high-yielding varieties usually can maximize their potential only under specific conditions and combined with other inputs (in particular fertilizers and irrigation), some still can perform well even without this combination.

[84] Geoff Tansey, *Supplementary Written Evidence to the All-Party Parliamentary Group Inquiry into 'World Food Security and the UK*, ¶ 13, All Party Parliamentary Group on Agriculture and Food for Development, June 2009, *available at* http://www.ukabc.org/appg/GeoffTanseyAPPGwrittenevidence.pdf.

of IP rights, and one that seems now to be capturing the attention of the Committee on Economic, Social and Cultural Rights.[85] The strengthened protection of IP rights on plant varieties and seeds at the global level may accelerate the "verticalization" of the food production chain, particularly when patents are granted, as agricultural producers would become dependent on the prices set by companies for the seeds on which they have patents and would be denied the traditional right to sell and exchange seeds among themselves, as well as to save part of their crops in order to retain seeds for the next planting season.

Thus, the oligopolistic structure of the input providers' market may result in poor farmers being deprived of access to seeds and productive resources essential for their livelihoods, leading in time to raise the price of food, making it less affordable for the poorest. The UNCTAD secretariat has noted a significant increase in such concentration that extends beyond seeds to all agricultural inputs. As a result of mergers and acquisitions, agrochemical companies have entered into the biotechnology and seeds business, leading to "unprecedented convergence between the key segments of the agriculture market (agrochemicals, seeds and agricultural biotechnology)," a process further reinforced by contractual agreements between companies in these sectors.[86] Thus, according to the ETC Group, the top ten seed companies account for $14,785 million, representing 67 percent of the global proprietary seed market; the world's largest seed company alone, Monsanto, accounts for 23 percent of that market; and the top three companies (Monsanto, DuPont, and Syngenta) account for 47 percent of the market, including 65 percent of the maize seed market and over half of the proprietary soybean seed market.[87] This concentration is itself the result of progress in biotechnology and of the patenting of genes or DNA sequences, obliging seed companies to resort to mergers and acquisitions in order to overcome the "patent thickets" and further innovation. It is this concentration, rather than IP rights alone, that threatens to make seeds unaffordable for many poor farmers.[88]

In addition, IP rights are not the only means seed companies have at their disposal to reap rewards for their investments. Even in the absence of strong IP rights protections in certain jurisdictions or in

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[85] *See* Consideration of Reports Submitted by States Parties Under Articles 16 and 17 of the Covenant, Concluding Observations of the Committee on Economic, Social and Cultural Rights: Switzerland, U.N. ESCOR, Comm. on Econ., Soc. & Cult. Rts., 45th Sess., ¶ 24, U.N. Doc. E/C.12/CHE/CO/2-3 (26 Nov. 2010) (expressing the view that "the so-called "TRIPS-plus" provisions concerning accession to the International Convention for the Protection of New Varieties of Plants [UPOV] increase food production costs, seriously undermining the realization of the right to food.")

[86] *Tracking the Trend Towards Market Concentration: The Case of the Agricultural Input Industry*, UNCTAD, Study prepared by the UNCTAD Secretariat, UNCTAD/DITC/COM/2005/16 (2006). The tendency has continued after the date of publication of the UNCTAD report. For instance, in March 2007, Monsanto and BASF announced a 1.5 billion USD collaboration in research and development; in September 2007, Monsanto and Dow Chemicals announced they would cooperate in the development of a genetically engineered variety of maize endowed with eight genetic traits; in May 2008, Monsanto and Syngenta concluded cross-licensing agreements on maize and soybean. Such agreements also may lead to vertical concentration: in June 2009, Monsanto and Dole Fresh Vegetables, Inc., announced a five-year collaboration to develop new varieties of broccoli, cauliflower, lettuce, and spinach, which Dole would commercialize on Northern American markets.

[87] ETC Group, *Who Owns Nature? Corporate Power and the Final Frontier in the Commodification of Life*, Nov. 2008, at 12.

[88] A study commissioned by the World Bank on Argentina, Mexico, and Brazil concludes that prices of seeds increased slightly as a result of the introduction of IP rights, although the authors conclude that "there appears to be little evidence of excessively high prices with agricultural inputs." William Lesser et al., *Intellectual Property Rights, Agriculture and the World Bank, in* INTELLECTUAL PROPERTY RIGHTS IN AGRICULTURE: THE WORLD BANK'S ROLE IN ASSISTING BORROWER AND MEMBER COUNTRIES 1, 9 (Uma Lele et al. eds., 1999); *see also* N. P. LOUWAARS ET AL., IMPACTS OF STRENGTHENED INTELLECTUAL PROPERTY RIGHTS REGIMES ON THE PLANT BREEDING INDUSTRY IN DEVELOPING COUNTRIES (2005).

addition to such protections, companies selling seeds may resort to contractual clauses (technology use agreements) or genetic use restriction technologies (GURTs) in genetically-modified seeds in order to protect their privilege. GURTs introduce into the plant variety genetic elements that produce a toxin late in seed development, thus making the re-use of seeds technically impossible and obliging the farmer to buy seeds from the seed provider on a yearly basis, or to acquire specific chemicals which can activate germination. The reliance on GURTs has been provisionally halted due to adverse publicity. As noted by Dan L. Burk, the impact of their introduction would be worrisome:

> The development of technological use controls . . . may substitute private technological rules for the public statutory rules declared by the legislature. Where control over the design of information rights is shifted into the hands of private parties, those parties may or may not honor the public policies that animate public access doctrines such as the "farmer's exemption" [allowing farmers to exchange or sell seeds saved from the harvest of protected varieties]. Rights-holders can effectively write their own intellectual property statute in. . . DNA. Producers who employ lock-out technology may in essence become private legislatures, imposing rules of usage without regard to the broader public interest that informs democratic rule-making.[89]

2. The Reality of the Dependency

How real is the risk of dependency of farmers on commercial varieties? Formally, of course, farmers are not obliged to purchase PVP (plant variety protection)-protected seed just because it is made available, or because this is part of a subsidized program in support of agriculture. Indeed, ideally, commercial seed systems and farmers' seed systems should be allowed to coexist, and farmers should be allowed to choose between both and decide for themselves what is best suited to their own specific needs. However, whether farmers have real alternatives to acquiring their seed from the commercial system becomes increasingly questionable.

First, farmers often receive commercial varieties as part of a package that includes credit (often vouchers), seed, fertilizer, and pesticide. In many cases, acceptance of such packages is the only way farmers can access credit in rural areas. They must accept the whole package in order to do so. A strong pressure, therefore, weighs on them to adopt the new, improved varieties proposed, in effect, sometimes stripping them of the possibility of choosing. Such pressure may also come from the buyers of crops, particularly for the export sector, who may require from their suppliers that they use certain seeds which guarantee uniformity and stability, at the expense of diversity and variability, leading to progressive genetic erosion.

Second, the coexistence between farmers' seed systems—operating at local or community levels between farmers, and mostly informal—and commercial seed systems is sometimes problematic. Traditional varieties circulating through farmers' seed systems—and on which the vast majority of farmers in developing countries still rely for most crops—are often excluded from government-approved seed lists that countries maintain under their seed regulations, and they are seldom included in seed distribution programs subsidized by governments. Occasionally, the strengthening of IP rights can even constitute a direct impediment to innovation by farmers, since the preservation of agro diversity and the development of farmers' seed systems relies not only on the use of landraces (traditional, non-PVP-

[89] Dan Burk, Contractual and Technical Restrictions on Patent Limitations (June 2009) (unpublished paper, on file with the author).

protected varieties) but also on the saving, exchange, or sale of harvested seeds. Indeed, it is often the case that traditional varieties can be combined with modern varieties in order to produce varieties which perform better in specific local environments. The granting of patents on plants, genes, or DNA sequences, is an obstacle to such practices. The 1991 UPOV convention does not provide to breeders' rights the kind of extended protection patents provide. But its recent strengthening also represents a concern in this regard, since this convention now prohibits the commercialization of varieties which are essentially derived from a PVP-protected variety, and prohibits farmers from exchanging or selling seeds saved from the harvest of protected varieties.[90]

If these developments go unchecked, the end result may be a progressive marginalization and disappearance of local varieties.[91] It is therefore vital that states—particularly developing countries where the function of traditional, farmers' seed systems is even more important, both for the prevention of genetic erosion and for the livelihoods of farming communities—design *sui generis* forms of protection of plant varieties which allow these systems to flourish, even if this means adopting non-UPOV compliant legislation; and if they do join UPOV, they should use all the flexibilities available under the UPOV convention.[92]

Indeed, while the progressive replacement of traditional varieties by improved, commercial varieties may be consistent with a linear idea of progress favoring the replacement by high-yielding varieties of traditional crop varieties in the most productive areas, the implications for resource-poor farmers in disadvantageous agro-ecological environments are very problematic.[93] Farmers' seed systems may be particularly important precisely to this most vulnerable category of farmers because of the importance of locally adapted varieties for agricultural production in such environments. It is here that the limits of the dominant paradigm of what it means to "favor access to the benefits of scientific progress and its applications" (to borrow again from Article 15(1)(b) of the International Covenant on Economic, Social and Cultural Rights) become evident. Aiming to achieve food security simply by providing farmers with seeds that are high-yielding in certain conditions is premised on seeing food security as primarily a problem of production, when issues of accessibility are at least equally as important. The question which is omitted from this view is who will benefit from increased production, and the incomes of which groups will rise in comparison to those of other groups? As explained by Sperling et al.:

> While formal sector varieties are referred to as "improved" and the quality of the seed is

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[90] UPOV Convention, *supra* note 39, arts. 14(5), 15.

[91] *See* CONNY ALMEKINDERS & NIELS LOUWAARS, FARMERS' SEED PRODUCTION: NEW APPROACHES AND PRACTICES (1999); Niels Louwaars, Seeds of Confusion: The Impact of Policies on Seed Systems 29 (2007) (unpublished Ph.D. dissertation, Wageningen Universiteit).

[92] For instance, the Central America-Dominican Republic-United States Free Trade Agreement, *supra* note 51, mentions under art. 15.1, ¶ 5 (in note) that:

> The Parties recognize that the UPOV Convention 1991 contains exceptions to the breeder's right, including for acts done privately and for non-commercial purposes, such as private and non-commercial acts of farmers. Further, the Parties recognize that the UPOV Convention 1991 provides for restrictions to the exercise of a breeder's right for reasons of public interest, provided that the Parties take all measures necessary to ensure that the breeder receives equitable remuneration. The Parties also understand that each Party may avail itself of these exceptions and restrictions. Finally, the Parties understand that there is no conflict between the UPOV Convention 1991 and a Party's ability to protect and conserve its genetic resources.

[93] J.E. DOUGLAS, SUCCESSFUL SEED PROGRAMS: A PLANNING AND MANAGEMENT GUIDE (1980). *See also* Steven Jaffé & Jitendra Srivastava, *The Role of the Private and Public Sectors in Enhancing the Performance of Seed Systems*, 9 WORLD BANK RES, OBSERVER 97 (1994).

certified, these varieties often yield poorly in many smallholder cropping systems. Such new varieties may not be adapted to the local agro-ecological conditions and farmers may not possess the management inputs (for example fertilizers and pesticides) crucial for their growth.[94]

B. Intellectual Property Rights as an Incentive to Research

It has been recalled that the main justification for the strengthening of IP rights in agriculture, whether in the form of patents or in the form of plant breeders' rights, is that this would favor innovation by guaranteeing researchers that they will be rewarded for their investment. This, to a certain extent, seems to be succeeding. The marked increase in IP protection has led to a significant rise in patenting activity and in plant breeding.[95] However, a careful look at the impacts of IP rights on research leads to a much more nuanced picture. First, the extension of IP rights could in fact lead to obstruct the very research it is intended to favor. Second, the use of IP rights as an incentive to stimulate innovation has given research a direction that may not benefit the poor farmers in developing countries. These two limitations are reviewed in turn.

1. The Risks of Intellectual Property Rights Blocking Research

Excessive protection of breeders' rights and patents may discourage innovation in the name of rewarding it. Applied research and crop improvement is a cumulative process, based on pre-existing plant material. Each incremental improvement that involves a new technology, therefore, faces the constraints of IP and germplasm which accumulate in the plant material. In jurisdictions where patents can be granted on life forms,[96] there is a risk that further research will be impeded, rather than encouraged, as it would depend

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[94] Louise Sperling & Tom Remington with John M. Haugen, *Seed Aid for Seed Security: Advice For Practitioners*, *Practice Brief 5: Using Seed Aid to Give Farmers Access to Seed of New Varieties 1*, International Center for Tropical Agriculture and Catholic Relief Services (2006).

[95] For an evaluation of the impact of countries adopting UPOV-compliant legislation or joining UPOV, see INT'L UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS, REPORT ON THE IMPACT OF PLANT VARIETY PROTECTION, 335(E), (2005) [hereinafter UPOV REPORT] *available at* http://www.upov.int/export/sites/upov/en/publications/pdf/353_upov_report.pdf. Based on the examples of Argentina, China, Kenya, Poland, and the Republic of Korea, the report shows that accession to the UPOV convention stimulates new breeding work and the release in the country concerned of varieties developed by foreign breeders. The report on impact prepared by UPOV does not discuss the impacts of UPOV-compliant legislation, with the associated expansion of the commercial seed system, on farmers' seed systems.

[96] In the case of *Diamond v. Chakrabarty*, 447 U.S. 303 (1980), following a patent application for genetically engineering a bacterium capable of breaking down crude oil, the US Supreme Court decided that the creation of a live, human-made organism is patentable under 35 U.S.C. § 101. According to the terms of Sec 101: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title." The Court considered that while natural laws, physical phenomena, abstract ideas, or newly discovered minerals are not patentable under this section, a live artificially-engineered microorganism may be patented since "the patentee has produced a new bacterium with markedly different characteristics from any found in nature and one having the potential for significant utility. His discovery is not nature's handiwork, but his own." The US Supreme Court has more recently confirmed that neither the 1930 Plant Patent Act nor the Plant Variety Protection Act (PVPA) should

on the possibility to use patented material. The growing importance in recent years of patents on life-forms, itself the result of the progress of biotechnology, may result in increasing restrictions to both farmers' and research exemptions, which PVP regimes generally include.

A number of countries, including the Andean Pact Countries,[97] Brazil, and Argentina,[98] have chosen not to grant patents on plants. Countries not allowing patents on plants may grant research exemptions as an exception to the protection of plant breeders' rights. Such exemptions are fully allowed by the 1991 UPOV Convention. As already noted above, this convention provides for exceptions for "acts done privately and for non-commercial purposes [and] for experimental purposes"[99]; it allows national legislation that permits 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, the protected variety"[100]; and it provides for the possibility of restricting breeders' rights for reasons of public interest.[101]

But even those countries which chose to grant patents on plants may, consistent with Article 30 of the TRIPS Agreement,[102] introduce an exemption for research, although the practice varies across the countries that allow the granting of patents.[103] WTO Members comply with TRIPS provided the exception imposed on patent-holders' rights remains limited; and provided patent-holders can still "extract economic value from their patent and can claim a 'legitimate interest' in the economic benefits."[104] A

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be read as repealing by implication 35 U.S.C. § 101; *see* J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, 534 U.S. 124 (2001). In the EU, Directive 98/44/EC on the Legal Protection of Biotechnological Inventions (1998 O.J. (L 213) 13) provides that neither plant and animal varieties nor essentially biological processes for the production of plants or animals are patentable (Article 4(1)). However, Article 3(2) of Directive 98/44/EC provides that "biological material which is isolated from its natural environment or produced by means of a technical process may be the subject of an invention even if it previously occurred in nature." In two decisions of 1992, the European Patent Office (EPO) took the view that given the potential value of genetically modified plants for combating food shortages, exploitation of such genetically modified plants cannot be considered immoral or against public order: see Opposition Division, 13 Mar. 1992, (concerning European patent application bearing publication number 122.791, *Lubrizol (Plant Gene Expression*); and Opposition Division, 15 Dec. 1992, concerning European patent application bearing publication number 242.236, *IIC*, 1993, 618; Technical Board of Appeal, 21 Feb. 1995 (T 356/93) (Appeal on the decision of the Opposition Division, 15 Dec. 1992), *Plant Genetic Systems* case. *See generally* Geertrui Van Overwalle, Protecting Innovations in Plant Biotechnology: Patents or Plant Breeders' Rights?, Mededelingen van de Faculteit Landbouwwetenschappen Universiteit Gent (57 Proceedings of the Sixth Forum for Applied Biotechnology, Brugge) 1521 (1993).

[97] Subregional Integration Agreement of the Andean Community (Cartagena Agreement), Decision 486—Common Provisions on Industrial Property, art. 15(b), (14 Sept. 2000), *available at* http://www.wipo.int/wipolex/en/text.jsp?file_id=124600.

[98] For more, see Geertrui Van Overwalle, *Biotechnology and Patents: Global Standards, European Approaches and National Accents*, *in* GENETIC ENGINEERING AND THE WORLD TRADE SYSTEM 77 (Daniel Wüger & Thomas Cottier eds., 2008).

[99] UPOV Convention, *supra* note 39, arts. 15.1(i), (ii).

[100] *Id*. art. 15.2.

[101] *Id*. art. 17.1.

[102] TRIPS Agreement, *supra* note 36, art. 30, provides that WTO 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."

[103] For instance, while the Canadian Patent Act, R.S.C., ch. P-4 s. 55.2(1) (1985) provides for a research exemption, an equivalent provision in the United States, 35 U.S.C. § 271(e)(1) (2010), has been significantly narrowed in recent case-law. *See* Madey v. Duke Univ., 307 F.3d 1351, 1362 (Fed. Cir. 2002).

[104] Panel Report, *Canada–Patent Protection of Pharmaceutical Products*, ¶¶ 7.56, 7.61, WT/DS114/R (17 Mar. 2000).

broad reading of the limitations which can be imposed on the definition of patent rights contained in Article 28 of the TRIPS Agreement would be consistent with the intentions guiding the agreement. When they concluded the TRIPS as part of the Uruguay Round of trade negotiations, the governments recognized that

> [t]he protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.[105]

They also recognized that "[m]embers may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of [the TRIPS] Agreement".[106] And they noted that :

> [a]ppropriate measures, provided that they are consistent with the provisions of [the TRIPS] Agreement, may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.[107]

Whether or not they allow for patents on plants, and whether or not they are bound by UPOV 1991, countries may grant a "research exemption" to ensure that IP rights shall not impose obstacles to further research based on protected varieties. The granting of a research exemption may not be sufficient, however. For even when the obstacle of IP rights on the research material is removed, researchers face additional problems of delayed or blocked access to needed research tools because of poor functioning of material transfer agreements (MTAs).[108] Innovative techniques to overcome barriers to research on patented material may have to be developed further.[109] In situations where multiple patent holders have patents in one variety, forming a "patent thicket," a patent pool could be formed, through which those patent-holders agree to license one or more of their patents as a package to one another, and to third parties (users) willing to pay the associated royalties.[110] Clearinghouses could be set up in order to facilitate the matching between users and patent-holders, particularly in situations of "patent thickets". A

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[105] TRIPS Agreement, *supra* note 36, art. 7.
[106] *Id*. art. 8, ¶ 1.
[107] *Id*. art. 8, ¶ 2.
[108] Zhen Lei, Rakhi Juneja & Brian D. Wright, *Patents Versus Patenting: Implications of Intellectual Property Protection for Biological Research*, 27 NATURE BIOTECHNOLOGY 36 (2009).
[109] I have benefited for the preparation of this section from reading a paper by Geertrui Van Overwalle, Patents in Agricultural Biotechnology and the Right to Food (June 2009) *available at* http://www.fundp.ac.be/droit/crid/propriete/G.VAN%20OVERWALLE%20scope%20of%20Patent.pdf.
[110] It was found for instance that beta carotene, or Golden Rice, which because of its high content of vitamin A is of major interest for developing countries, embodied seventy patents, belonging to thirty-two different companies and universities. In order to overcome the resulting obstacles to the diffusion of Golden Rice, the key patent-holders were approached and agreed to grant licenses, free of charge, to developing countries, with the right to sub-license; a specific governing body (the Humanitarian Board) was established to this effect. *See* Michael Blakeney, *The Role of Competition in Biotechnological Patenting and Innovation*, 9 BIO-SCIENCE L. REV. 95 (2006).

major example of this in the area of agricultural biotechnology is the Public Intellectual Property Resource for Agriculture (PIPRA), an alliance of more than forty public institutions from more than twelve countries that seeks to decrease barriers created by intellectual property and to facilitate technology transfer by pooling their efforts to increase dissemination of innovations in staple and specialty crops, in particular by providing a one-stop IP information clearinghouse for access to public sector patented technologies. Finally, research can be encouraged by developing open source experiments such as the Biological Open Source (BiOS) License pioneered in Canberra by the Centre for Applications of Molecular Biology in International Agriculture (CAMBIA), which puts the GUS and TransBacter technologies at the free disposal of researchers in agricultural biotechnology, without any condition other than to ensure that any improvements made to these enabling tools will be shared under the BiOS open source license regime.

Where patents restrict research in ways which may have an impact on food security and are an obstacle to face situations of "national emergency" or other "extreme urgency," for instance in the face of declining crop productivity, Article 31 of the TRIPS Agreement allows compulsory licensing, i.e., the use "of the subject matter of a patent without the authorization of the right holder."[111] Inspiration may be sought in this regard from the Patents and Plant Variety Rights (Compulsory Licensing) Regulations adopted in the United Kingdom in 2002, which allow the application for a license to acquire or develop a new plant variety, which "constitutes significant technical progress of considerable economic interest in relation to the invention protected by the patent."[112] In addition, in line with the general purposes of the TRIPS Agreement recalled above, IP rights may be restricted in the public interest, for instance through the doctrine of eminent domain,[113] and developed countries may make available to developing countries any biotechnologies developed through public research without the need for a license or other permission.

In the short term, these tools may be appropriate to limit the negative impacts of the recent trend towards patent claims made following the adaptation of specific gene traits that could confer one or more forms of stress tolerance linked to climate change (including salinity, drought or flood, heat or cold). In the long term, it has been suggested by Michael Blakeney that a procedure be set up

> to grant nonexclusive licenses to any requesting party for the use of any patented tool of biotechnology for developing country and LDC food security purposes. The royalty rate would reflect the extent of the value forgone by the patent holder. This will often be zero, given that a northern patent holder will often not contemplate commercializing its technology in developing country markets. Also, . . . the patented technology will often be used in a non-agricultural context. This compulsory licensing could significantly enhance food security without undercutting the profitability of the northern invention.[114]

2. The Direction of Research: "Orphan Crops"

The promotion of innovation in agriculture through the incentive of IP rights has resulted in an imbalance

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[111] *Id.*.

[112] These Regulations implement Article 12 of Directive 98/44/EC of the European Parliament and of the Council on the legal protection of biotechnological inventions. Council Directive 98/44/EC, art. 12(3)(b), 1998 O.J. (L 213) 13.

[113] Michael R. Taylor & Jerry Cayford, *Biotechnology Patents and African Food Security: Aligning America's Patent Policies and International Development Interests*, 6 MINN. J.L. SCI. & TECH. 277 (2004).

[114] Michael Blakeney, Compulsory Licensing and Food Security 19 (June 2009) (unpublished manuscript, on file with author).

between the private and the public sectors in agricultural research. For a number of reasons, public research centers are less able to benefit from the protection of IP rights than private firms : as a result, they are often under-funded.[115] Because of its dependency on the private sector, most of agricultural research and development has been towards meeting the needs of farmers in rich countries, while the needs of poor farmers in developing countries have been comparatively neglected, despite commendable efforts from the public sector in these countries.[116] The private sector is driven by profit-seeking motives. It will, therefore, invest primarily where the returns can be expected to be highest. Very little research has benefited tropical maize, sorghum, millet, banana, cassava, groundnut, oilseed, potato or sweet potato, for example—sometimes referred to as orphan crops—and public research centers have not made up for the lack of interest of the private sector in these crops. Indeed, the evaluation by UPOV itself of the impact of countries adopting UPOV-compliant legislation or joining UPOV, acknowledges that "the development of new varieties of plants will be encouraged where there is commercial viability, but in cases where there is no existing, or potential, commercial market for varieties, the presence of a PVP system should not be expected to encourage the development of new varieties". In such cases, as acknowledged by the report, breeding should be supported by the public sector.[117]

V. Promoting Innovation in Agriculture: An Alternative Approach

In South Asia and Sub-Saharan Africa, the overwhelming majority of farmers still rely on traditional farmers' seeds systems in order to grow their crops. Reliance by farmers on farmers' seed systems allows them to limit the cost of production, by preserving a certain degree of independence from the commercial seed sector. The system of unfettered exchange in farmers' seed systems ensures the free flow of genetic materials, thus contributing to the development of locally appropriate seeds and to the diversity of crops. In addition, these varieties are best suited to the difficult environments in which they grow. They result in reasonably good yields without having to be combined with other inputs such as chemical fertilizers. Because they are not uniform, they may be more resilient to weather-related events or to attacks by pests or diseases. It is, therefore, in the interest of all, including professional plant breeders and seed companies who depend on the development of these plant resources for their own innovations, that these systems be supported. In order to achieve this, we must combine the discussion on IP rights on seeds and the debate on access to genetic resources under the CBD and the International Treaty on Plant Genetic Resources for Food and Agriculture. How can we strengthen the position of farmers vis-à-vis the seed companies that could be tempted to abuse their dominant position allowed by the protection of IP rights ? And how can we reward farmers for their contribution to the enhancement of agrobiodiversity seen as a global public good, and how can we promote innovations through farmers' seed systems? The promotion of farmers' seed systems should be seen both as an end in itself and, because it would broaden the choices open to farmers, as a way to improve the bargaining position of farmers against that of the seed companies.

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[115] *See* UNDP, HUMAN DEVELOPMENT REPORT 2001: MAKING NEW TECHNOLOGIES WORK FOR HUMAN DEVELOPMENT 102, tbl.5.1 (2002).

[116] While the private sector represented 41 percent of agricultural research and development globally in 2000, these investments were primarily concentrated in industrialized countries, in contrast, "only 6 percent of total investments in the developing world were derived from private firms." Nienke M. Beintema & Gert-Jan Stads, *Measuring Agricultural Research Investments: A Revised Global Picture* 4 (2008), *available at* http://www.asti.cgiar.org/pdf/Global_revision.pdf.

[117] UPOV REPORT on Plant Variety Protection, *supra* note 95, at 11.

A. Promoting and Protecting Farmers' Rights

A first step towards restoring an adequate balance between the rights of professional plant breeders and the incentives for them to innovate, on the one hand, and the need to reward farmers for the preservation and enhancement of plant genetic resources, on the other hand, is by strengthening the protection of farmers' rights under domestic and international law. The IT-PGRFA recognizes

> the enormous contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world.[118]

It refers to the responsibility of the states parties to realize farmers' rights, by (a) protecting traditional knowledge relevant to plant genetic resources for food and agriculture; (b) ensuring that farmers can equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and (c) protecting their right to "participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture."[119] Consistent with Article 1 of the International Treaty, this provision should be read with the CBD, which states that each party should,

> subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.[120]

Among the elements of farmers' rights as defined in the IT-PGRFA is "the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture."[121] The impact that could result from effectively implementing this principle cannot be overstated. Ideally, farmers should be actively involved in the design of legislation covering the certification and trade of seeds or the conservation of plant genetic resources, as well as of plant variety protection laws and laws regarding patents. This active participation should also be ensured for legislation or policies relating to the rest of agriculture (as opposed to the stewardship of plant genetic resources), since choices made in that area can significantly alter the structure of incentives for farmers who conserve genetic resources. In order to be effective, such participation presupposes capacity-building, for instance through information being provided to farmers' organizations or through the preparation of impact assessments accompanying proposals for all important changes in legislation or policies. Institutional innovations can contribute both to ensuring such participation and to building the capacity of farmers' organizations to take part in the decisions affecting them. In Thailand for instance, a

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[118] IT-PGRFA, *supra* note 73, art. 9.1.
[119] *Id*. art. 9.2.
[120] CBD, *supra* note 54, art. 8(j).
[121] IT-PGRFA, *supra* note 73, art. 9.2(c).

Local Wisdom Learning Centre has been established under the Ministry of Agriculture and Cooperatives, encouraging experience sharing between farmers and improving their ability to contribute to the identification of the solutions to the obstacles they face. In addition, a National Farmers' Council is being established, in order to enable farmers to participate in policy making processes and systematic planning of agricultural development as well as to protect and promote their interests.

The recognition of the other dimensions of farmers' rights can make an important contribution to the preservation of agro-biodiversity and, thus, to the protection of crop genetic diversity.[122] However, Article 9 IT-PGRFA by itself will not suffice. First, this provision remains vague and requires further implementation measures. It refers to farmers' "rights," but in the absence of remedies, no such rights exist in fact. The recognition of farmers' rights is highly uneven across the states parties to the International Treaty. Whereas plant breeders' rights and biotech-industry patents are defined and enforced at international level through UPOV and all WTO Members must ensure some protection of plant varieties under Article 27.3(b) of the TRIPS Agreement, farmers' rights are only recognized in principle, and in vague terms, in the IT-PGRFA. Furthermore, there exists no forum in which the implementation of farmers' rights in various settings is discussed, in order to provide benchmarks and examples of good practices from which Governments could seek inspiration.[123]

But progress is being made. At the Third Meeting of the Governing Body of the IT-PGRFA held in Tunis on 1-5 June 2009, it was agreed that member countries should review all measures affecting farmers' rights and remove any barriers preventing farmers from saving, exchanging, or selling seed; and that they should involve farmers fully in national and regional workshops on the implementation of Farmers' Rights. At the time of writing, the Secretary of the IT-PGFRA is collecting information on the implementation of farmers' rights for presentation at the next meeting, to be held in March 2011 in Bali. This peer review should encourage states to fully implement Article 9 of the IT-PGRFA. However, important though as it is -- if it is interpreted as requiring the removal of barriers to the saving, exchange, or selling of seeds --, the recognition of farmers' rights as specified under the Treaty shall not suffice, if farmers' seed systems are not supported, in addition, by appropriate public policies : section C below suggests what such policies might consist in.

B. From Direct and Bilateral Benefit-Sharing to Indirect and Multilateral Support for Agro Biodiversity Maintenance

Article 9 IT-PGRFA thus suffers from the weakness of its enforcement. But it exhibits another major deficiency. While the wording used in Article 9.2(b) suggests that protecting traditional knowledge may have to follow the model of IP rights, this quest may be misguided. Protection against the misappropriation of genetic resources is of course important, both as a matter of equity and as a means of preserving agro diversity. But it should not result in new enclosures preventing access to genetic resources as a common heritage. The sharing of genetic resources not only promotes diversity, it also can contribute to food security by favoring research on new varieties, a process of sharing of, and improvement on, genetic resources in which farmers are actively involved now, and should remain so in

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[122] *See* REGINE ANDERSEN, Governing Agrobiodiversity: Plant Genetics and Developing Countries (2008).

[123] For a collection of seventeen "success stories" in the implementation of farmers' rights as defined in IT-PGRFA, *supra* note 73, art. 9, covering eleven countries, see REGINE ANDERSEN & TONE WINGE, FRIDTJOF NANSEN INST., The Farmers' Rights Project—Background Study 7: Success Stories from the Realization of Farmers' Rights Related to Plant Genetic Resources for Food and Agriculture (2008). For a very valuable collection of resources on this issue see Farmers' Rights Project, Fridtjof Nansen Institute, *available at* http://www.farmersrights.org.

the future.[124]

As we have seen, this is one reason why the CBD may be more appropriate for the management of plant genetic resources for pharmaceutical uses than for food and agriculture. Indeed, the adoption of the IT-PGRFA was an implicit recognition of this difference, although it remained short of drawing all the consequences thereof since the crops not listed in annex I to the International Treaty still remain within the CBD framework. The specificity of plant genetic resources used for food and agriculture is also relevant for the implementation of farmers' rights under the IT-PGRFA. Article 9.2(b) of the International Treaty concerns the right to participate equitably in the sharing of benefits arising from the utilization of plant genetic resources for food and agriculture. However, such benefits should not only accrue to those few farmers who happen to have plant varieties that are utilized by commercial breeding companies. Instead, in recognition of the fact that genetic resources constitute a common heritage to which generations of farmers across the globe have contributed, they should be shared with farmers in all countries engaged in the conservation and sustainable use of agro biodiversity.

Indeed, this has traditionally been the approach of the FAO, since the adoption on 29 November 1989 of Resolution 5/89 of the FAO Conference on farmers' rights. That resolution is based on the recognition that "plant genetic resources are a common heritage of mankind to be preserved, and to be freely available for use, for the benefit of present and future generations," and that the contribution of farmers, "unnumbered generations of [which] have conserved, improved and made available plant genetic resources," need to be better recognized and rewarded. This justifies the recognition of farmers' rights, "vested in the International Community, as trustee for present and future generations of farmers, for the purpose of ensuring full benefits to farmers, and supporting the continuation of their contributions."

Such an approach is multilateral and indirect, because plant genetic resources are considered to be conserved and improved by the undifferentiated community of farmers worldwide -- a contribution for which they should be rewarded, and which they should be incentivized to continue. This differs from the approach to benefit-sharing under the Convention on Biological Diversity, which is instead bilateral and direct insofar as "benefits are to be shared between purported 'owners' and buyers of the resources."[125] But benefit-sharing as conceived under the CBD has failed. In spite of the existence of a number of legislations in developing countries which foresee forms of direct benefit sharing between the owners and buyers of genetic resources, often on the basis of prior informed consent on mutually agreed terms, as set out in the CBD, "so far there have been no examples of direct benefit sharing between providers and recipients of plant genetic resources for food and agriculture resulting from such legislation."[126] In addition, should the approach favored under the CDB overcome the obstacles it has been facing hitherto, now that the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization has been adopted,[127] this could have perverse consequences. Because the demand for farmers' varieties among commercial breeders remains limited, so would the number of beneficiaries among farmers, and the vast majority of farmers would remain uncompensated for their contribution to the maintenance and improvement of the common pool of genetic resources. Additionally, a system of direct benefit-sharing between suppliers owning the resources and buyers commercializing them could lead to "disincentives to share seeds and propagating material among

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[124] Sabrina Safrin, *Hyper-ownership in a Time of Biotechnological Promise: The International Conflict to Control the Building Blocks of Life*, 98 AM J. INT'L L. 641 (2004). On the contribution of farmers' rights to the preservation and enhancement of agrobiodiversity, see Martin A. Girsberger, *Biodiversity and the Concept of Farmers' Rights in International Law – Factual Background and Legal Analysis* (Bern: Peter Lang, 1999).

[125] Fridtjof Nansen Institute, Information Paper on Farmers' Rights, ¶ 2.2, 20 May 2009, *available at* http://www.farmersrights.org/pdf/FNI-infopaper-on-FR-GB3.pdf.

[126] *Id.*

[127] *See* Nagoya Protocol, *supra* note 63.

farmers, because of expectations of personal benefit, or the expectations of individual communities to benefit."[128] In other terms, it would encourage privatization -- in the etymological sense of allowing owners to exclude others --, when what is needed is to recognize the status of genetic resources as a common good that should be more widely accessible.

C. Supporting Farmers' Varieties and Associated Knowledge

Rather than preventing access to traditional varieties and associated knowledge by creating a new system of enclosures, then, what is required is to move toward forms of indirect and multilateral support for the maintenance of agro biodiversity. States should provide proactive support for the development of traditional varieties.[129] In order to encourage farmers who conserve and sustainably use plant genetic resources for food and agriculture, extension services could be provided to them specifically, and other incentives could be put in place, such as to facilitate the marketing of their produce or to provide them easier access to credit. In the absence of proactive policies aimed at preserving and encouraging the development of farmers' seed systems and associated traditional knowledge and practices, such systems risk disappearing, as a result of the various kinds of pressures discussed above. In order to ensure that traditional knowledge is kept alive and can further develop among farmers, a number of policies could be adopted.[130]

1. Making Seed Regulations More Hospitable to Traditional (Farmers') Varieties

As we have seen, one kind of pressure on farmers' seed systems stems from the fact that seed regulations (national seed certification schemes) may only catalogue commercial varieties which are PVP-protected (since only these present the stability and uniformity required for cataloguing), and either explicitly exclude the trade of non PVP-protected seeds or lead to *de facto* exclusion of traditional varieties, since these are normally not genetically homogeneous enough to meet the requirements for approval and certification.[131] The reform of seed regulations may therefore be considered. Traditional varieties and associated knowledge could be documented in catalogues and gene banks, and farmers contributing to these banks could be compensated. In the EU, the existing seed certification scheme[132] was amended in 2008 in order to encourage *in situ* conservation and the sustainable use of plant genetic resources, landraces and varieties which are naturally adapted to local and regional conditions but are threatened by genetic erosion. The purpose of this amendment is to allow such varieties (referred to as "conservation

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[128] *Id*.
[129] *See* IFPRI & FAO, *Local Markets, Local Varieties. Rising Food Prices and Small Farmers' Access to Seed*, IFPRI Issue Brief 59 (Feb. 2009) (based on case-studies from Mali, Kenya, and India).
[130] Fridtjof Nansen Institute, *supra* note 125, ¶ 2.1.
[131] *See* Shabnam Anvar, *Semences et droit. L'emprise d'un modèle économique dominant sur une réglementation sectorielle*, Doctoral Thesis, Université de Paris I-Panthéon-Sorbonne (2008).
[132] Council Directive 2002/53/EC, on the common catalogue of varieties of agricultural plant species, 2002 O.J. (L 193), 1 (as last amended by Commission Regulation (EC) No 1829/2003 of the European Parliament and of the Council (2003 O.J. (L 268) 1)); *see also* Council Directive 2002/54/EC on the marketing of beet seed (2002 O.J. (L 193) 12) (as last amended by Council Directive 2004/117/EC (2005 O.J. (L 14) 18); and Council Directive 2002/56/EC on the marketing of seed potatoes (2002 O.J. (L 193) 60) (as last amended by Commission Decision 2005/908/EC (2005 O.J. (L 329) 37)).

varieties") to be grown and marketed even where they would not otherwise comply with the general requirements in regards to the acceptance of varieties and the marketing of seed and seed potatoes. Derogations are therefore provided for the inclusion of conservation varieties in the national catalogues of varieties of agricultural plant species as well as for the production and marketing of seed and seed potatoes of those varieties.[133] While these derogations are still subject to extremely restrictive conditions, and should be significantly expanded in the future before they can truly encourage these varieties to be maintained, the reform goes in the right direction.

Other encouraging developments have been reported. Farmers' rights are protected under the Indian Protection of Plant Varieties and Farmers Rights Act of 2001. Farmers may apply for registration of any new variety they have bred or developed, under the same conditions as breeders; farmers who are engaged in the conservation of diverse varieties of plants may apply to be rewarded through the National Gene Fund; and "a farmer shall be deemed to be entitled to save, use, sow, resow, exchange, share, or sell his farm produce including seed of a variety protected under this Act in the same manner as he was entitled before the coming into force of this Act,"[134] although he or she "shall not be entitled to sell branded seed [any seed put in a package or any other container and labeled in a manner indicating that such seed is of a protected variety] of a variety protected under this Act."[135] The preservation of a traditional system of farmers' seed systems alongside the formal seed system, ensures that poor farmers will not have to spend on buying seeds. It also favors the maintenance and development of diversity in plant varieties and seeds, which as we have seen, is vital for agricultural development and long-term food security. In Senegal, peasant-farmers hold community registers of peasant varieties since 2003, a similar initiative where interesting or rare peasant varieties are described and listed so they can be circulated and disseminated more easily.[136] International support for such programs, for instance through the FAO, should be expanded in the future.

2. Local Seed Exchanges, Community Seed Banks, and Seed Fairs

Local seed exchange is an important component of seed supply and diffusion in regions where the seeds of traditional varieties are not available on the markets. It also helps the exchange of knowledge associated with its conservation and use. Initiatives favoring the development of local seed exchanges could be scaled up, by the support of community seed banks and seed fairs. Seed fairs bring together local farmers who have surplus seed of traditional food crops to sell or trade with other farmers looking for such seed. In some cases, the poorest seedless farmers receive vouchers from the government, which can be exchanged for seed at the fair. This allows the farmers to select and buy their preferred seed varieties. Community seed banks pool the seed material from member farmers. Appropriate institutional arrangements can ensure the availability of planting material at the appropriate time as well as an adequate diversity of varieties.[137] Such community seed banks exist in countries such as the Philippines

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[133] *See* Commission Directive 2008/62/EC, Providing for Certain Derogations for Acceptance of Agricultural Landraces and Varieties Which are Naturally Adapted to the Local and Regional Conditions and Threatened by Genetic Erosion and for Marketing of Seed and Seed Potatoes of Those Landraces and Varieties, 2008 O.J. (L 162) 13.

[134] *Protection of Plant Varieties and Farmers' Rights Act 2001*, *supra* note 53, §39.

[135] *Id*.

[136] INT'L INST. FOR ENV'T & DEV., PEASANTS SEEDS: THE FOUNDATION OF FOOD SOVEREIGNTY IN AFRICA (2008).

[137] FAO, SWAMINATHAN RESEARCH FOUND., Rural and Tribal Women in Agrobiodiversity Conservation: An Indian Case Study, RAP Publication 2002/08 (2002).

and India and frequently emanate from grassroots organizations. In India, the organization Navdanya has established thirty-four seed banks in thirteen states across the country in the last two decades. Operating through a network of community seed banks in different ecozones assists the maintenance and improvement of agricultural biodiversity. In Mali, some seed banks contain more than 350 samples of seventy different species.

Apart from their contribution to agrobiodiversity, these systems make farming more affordable for cash-strapped farmers, and they ensure access to seeds that can be highly productive in specific agro-ecological environments. They could be further scaled up for a larger contribution to food security. Incentives for the use of food products that emanate from these systems in processing and marketing, or through public procurements schemes, could further help maintain and enhance agro biodiversity, at the same time brining much needed additional incomes to vulnerable groups. One note of caution is in order, however. Seed banks may be expensive and they are not sufficient, in isolation, to develop the world's genetic material and the associated traditional knowledge. Instead, it is in everyone's interests (including that of the seed industry) to conserve seeds *in situ*, i.e. within smallholder agro ecosystems. Local farmer-run seed banks must therefore be combined with local grain reserves of landraces, and smallholders should be supported by improved land security, fair markets, access to credit, and extension services.

D. Putting Science at the Service of Farmers: Participatory Plant Breeding

While there is a tension between the strengthening of IP rights and farmers' rights, it is at the same time important to identify the considerable contributions that scientific research can make to improve the livelihoods of the most marginalized farmers. Participatory plant breeding (PPB), for instance in Nepal, exemplifies the potential complementarities between the most advanced science and the needs of local communities. PPB intends to answer the needs of small farmers living in poor and marginal areas for which conventional breeding has offered few suitable varieties. PPB emanates from the regions which were neglected by the Green Revolution model of agriculture, which focused on breadbasket regions and, consequently, did not deliver new plant varieties for small-scale farmers working under unstable and difficult growing conditions.

In PPB, farmers are treated as partners by researchers who work directly with them, often combining traditional seeds with modern varieties. Most of the testing takes place on the farm. This ensures that the research undertaken is relevant to the farmers' needs and that, since local varieties are used, the resulting varieties will be suited to the local environment. It also is empowering—particularly for poor rural women who often preserve the best seed for planting and therefore play a key role in managing plant genetic resources. Additionally, it gives farmers a greater measure of control over their livelihood. PPB programs already exist in Syria, Egypt, Eritrea, Mali, Nepal, Yemen, Nicaragua, and Honduras.[138]

PPB programs can be started in Farmer Field Schools (FFS), which aim to make farmers experts in their own fields. Originally introduced as part of the integrated pest management approach that emerged in the 1980s as a reaction to the environmental and social consequences of the Green revolution

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[138] Gerry Toomey, Int'l Dev. Research Ctr., *Farmers as Researchers: The Rise of Participatory Plant Breeding*, 1999, *available at* http://www.idrc.ca/ev_en.php?ID=5559&ID2=DO_TOPIC ; Michael L. Morris & Mauricio R. Bellon, *Participatory Plant Breeding Research: Opportunities and Challenges for the International Crop Improvement System*, 136 EUPHYTICA 21 (2004).

model, FFSs enable farmers to reduce their use of pesticides and rely instead on endogenous skills, knowledge, and resources. Indeed, varieties are only one element in productive farming systems. Better soil management techniques, composting, water management, and agronomic practices may have an equal or greater impact upon productivity than the variety itself.

VI. Conclusion

In April 2008, the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), the result of a four years process which involved 400 experts from all regions and was co-sponsored by the World Bank, FAO, UNEP, UNDP, WHO, UNESCO, and GEF, presented governments with the most recent and comprehensive assessment of agriculture. It reached the conclusion that "[t]echnologies such as high-yielding crop varieties, agrochemicals and mechanization have primarily benefited the better resourced groups in society and transnational corporations, rather than the most vulnerable ones. To ensure that technology supports development and sustainability goals, strong policy and institutional arrangements are needed."[139] Research and development in agriculture must be guided, not by a preconceived view about the benefits technology can bring to farming, but by a careful examination of its impacts on food security and, specifically, on the ability of the most vulnerable farmers to improve their livelihoods.

The dominant paradigm of agricultural development favors the strengthening of IP rights in order to promote and reward innovation by the private sector, and the provision of improved seed varieties to farmers in order to help them produce higher yields. But this model may leave out precisely those who need most to be supported, because they are the most vulnerable, living in the most difficult environments. There are other ways of putting science at the service of farmers, which may better suit the needs of this category, and which public policies may have to pay greater attention to in the future.

While this contribution has focused on the notion of scientific progress as applied to agricultural production, more general lessons can be drawn. First, progress in science is not to be conceived as unilinear. Different paths may be explored, and which paths are pursued can make a significant difference. In order to ensure that scientific progress truly contributes to the advancement of broader aims, such as human development and human rights, the impacts of these different paths should be carefully measured, and the choices made by states as to which kind of progress to support, assessed on that basis. It follows that granting a right to "benefit from scientific progress and its applications" cannot be conceived independently of the views of the intended beneficiaries. Ideally, participatory mechanisms should be put in place, in support of and informed by impact assessments, in order to guide the choices that are made.

Second, there may be a tension between the right to enjoy the benefits of scientific progress and the continued strengthening of IP rights.[140] The most visible, and indeed the most widely discussed,

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[139] IAASTD, Summary for Decision Makers of the Global Report 23 (2008).

[140] It would be inappropriate to frame the issue as one of human rights in conflict with one another. Instead, a clear distinction should be made between human rights and the granting of monopoly privileges as IP rights. Not making this distinction would result in confusing the ends with the tools which may serve to achieve them. ICESCR, *supra* note 8, art. 15, ¶ 1(c), guarantees the right of everyone to benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he or she is the author. But this human right benefits only natural persons and not legal persons. In addition, the Committee on Economic, Social and Cultural Rights takes the view that the private interests of authors should not be unduly favored and that the public interest in enjoying broad access to their productions should be given due consideration. The Committee concludes

manifestation of this tension is between the right of those holding patents or other IP rights on the one hand, and those unable to access the knowledge or technology that is protected by the granting of a temporary monopoly to the right-holder, on the other hand. Especially when combined with excessive concentration within certain sectors, IP rights that are too far-reaching allow the rights holders to capture a disproportionate revenue in reward of their investment. In general, a more systematic use of antitrust legislation in order to combat abuses of economic power should make it possible to surmount this barrier. In contrast, a difficulty that may be underestimated in the discussions on the impact of IP rights on the right to benefit from scientific progress and its applications is the direction that IP rights give to scientific research. Profit-driven research serves the needs of the high-value segments of the markets, while neglecting the real needs of the poorest and most marginalized groups. A strong role for public investment in research is required in order to compensate for this imbalance.

Third, institutions matter. The right to benefit from scientific progress and its applications may require, for instance, that vulnerable communities are better organized in order for knowledge to be transmitted, and "owned" horizontally rather than imposed, or delivered, from above. Farmer field schools and participatory plant breeding are examples in the field of agricultural research. Scientific progress for the poorest cannot be conceived without the poorest, whose needs are sometimes misunderstood, even by the scientists pursuing their research with the best intentions. Participatory research is also empowering and may constitute a powerful curb to a path of technological development that, by benefiting primarily those who are already well connected or who have the highest purchasing power, would increase inequalities both within societies and between societies. Just like economic growth is not poverty-reducing per definition, scientific progress may, or may not, be conceived in ways that serve farmers who need it most.

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that intellectual property is a social product and has a social function, and notes explicitly that States parties thus have a duty to prevent unreasonably high costs for access to plant seeds or other means of food production. *General Comment No. 17: The Right of Everyone to Benefit from the Protection of the Moral and Material Interests Resulting from Any Scientific, Literary or Artistic Production of Which He or She is the Author, adopted* Nov 2005, U.N. ESCOR, Comm. on Econ., Soc. & Cult. Rts., 35th Sess., ¶ 35, U.N. Doc. E/C.12/GC/17 (2006).