

1. Marginalization of Small Farmers	604
2. Potential Increase in Food Production	605
3. Enhancement of the Nutritional Quality of Food	606
4. Production of Crops That Can Withstand Environmental Stresses	607
B. Environmental Impacts of GM Crops	607
1. Erosion of Biodiversity	607
2. Acceleration of Resistance to Herbicides and Insecticides	608
3. Genetic Pollution and the Creation of Superweeds	608
4. Harm to Non-Target Organisms	609
C. The Environmental Justice Implications of GMOs	610
III. The International Regulatory Framework for Trade in GMOs	611
A. The SPS Agreement	611
B. The Biosafety Protocol	613
C. The EC-Biotech Decision	615
1. Broad Scope of the SPS Agreement	616
2. Narrow Interpretation of Justified Delay in the Implementation of GMO Approval Procedures	618
3. Narrow Scope of Provisional Measures Under Article 5.7 of the SPS Agreement	620
4. Limited Relevance of International Law in Interpreting WTO Rules	622
D. The GMO Regulatory Framework through an Environmental Justice Lens	624

IV. Alternative Approaches to Promote International Environmental Justice	625
A. Recognition of the Primacy of Human Rights Law	626
B. Mitigation of North-South Inequality	628
1. Common But Differentiated Responsibility	631
2. Special and Differential Treatment	633
C. Mitigating the Abusive Practices of Transnational Corporations	637
D. Empowerment of Historically Subordinated Communities	639
Conclusion	641

*584 INTRODUCTION

On September 29, 2006, a World Trade Organization (WTO) dispute settlement panel issued its final decision (the EC-Biotech decision) in the complaint brought by the United States, Canada, and Argentina against the European Communities (EC) over the EC's alleged moratorium on the approval and marketing of agricultural and food products containing genetically modified organisms (GMOs). [FN1] The panel concluded that the EC had applied a *de facto* moratorium on the approval of biotech products between June 1999 and August 2003 and that this moratorium resulted in "undue delay" in the EC's GMO pre-marketing approval procedures in violation of the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement). [FN2] The panel also struck down individual EC Member states' national GMO bans on the grounds that these measures were not based on risk assessments. [FN3]

The trade impasse over GMOs has its genesis in the conflicting approaches of *585 the United States and the EC to the regulation of biotechnology. [FN4] The United States has adopted a product-oriented approach, which assumes that the process of transferring genes from one species of plant, animal, or virus to another does not pose greater risks to human health and the environment than conventional plant breeding technologies such as hybridization. [FN5] Consequently, genetically modified products are not subjected to stricter regulatory scrutiny than their conventional counterparts absent some tangible alteration in the physical characteristics and properties of the end product. [FN6] By contrast, the EC has adopted a process-oriented approach, which assumes that genetically altered products may pose novel or unique human health and environmental risks as a consequence of genetic modification. [FN7] Genetically altered products are therefore subject to a pre-marketing approval process involving extensive risk evaluation and public input. [FN8] In addition, genetically modified products must bear a label indicating the presence of GMOs and must be traceable through the production and distribution chain via an elaborate information tracking system. [FN9]

The EC-Biotech decision did not resolve the polarized transatlantic debate over the regulation of biotechnology. The panel did not address the safety of GMOs, the right of countries to regulate genetically modified products more stringently than their conventional counterparts, or the consistency of the EC's pre-marketing approval legislation

with WTO obligations. [FN10] The panel did not rule on the legal status of the precautionary principle [FN11] or explain why it did not *586 find the leading biodiversity and biosafety treaties relevant to its interpretation of the SPS Agreement. [FN12] Instead, the panel's findings were based primarily on the narrow procedural determination that the EC's moratorium violated Annex C(1)(a) and Article 8 of the SPS Agreement, which prohibit "undue delay" in product approval procedures. [FN13] Maintaining that the moratorium had been lifted in 2004, the EC declared that the panel's decision would have no practical impact on its regulatory practices [FN14] and declined to seek appellate review. [FN15]

The ongoing trade and regulatory conflict between the United States and the EC over GMOs has obscured the intense debate in the developing world over the environmental and socioeconomic implications of this technology. Proponents of biotechnology contend that genetically modified (GM) crops will alleviate hunger and protect the environment in the developing world by increasing agricultural productivity, enhancing nutritional quality, reducing the use of pesticides and herbicides, and producing crops that can withstand environmental stresses, such as drought, heat, frost, and soil salinity. [FN16] Opponents of biotechnology have argued that GM crops will increase the use of pesticides and herbicides, irreversibly diminish biodiversity, undermine traditional agricultural practices, accelerate the corporate takeover of the global food supply, and increase hunger and poverty by benefiting commercial agribusiness at the expense of small farmers. [FN17]

*587 Developing countries attempting to devise appropriate biotechnology regulation must contend with the economic power and influence of the United States and the EC. [FN18] Although the vast majority of GM crops are grown in the United States, Canada, Argentina, China, and South Africa, [FN19] U.S. agribusiness has been promoting the cultivation of GMOs in the developing world. [FN20] The United States has conditioned bilateral free trade agreements and development assistance on the acceptance of GMOs. [FN21] Indeed, the United States has gone so far as to offer GM seeds as food aid to famine-stricken countries in sub-Saharan Africa, leading to accusations by the EC and by many nongovernmental organizations that the United States was exploiting a humanitarian crisis in order to expand the market for GMOs. [FN22] Many African countries refused the proffered "aid" out of concern about the potential human health and environmental impacts of GMOs. [FN23] Likewise, the EC's stringent food safety rules, particularly the traceability and labeling requirements, have compelled many developing countries to forego all GM crops for fear of losing lucrative EC markets due to the difficulty of segregating GM and non-GM products. [FN24]

Developing countries' attempting to regulate agricultural biotechnology must also contend with unresolved legal questions about the relationship between international trade law and international environmental law. [FN25] A substantial body of legal scholarship has examined the overlap and the conflict between the trade and environmental agreements that govern the transboundary movement of *588 GMOs, particularly the SPS Agreement and the Cartagena Protocol on Biosafety to the Convention on Biological Diversity. [FN26] There has been heated disagreement over the extent of the overlap between those agreements and which agreement should prevail in the event of a conflict. [FN27] As explained above, the recent decision in the EC-Biotech case left many questions unanswered.

This article contributes to the trade and environment literature and to the literature on environmental justice by reframing the dispute over GMOs as an environmental justice issue and by placing this controversy in the context of the historic and ongoing dispute between developed and developing countries over the rules governing trade in conventional agricultural products. [FN28] The article argues that GMOs cannot be evaluated in clinical isolation from the larger controversies over agricultural trade and that environmental justice is a useful framework for integrating the environmental, human rights, and trade concerns raised by GMOs. By grounding its analysis in environmental justice, the article seeks to highlight the unique risks and benefits of biotechnology for developing countries, to examine the deficiencies in the existing trade and environmental agreements applicable to GMOs, and to propose an alternative approach compatible with environmental justice.

Part I of the article explains the relevance of environmental justice to the controversy over GMOs and places the GMO debate in historical context. Part II analyzes the socioeconomic and environmental risks and benefits of agri-

cultural *589 biotechnology for developing countries. Part III examines the international regulatory framework applicable to agricultural biotechnology, discusses the WTO dispute settlement panel's decision in the EC-Biotech case, and assesses the adequacy of this regulatory framework for addressing the environmental justice implications of GMOs. Part IV proposes an alternative regulatory framework that promotes environmental justice by better integrating trade, environmental protection, and human rights.

I. ENVIRONMENTAL JUSTICE AND THE GMO CONTROVERSY

In order to explain the relevance of environmental justice to contemporary debates over GMOs, this Part provides a brief overview of the scholarly literature on environmental justice and highlights several themes of particular relevance to an environmental justice analysis of agricultural biotechnology. It then examines the causes of environmental injustice in the developing world by analyzing the relationship among poverty, hunger, and environmental degradation. Finally, it places the controversy over GMOs in historical context in order to underscore the underlying structural inequities in agricultural trade and production that perpetuate environmental injustice in developing countries.

A. INTERNATIONAL ENVIRONMENTAL JUSTICE: INTEGRATING HUMAN RIGHTS AND ENVIRONMENTAL PROTECTION

Environmental justice refers to both a social movement in developed and developing countries [FN29] and an increasingly important paradigm through which to evaluate domestic and international environmental law. [FN30] Much of the environmental justice literature in the United States has emphasized the disproportionate concentration of environmental hazards in poor and minority communities. [FN31] The location of hazardous waste landfills, polluting industry, and other undesirable facilities in these communities exposes the most socially and economically *590 disadvantaged populations to the health risks associated with high levels of air and water pollution. [FN32] Environmental justice is also concerned with the inequitable distribution of environmental amenities (such as parks, recreation areas, and open space) [FN33] and vital environmental services (such as flood control and emergency response). [FN34] For example, the inadequate rescue and relocation of thousands of mostly African-American, public transit-dependent New Orleans residents by federal, state, and local officials in the aftermath of Hurricane Katrina brought into sharp relief the fact that poor people and people of color are disproportionately burdened by environmental hazards, under-protected by governmental authorities, and underserved by public projects and amenities. [FN35]

The scholarship on international environmental justice has likewise emphasized the inequitable distribution of the environmental costs of globalization between developed and developing countries and the disproportionate concentration of environmental hazards in poor and marginalized communities in the developing world. [FN36] In the context of the most widely recognized environmental problems (such as the hazardous waste trade, climate change, and deforestation), the development policies and consumption patterns of developed countries are placing unsustainable pressures on the global environment, and developing countries and poor populations across the globe are bearing a disproportionate share of the environmental costs. [FN37]

This distributional inequity is most evident in the export of polluting industries and hazardous wastes from wealthy, developed countries to poor developing *591 countries in Asia, Africa, and Latin America. [FN38] Developing countries have become attractive sites for hazardous waste disposal due to weak environmental regulation and lax enforcement. [FN39] Furthermore, poverty and debt create strong incentives for developing countries to sacrifice the health and well-being of their citizens by accepting hazardous waste shipments from wealthy nations. [FN40] While elites in developing countries may be able to insulate themselves from the consequences of the hazardous waste trade by residing in communities with better air and water quality, the poor often live and work in close proximity to environmental hazards. [FN41] Despite efforts by the international community to regulate the hazardous waste trade by treaty, the illegal export of hazardous waste remains a pressing environmental concern. [FN42] In

September 2006, for example, thousands of people in the Ivory Coast were exposed to a toxic cocktail of petrochemical waste and caustic chemicals when a Greek-owned tanker leased by a Swiss corporation headquartered in the Netherlands dumped its deadly cargo just outside the city of Abidjan. [FN43]

Distributional inequity is also evident in the context of natural resources. The vast majority of the world's poor are located in rural areas in the developing world, and depend on forests, fisheries and agriculture for their livelihoods. [FN44] Ecosystem goods and services (including crops, lumber, fish, and agro-forestry products, as well as services such as flood control and maintenance of soil fertility) are often the only capital assets to which the poor have access. [FN45] Regrettably, rural dwellers in developing countries often find themselves in direct conflict with powerful industries (such as large-scale agriculture, commercial fishing, mining, or logging) over access to natural resources. [FN46] Lacking the ability to obtain redress through government bureaucrats, lawmakers, or courts, these rural dwellers often resort to extra-legal collective action in order to resist environmentally destructive projects that deprive them of the ecological necessities of life, such as food, water, and land. [FN47] Many environmental justice struggles in developing countries have been spearheaded by local and indigenous farming communities in opposition to development strategies that threatened their lands, *592 their livelihoods, and the health of their ecosystems. [FN48] These environmental justice struggles draw their activist base from economically and politically marginalized communities directly affected by environmental degradation who view the environmental conflict as part of a larger struggle for social and economic justice. [FN49]

One of the objectives of environmental justice is to promote equitable access to environmental necessities and to ensure that no communities are disproportionately burdened by environmental degradation. [FN50] Human rights law is an important tool for securing environmental justice. Indeed, environmental justice is premised on fundamental human rights, including the rights to life, health, and cultural integrity, as well as the emerging right to a healthy environment. [FN51]

Food is the quintessential environmental necessity without which human life cannot be sustained. The right to food is recognized as a fundamental human right in Article 25 of the Universal Declaration of Human Rights [FN52] and in Article 11 of the International Covenant on Economic, Social and Cultural Rights. [FN53] The United Nations Convention on the Rights of the Child also imposes a duty on governments to provide adequate food. [FN54] Food security is therefore an important environmental justice issue. [FN55]

Based on the foregoing overview of the environmental justice literature, an environmental justice analysis of agricultural biotechnology must evaluate both the socioeconomic and environmental implications of this technology. It must *593 examine the impact of this technology on food security and on the livelihoods of vulnerable populations in developing countries, such as small farmers and indigenous communities. Finally, it must assess the North-South distribution of the benefits and burdens of this technology.

B. THE ROOTS OF INTERNATIONAL ENVIRONMENTAL INJUSTICE: POVERTY, HUNGER AND ENVIRONMENTAL DEGRADATION

In order to evaluate the environmental justice implications of agricultural biotechnology, it is important to understand both the extent and the underlying causes of hunger and natural resource degradation in the developing world.

Although per capita food production has increased dramatically in recent decades, there are over 800 million people in the developing world who suffer from chronic hunger and malnutrition. [FN56] Malnutrition contributes to the death of nearly six million children every year in developing countries [FN57] and costs developing countries billions of dollars in foregone economic activity. [FN58] Despite the commitment by member countries of the United Nations to halve the number of undernourished people in the world by 2015 (using 1990-1992 as a baseline), virtually no progress has been made toward this target in recent years. [FN59]

Food insecurity in the developing world is often exacerbated by ill-conceived agricultural development projects that favor large-scale, industrial production of crops and animals at the expense of the needs of small farmers. [FN60] These large-scale industrial agricultural projects also generate a wide range of environmental problems that compromise food production, including deforestation, soil degradation, loss of biodiversity, and contamination of surface and groundwater supplies. [FN61] Indeed, according to the United Nations Millennium Ecosystem Assessment Report, natural resource degradation is occurring most rapidly in the world's poorest regions and threatens to increase poverty and exacerbate hunger by disrupting vital ecosystem services, such as water filtration, soil formation, flood control, crop pollination, and food provision. [FN62]

Four basic propositions shed light on the underlying causes of hunger and environmental degradation in the developing world and suggest potential solutions.

***594** First, hunger in the developing world is a function of poverty rather than food scarcity. In the last several decades, global food production has far outpaced population growth, [FN63] and many developing countries experiencing chronic malnutrition are net food exporters. [FN64] People go hungry because they are poor--because they lack the means with which to purchase or grow food. [FN65] Efforts to tackle undernourishment must therefore focus on poverty reduction rather than merely boosting food production.

Second, poverty and undernourishment are predominantly concentrated in rural areas in the developing world. Despite the global trend toward urbanization, some seventy-five percent of the developing world's poor reside in rural communities. [FN66] The majority are small farmers whose livelihoods depend on marketing their agricultural products. [FN67] Consequently, the provision of free or low cost food to developing countries through aid or trade may exacerbate hunger by depressing food prices and undermining the livelihoods of small farmers. [FN68]

Third, economic diversification and industrialization are necessary to promote food security at the national level. [FN69] The most food-insecure developing countries are those that depend on the export of a handful of agricultural commodities for a substantial portion of their foreign exchange earnings. [FN70] Adverse weather, pest infestations, market price fluctuations, and the declining terms of trade for agricultural commodities vis-à-vis manufactured goods can depress export earnings and deprive these countries of the resources necessary to finance food imports and productive investment. [FN71] Consequently, developing countries must ***595** resist development strategies that reinforce agro-export specialization.

Fourth, biological diversity is necessary for the health and resilience of the world's food supply. [FN72] The replacement of indigenous crop varieties and biodiverse cultivation systems with monocultures increases vulnerability to pests and disease, diminishes soil fertility, promotes dependence on toxic agrochemicals, increases the likelihood of catastrophic crop failure in the event of blight, and adversely affects human nutrition by reducing the variety of foods consumed. [FN73] Even though thousands of crops have been cultivated since the dawn of agriculture, the global food supply currently depends on approximately 100 species of food crops. [FN74] Just four of these crops (corn, wheat, rice and potatoes) supply over sixty percent of the world's dietary energy needs. [FN75] Thus, development strategies that encourage monocultural production techniques render our food supply vulnerable to catastrophic disruptions of the food supply akin to the Irish potato famine. [FN76]

In order to appreciate the relevance of these points to the ongoing controversy over GMOs, it is essential to place this controversy in the context of historic and contemporary debates over agricultural trade policy.

C. THE GMO CONTROVERSY IN HISTORICAL CONTEXT

The controversy over GMOs has its genesis in patterns of agricultural trade and production that disadvantage developing countries and contribute to poverty, hunger and environmental degradation.

1. The Colonial Legacy

The saga begins with colonialism, which was based in part on the extraction of the resources of colonial possessions for the benefit of colonizing nations. [FN77] As a consequence of colonialism, most developing countries were integrated into the *596 world economy as producers of natural resources and consumers of imported manufactured goods. [FN78] Economic specialization in agro-export production diverted high quality crop land from food production to cash crop production and encouraged dependence on food imports to satisfy domestic nutritional needs. [FN79] In developing countries that practiced plantation agriculture, colonialism generated poverty and inequality by concentrating land ownership in the hands of the rural elite while relegating small farmers to marginal, ecologically fragile lands. [FN80] Economic specialization in agro-export production also degraded the environment by replacing countless varieties of indigenous crops with genetically uniform crops that required the application of large amounts of agrochemical inputs. [FN81]

Colonialism ensured that developing countries would enter the global economy in a structurally disadvantageous position. In order to facilitate colonial rule, colonial authorities discouraged the development of indigenous economic capacity and indigenous government institutions. [FN82] Moreover, the agro-export specialization imposed during the colonial period deprived developing countries of the steady income streams necessary for productive investment by subjecting export revenues to the volatility of agricultural commodity markets and to the declining terms of trade for agricultural products in relations to manufactured goods. [FN83] When political independence was finally achieved, the former colonies were at an enormous disadvantage in the global marketplace, [FN84] and most continued to specialize in agro-export production and to import manufactured goods. [FN85]

In short, colonialism transformed self-reliant subsistence economies into economic satellites of the developed world that remained dependent on the export of raw materials and on the import of manufactured goods. Many of these former colonies were rendered destitute, ecologically vulnerable, dependent on imported food to satisfy domestic nutritional needs, and plagued with poverty and inequality.

2. The Green Revolution

The saga of agriculture in the developing world continues with the Green Revolution. The Green Revolution was a post-World War II philanthropic effort *597 to reduce world hunger by increasing global crop yields. [FN86] With the support of the Ford and Rockefeller Foundations, international crop breeding institutions developed new varieties of rice, wheat, and corn that were more responsive than traditional varieties to the application of synthetic fertilizers and controlled irrigation. [FN87]

The Green Revolution was a tremendous success from the standpoint of food production. Food production in the developing world more than doubled between 1960 and 1985 and kept well ahead of population growth. [FN88] However, as explained above, the underlying cause of hunger is poverty, and efforts to address undernourishment must therefore be evaluated on the basis of their impact on poverty and inequality.

The Green Revolution exacerbated hunger in the developing world by aggravating poverty and inequality. [FN89] First, the Green Revolution disproportionately benefited wealthy farmers because many poor farmers could not afford the expensive inputs required to achieve high yields, including synthetic fertilizers, chemical pesticides, and irrigation equipment. [FN90] Second, the glut in world food production resulting from the Green Revolution depressed agricultural prices and rendered many small farmers destitute. [FN91] Third, the Green Revolution's emphasis on boosting food production was often promoted as an alternative to land reform and other redistributive measures—the very measures that have achieved the greatest success in alleviating poverty, promoting economic development, and *598 enhancing food security. [FN92] As one commentator pointedly observed, “The [U.N. Food and Agriculture Organization's] much heralded Green Revolution, with its technologically generated maximum yields, has led in India, Thailand, Mexico and elsewhere to the concentration of land among those with the most capital, and to a verit-

able army of landless peasants.” [FN93]

The Green Revolution also produced serious environmental degradation in developing countries. Farmers throughout the developing world abandoned ecologically sustainable low-input agricultural practices in favor of uniform seeds, chemical fertilizers, and synthetic pesticides manufactured by transnational corporations based in the industrialized world. [FN94] The environmental consequences of this dramatic shift to industrial agriculture included loss of soil fertility, depletion of groundwater reserves, agrochemical contamination of surface waters and groundwater, loss of ecosystem biodiversity, loss of traditional food crops, increased pesticide-related illness, narrowing of the genetic basis of the world's food supply, and heightened vulnerability of the global food supply to catastrophic blight. [FN95] Indeed, in many areas of the world, the deterioration in soil quality associated with the Green Revolution ultimately depressed agricultural productivity. [FN96]

Finally, the Green Revolution coincided with the concentration of market power in a handful of agrochemical conglomerates that supplied the pesticides, fertilizers, seeds and machinery needed for capital-intensive agricultural production. [FN97]

3. Trade, Aid, and Poverty

The plight of small farmers in the developing world was exacerbated by the trade and aid policies of wealthy industrialized countries in the aftermath of *599 World War II. In the post-war period, the United States and Western Europe generously subsidized the agricultural sector and used a variety of tariff and non-tariff import barriers to protect their farmers from foreign competition. [FN98] By contrast, most developing countries taxed the agricultural sector to finance industrialization and lacked the resources to provide farmers with significant subsidies. [FN99] The subsidies and import barriers maintained by developed countries were largely permitted by the 1947 General Agreement on Tariffs and Trade (1947 GATT), which contained a variety of exceptions and omissions that allowed agricultural protectionism to flourish. [FN100]

As a consequence of government subsidies and technological innovation, food production in the United States overwhelmed domestic demand, producing a glut on the market and depressing the income of agricultural producers. [FN101] Agribusiness executives and political leaders devised a solution to the problem of overproduction: dispose of the surplus production as food aid, and use the food aid as political leverage and as a means of creating new markets for U.S. agricultural exports. [FN102] Under U.S. Public Law 480 (the so-called “Food for Peace Program”), [FN103] surplus agricultural production was made available to developing countries free of charge or at reduced prices. [FN104] At the same time, the United States continued to subsidize domestic agricultural production and to use tariff and non-tariff barriers to protect its markets from foreign competition. [FN105] Regrettably, Public Law 480 and the subsidies and import barriers maintained by the United States and by other developed countries increased poverty and hunger in the developing world by depressing agricultural commodity prices, undermining the livelihoods of poor farmers, and depriving developing countries of the foreign exchange earnings needed to import food and manufactured products. [FN106]

*600 4. The Debt Crisis and the Double Standard in International Agricultural Trade

The debt crisis of the 1980s ushered in a double standard in international agricultural trade that devastated rural livelihoods and accelerated environmental degradation in the developing world. The debt crisis was triggered by the quadrupling of petroleum prices by the Organization of Petroleum Exporting Countries (OPEC) in 1973. [FN107] Many developing countries borrowed money from commercial banks simply to pay for fuel and for petroleum-based agricultural inputs. [FN108] When a second OPEC oil price increase in 1979-80 caused interest rates to skyrocket at a time when agricultural commodity prices had plummeted, many developing countries were unable to repay their debts. [FN109] By the mid-1980s, two-thirds of African countries and nearly three-quarters of Latin American coun-

tries had adopted structural adjustment programs mandated by the World Bank and the IMF in order to restructure existing debt or to obtain new loans. [FN110]

Structural adjustment reinforced the crippling dependency of developing countries on agro-export specialization and inflicted serious environmental damage. Developing countries were instructed to maximize agricultural exports in order to generate the revenue to service their foreign debt. [FN111] The drive to increase agricultural exports harmed the environment by promoting the expansion of chemical-intensive industrial agriculture. [FN112] Ironically, the glutting of world markets, by developing country exporters depressed agricultural prices even further and reduced the export earnings available for debt servicing. [FN113]

Structural adjustment also introduced a double standard that continues to plague world agricultural trade: protectionism for the wealthy and free markets for the poor. As a condition of debt restructuring, developing countries were required to institute a full range of free market economic reforms, including reductions in government spending, privatization of state enterprises, elimination of subsidies, lowering of tariffs, and elimination of non-tariff import barriers. [FN114] No such requirements were imposed on developed countries. Indeed, developed countries continued to subsidize and protect their agricultural producers [FN115] while *601 benefiting from the relative market openness in developing countries. [FN116] The elimination of tariff and non-tariff import barriers in developing countries exposed their small farmers to ruinous competition from highly subsidized U.S. and European agricultural producers. [FN117] The vulnerability of developing country farmers was compounded by the elimination of subsidized credit, the reduction of extension services, and the withdrawal of government assistance programs. [FN118]

The WTO Agreement on Agriculture purported to mitigate these inequities and to “establish a fair and market-oriented agricultural trading system” by gradually dismantling agricultural subsidies and tariffs. [FN119] Regrettably, the Agreement reinforced the international double standard. While ambiguities in the Agreement's key provisions enabled developed countries to maintain high levels of agricultural protectionism, the Agreement did succeed in prohibiting developing countries that did not historically subsidize agriculture from doing so in the future. [FN120]

As a consequence of this double standard in the rules governing international agricultural trade, agricultural producers in the United States and the European Union are impoverishing millions of small farmers in the developing world by dumping agricultural commodities on world markets at prices below the cost of production. [FN121] According to studies undertaken by the Minneapolis-based Institute for Agriculture and Trade Policy, the United States exports cotton at 47 percent below the cost of production, wheat at 28 percent below the cost of production, rice at 26 percent below the cost of production, and corn at 10 percent below the cost of production. [FN122]

It is unclear, however, that eliminating U.S. and EU agricultural subsidies would be sufficient to raise world market agricultural commodity prices in the absence of measures to address market concentration in the agro-food sector. [FN123] *602 Low agricultural commodity prices are due, at least in part, to the market power of the agribusiness conglomerates that dominate world agricultural trade. [FN124] Three companies carry out 82 percent of all U.S. corn exporting. [FN125] Four companies control 61 percent of U.S. flour milling capacity. [FN126] Four companies own 60 percent of U.S. terminal grain handling facilities. [FN127] The global seed and pesticide markets are similarly concentrated. [FN128] The domination of agricultural markets by a small number of agribusiness conglomerates enables these companies to dictate low prices for agricultural output while charging high prices for inputs such as seeds and pesticides. [FN129] Large growers in the United States are compensated for these distorted prices with generous agricultural subsidies, while family farmers are increasingly driven out of business. [FN130] In addition, these agribusiness conglomerates wield considerable political influence and have persuaded U.S. government officials to demand greater access to developing country markets while maintaining lavish agricultural subsidies in the domestic market. [FN131]

In sum, the rural sector in the developing world is in profound crisis. Within the last decades, billions of small

farmers have been driven off the land and into urban slums. [FN132] The exodus from rural areas has been so dramatic that urban employment has been unable keep pace with the influx of migrants. [FN133] The double standard in world agricultural trade and the market distortions caused by corporate near-monopolies exacerbate this crisis by undermining the precarious livelihoods of poor farmers. It is in this context that one must evaluate the promise and the perils of biotechnology.

II. GMOS AND JUSTICE: THE ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS OF AGRICULTURAL BIOTECHNOLOGY IN DEVELOPING COUNTRIES

The proponents of agricultural biotechnology claim that GM crops will promote food security and protect the environment by boosting food production, enhancing the nutritional content of food, reducing the use of pesticides and *603 herbicides, and producing crops that can withstand environmental stresses such as drought, heat, frost, and soil salinity. [FN134] The critics of biotechnology contend that GM crops will irreversibly diminish biodiversity, increase agrochemical use, undermine traditional agricultural practices, accelerate corporate domination of the global food supply, and increase hunger and poverty. [FN135]

This section draws upon the insights gleaned from the preceding sections in order to assess the impact of biotechnology on the factors that produce hunger and environmental degradation in the developing world. Because GM crops have not been widely cultivated in the developing world, the conclusions drawn are necessarily preliminary. Before embarking on an assessment of the socioeconomic and environmental risks and benefits of GM crops, it is useful to highlight a few features of the biotechnology industry.

While the Green Revolution was a public sector initiative to increase food production in the developing world, the biotechnology industry is driven by profit. [FN136] The industry is highly concentrated and is characterized by oligopolistic competition among a few large corporations. [FN137] Approximately 88 percent of all GM crops grown worldwide in 2004 were the product of Monsanto seeds. [FN138] Six corporations (BASF, Dow, Bayer, DuPont, Monsanto, and Syngenta) control 75-80 percent of the global pesticides market. [FN139] Two corporations (Monsanto and DuPont) dominate world seed markets for corn and soybeans. [FN140]

The biotechnology industry maximizes profits by marketing its products to wealthy commercial farmers in affluent countries while devoting scant resources to the needs of poor farmers in the developing world. [FN141] Most of the industry's research is devoted to export crops grown in large-scale monocultures. [FN142] Only one percent of the industry's research targets small-scale producers. [FN143] Despite the diversity of GM crops that could be developed, almost all of the world's GM acreage consists of four crops (soybeans, corn, cotton, and canola), and most of these crops are engineered for herbicide tolerance or insect resistance. [FN144] It is no coincidence that these widely commercialized GM crops are the lucrative export *604 crops cultivated by U.S. agribusiness. [FN145] Finally, because GM seeds are subject to strict intellectual property protection, farmers using these seeds must pay a higher premium for the seeds, and they must forego their traditional rights to save, share, and modify these seeds; farmers are also contractually bound to use agrochemicals of a particular seed manufacturer. [FN146]

A. SOCIOECONOMIC IMPACTS OF GM CROPS

1. Marginalization of Small Farmers

The introduction of GM crops in developing countries threatens to exacerbate poverty and inequality by reproducing the anti-poor bias of the Green Revolution. First, GM crops will disproportionately benefit wealthy farmers because most poor farmers will be unable to obtain the cash or credit to purchase the patented seeds and the expensive chemical inputs necessary to cultivate GM crops. [FN147] Second, the obligation to purchase new seeds every sea-

son, rather than saving seeds for replanting, erodes farmers' traditional rights to save and exchange seeds, and may be financially prohibitive. [FN148] Indeed, farmers may not understand this restriction until the biotechnology industry takes aggressive measures to collect royalties for these seeds. [FN149] Third, small farmers who incur debt in order to purchase the expensive seeds and chemical inputs run the risk of bankruptcy if yields fluctuate or if output prices decline. [FN150] Fourth, even poor farmers who do not purchase GM seeds may nevertheless incur substantial economic losses if the GM seeds boost the yields of wealthy farmers and depress agricultural commodity prices. [FN151] Fifth, GM crops may exacerbate rural poverty by enabling large-scale producers to reduce the use of manual labor (for example, by using herbicide-tolerant crops to reduce the need for manual weeding). [FN152] In developing countries, where labor is abundant, the labor-saving benefits of GM seeds will likely accrue to large commercial farmers at the expense of landless laborers and small farmers who supplement their income through part-time employment on large commercial farms. Finally, if GM crops contaminate non-GM crops, farmers in developing countries who export their crops to countries that restrict GM products (such as EC member countries) could suffer enormous financial losses. In short, GM crops pose significant socioeconomic risks to small farmers.

The adoption of GM seeds also raises a variety of risks associated with the corporate domination of the food supply. Farmers who purchase seeds produced by the biotechnology industry may suffer financial losses because these seeds may not be suitable for local conditions, such as drought and salinity. [FN153] In Brazil and Paraguay, for example, many farmers experienced disappointing harvests and faced mounting debt when their GM soybean crops performed worse than conventional varieties during drought conditions. [FN154] Regrettably, the proprietary nature of GM seeds limits the ability of farmers to modify and adapt these seeds to unique local requirements. [FN155] Furthermore, as farmers become less self-reliant and increasingly dependent on seeds and chemical inputs manufactured by the agrochemical industry, many will lose the cultural knowledge and skills required to grow subsistence crops using traditional methods. [FN156] This loss of skills and cultural knowledge threatens to undermine the cultural integrity of local and indigenous communities and to expose these communities to catastrophic supply disruptions or onerous debt if input prices increase or output prices decline. [FN157] Finally, regardless of whether developing country farmers purchase GM seeds, the biotechnology industry may cause enormous economic dislocations by developing transgenic substitutes for developing country exports, such as cocoa, palm oil, and coconut oil. [FN158]

Based on the foregoing analysis, it is unlikely that the introduction of the most commonly commercialized GM crops in developing countries will reduce poverty, promote food security, and enhance the well-being of small farmers. On the contrary, GM crops are likely to be structurally biased against small farmers due to the high cost of the seeds and inputs, the intellectual property protections, and the increasing unavailability (in the aftermath of structural adjustment) of subsidized credit, extension services, and other government-funded programs to provide small farmers with technical and financial assistance.

2. Potential Increase in Food Production

While GM crops have the potential to enhance agricultural productivity, there is widespread consensus that GM crops, unlike their Green Revolution counterparts,*606 have not to date boosted food production. [FN159] Studies suggest that yields are either lower than or at most equivalent to non-GM varieties. [FN160]

Even if GM crops did boost food production, poverty might not necessarily decline. As the experience of the Green Revolution illustrates, poor farmers in developing countries will not be able to benefit from this expensive technology in the absence of cash, credit, technical assistance, and access to markets. [FN161] Indeed, increased food production could further marginalize poor farmers by glutting markets and depressing agricultural prices. [FN162]

3. Enhancement of the Nutritional Quality of Food

Genetic modifications that enhance the nutritional quality of food could be of considerable benefit to malnour-

ished individuals in developing countries. For example, Golden Rice is a genetically modified rice that produces beta-carotene, a substance that the human body can convert to Vitamin A. [FN163] The proponents of biotechnology claim that Golden Rice can address the problem of Vitamin A deficiency, a condition that kills one million children each year and produces over fourteen million cases of eye damage in pre-school children in developing countries. [FN164] However, critics of biotechnology have raised several important concerns in the context of Golden Rice that are relevant to all genetic modifications designed to enhance nutritional quality. First, it is unclear whether malnourished individuals consume sufficient fat to metabolize the beta-carotene in Golden Rice and convert it to Vitamin A. [FN165] Second, the yellow color of the rice may cause it to be rejected for cultural reasons. [FN166] Third, Vitamin A deficiency is a symptom of diminished crop and dietary diversity. Rather than genetically altering the rice consumed by the poor, it might be preferable to address the underlying problem by introducing multi-cropping in rice fields in order to encourage rice farmers to cultivate leafy green vegetables that provide Vitamin A and a whole range of other micronutrients. [FN167]

*607 4. Production of Crops That Can Withstand Environmental Stresses

The production of GM crops that can withstand environmental stresses such as drought, heat, frost, and soil salinity would certainly be beneficial to small farmers in developing countries. While research on such crops is taking place, [FN168] the profit-driven nature of the biotechnology industry raises questions about whether such crops will be made commercially available at prices that small farmers can afford. [FN169]

B. ENVIRONMENTAL IMPACTS OF GM CROPS

This section examines the environmental impacts of the two types of genetic modifications that account for almost all of the world's GM-planted acreage: herbicide-tolerant crops and insect-resistant crops. Herbicide-tolerant crops are designed to resist the application of broad spectrum herbicides (such as Monsanto's Roundup), thereby enabling the herbicide to kill weeds without damaging the crops. [FN170] In theory, herbicide tolerant crops will require fewer applications of herbicides, will decrease soil erosion by requiring less tilling or mechanical weed control, and will diminish the need for manual weeding. [FN171] Insect-resistant crops incorporate microbial pesticides (such as *Bacillus thuringiensis*, commonly known as Bt) that kill susceptible pests, thus reducing the need to apply chemical insecticides. [FN172]

1. Erosion of Biodiversity

One of the primary concerns about GM crops is that they reinforce the monocultural production techniques introduced during the colonial era and reinforced by the Green Revolution and by structural adjustment. As explained in Part I, the displacement of indigenous crop varieties and biodiverse cultivation systems by monocultures increases vulnerability of crops to pests and disease, depletes the fertility of the soil, increases dependence on synthetic fertilizers and pesticides, increases the probability of catastrophic crop failure in the event of *608 blight, and adversely affects human nutrition by reducing the variety of foods consumed. The cultivation of GM crops is thus inherently inconsistent with the biodiversity necessary to promote ecologically sustainable food production.

2. Acceleration of Resistance to Herbicides and Insecticides

The proponents of biotechnology claim that GM crops will benefit the environment by reducing the use of herbicides and insecticides. The critics contend that GM crops will accelerate the evolution of herbicide- and insecticide-resistance, thereby necessitating the application of greater amounts of toxic agrochemicals.

A comprehensive review of the literature on GM crops published in 2007 by Friends of the Earth International

(FOEI) concluded that the cultivation of GM crops in the United States has resulted in a significant increase in herbicide use. [FN173] One of the reasons for greater herbicide use was the evolution of herbicide resistance by weeds, which forced farmers to apply other, more toxic herbicides. [FN174] The authors of the FOEI study suggest that the steep increase in the number of weeds resistant to Monsanto's herbicide Roundup is a direct consequence of the increased and more frequent use of Roundup associated with the cultivation of Roundup-resistant soybeans, cotton, and corn. [FN175] Thus, far from reducing herbicide use, the introduction of herbicide tolerant crops appears to have increased both the quantity and the toxicity of the herbicides applied.

A related concern about GM crops is that the widespread cultivation of Bt-resistant crops might likewise accelerate the development of Bt resistance in insects and result in the use of greater quantities of more toxic insecticides. [FN176] The development of Bt resistance will diminish the utility of Bt not only for farmers growing Bt-resistant crops but for neighboring farmers who use microbial Bt as a natural insecticide on conventional crops. [FN177] Organic farmers and poor farmers in developing countries who cannot afford synthetic pesticides are those likely to be most affected. Consequently, developing countries considering the adoption of Bt-resistant crops should carefully evaluate the socioeconomic implications of potential acceleration of Bt resistance in insects.

3. Genetic Pollution and the Creation of Superweeds

Other risks associated with GM crops are the transfer of genes from GM crops to conventional crops (genetic pollution) and the development of herbicide-resistant or insect-resistant superweeds.

***609** One possibility is that GM crops may themselves become weeds. For example, herbicide-tolerant cotton seeds left in the fields from the previous season's crop may germinate in the current wheat crop, thus necessitating the application of a more potent weed-killer. [FN178]

Another possibility is that GM crops might transfer transgenes conferring herbicide resistance or insect resistance to other plants, which could then become superweeds immune to herbicides or to insect predators. [FN179] The ecological consequences of creation and dissemination of such superweeds within the farm and into the broader environment are difficult to predict. [FN180] The control of superweeds immune to the most commonly used herbicides might require the use of more toxic herbicides, resulting in greater environmental harm and higher costs to farmers. [FN181]

This risk of gene transfer is particularly high for crops grown in close proximity to wild relatives. [FN182] While there is consensus among scientists that transgenic crops will eventually transfer transgenes to wild relatives, there is disagreement on the seriousness of the resulting consequences. [FN183] Genetic transfers may pose particular threats in countries that are the centers of diversity for certain crops (such as corn in Mexico) if they result in a loss of the genetic variability that future generations will need in order to adapt crops to changing environmental conditions. [FN184] Moreover, plants carrying pharmaceutical and industrial traits, such as plants engineered to produce contraceptives, growth hormones, blood thinners, industrial enzymes, and vaccines, represent the next wave of GM crops. [FN185] The transfer of transgenes from industrial and biopharmaceutical crops to food crops may contaminate the food chain and pose grave human health and environmental risks. [FN186]

4. Harm to Non-Target Organisms

Finally, GM crops may harm non-target organisms, including beneficial soil organisms and the natural predators of the target insect pest. [FN187] If the cultivation of GM crops by farmers in developing countries harms natural predators of the ***610** target insect pest, those most affected are likely to be neighboring farmers who rely on such predators for insect control because they cannot afford or do not want to use chemical pesticides. [FN188] Similarly, if the cultivation of GM crops by farmers in developing countries harms beneficial soil organisms, those most af-

ected are likely to be farmers who rely on such soil organisms to maintain soil fertility because they cannot afford or do not want to use chemical fertilizers. [FN189] The disruption of natural pest control and the reduction of soil fertility will depress agricultural production. [FN190] Agrochemical use is likely to increase in order to replenish soil fertility and to combat pests--with resulting harm to human health and the environment. [FN191]

In sum, the GM crops that promise to diminish agrochemical use may in fact increase the use of chemical pesticides and synthetic fertilizers by accelerating herbicide resistance and insecticide resistance, by harming the predators of target species and by harming beneficial soil organisms. GM crops also introduce novel risks, such as the transfer of transgenes to conventional crops with uncertain but potentially serious consequences. Far from being an alternative to environmentally harmful industrial agriculture, GM crops threaten to reinforce industrial agriculture in the developing world.

C. THE ENVIRONMENTAL JUSTICE IMPLICATIONS OF GMOS

GMOs pose unique socioeconomic and environmental risks in developing countries. Based on the analysis set forth in the preceding sections of this Part, the environmental justice implications of GMOs can be summarized as follows:

First, GMOs pose risks to the livelihoods of small farmers. GM crops may replicate the anti-poor bias of the Green Revolution because many small farmers will be unable to afford the patented seeds (which must now be purchased every planting season) and the expensive agrochemical inputs necessary to cultivate them. Small farmers who incur debt to purchase these costly inputs may face bankruptcy if agricultural commodity prices decline. Furthermore, GMOs may increase poverty and inequality by reducing the need for manual labor, depressing agricultural commodity prices (to the extent that they successfully boost food production), and contaminating the crops that small farmers export to EC member states and other countries that restrict GMOs. Because seventy-five percent of the developing world's malnourished people are rural dwellers, any impairment of small farmers' precarious livelihoods threatens the fundamental human right to food.

Second, the cultivation of GM crops threatens to increase the power of ***611** transnational agribusiness over the world's food supply, to deprive small farmers of their traditional rights to save, share and modify seeds, and to accelerate the loss of valuable cultural knowledge about environmentally-friendly traditional cultivation methods.

Third, GMOs pose environmental risks that will disproportionately affect small farmers. The development of insect resistance to the microbial insecticide Bt, the dissemination of herbicide-resistant superweeds, injury to the natural predators of target pests, and harm to beneficial soil organisms will have particularly severe effects on the livelihoods of poor farmers who rely on low-cost, natural methods to control pests and maintain soil fertility and who cannot afford expensive chemical inputs.

Finally, the risks associated with genetic pollution will be higher in developing countries that are the centers of diversity for certain crops (such as corn in Mexico), particularly if the gene transfer results in the loss of genetic variability necessary to adapt crops to changing environmental conditions or in the transfer of pharmaceutical and industrial traits to food crops.

In short, the cultivation of GM crops in developing countries will benefit large commercial farmers and the agribusiness conglomerates that dominate seed and agrochemical markets while imposing serious environmental and socioeconomic risks on small farmers.

The remainder of this article examines the ability of the international legal instruments governing trade in GMOs to address the environmental and socioeconomic concerns raised in this Part and proposes alternative approaches more compatible with international environmental justice.

III. THE INTERNATIONAL REGULATORY FRAMEWORK FOR TRADE IN GMOS

The international trade in GMOs is governed primarily by the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) [FN192] and by the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (the Biosafety Protocol). [FN193] This Part summarizes the key provisions of the SPS agreement and the Biosafety Protocol, discusses the WTO dispute settlement panel's decision in the EC-Biotech case, and evaluates the ability of this legal regime to adequately address the environmental justice concerns posed by agricultural biotechnology in the developing world.

A. THE SPS AGREEMENT

The SPS Agreement governs health and safety regulations known as sanitary and phytosanitary measures (SPS measures). The SPS Agreement defines SPS *612 measures as measures applied to protect human, animal, or plant life or health within the territory of the WTO member from a series of enumerated risks, including risks arising from additives and contaminants in food and risks arising from the entry or spread of pests, diseases, disease-carrying organisms, and disease-causing organisms. [FN194]

The primary purpose of the SPS Agreement is to prevent WTO members from enacting protectionist measures disguised as health and safety regulations. [FN195] The SPS Agreement seeks to achieve this objective by promoting harmonization of international health and safety standards [FN196] and by requiring WTO members who adopt health and safety measures that are more protective than international standards to justify these measures on the basis of sound science. [FN197]

Under the SPS Agreement, SPS measures that conform to international standards, such as those established by the Codex Alimentarius Commission, the International Plant Protection Convention, or the International Office of Epizootics, are presumed to be consistent with the SPS Agreement and with the 1994 General Agreement on Tariffs and Trade. [FN198]

SPS measures that are more protective than international standards require scientific justification. [FN199] Article 2.2 of the SPS Agreement requires that SPS measures be “based on scientific principles” and “not maintained without sufficient scientific evidence.” [FN200] Article 5.1 elaborates on this obligation by requiring that SPS measures be “based on” a risk assessment. [FN201] The risk assessment must take into account the available scientific information [FN202] and will only justify the SPS measure if there is a “rational relationship between the measure and the risk assessment.” [FN203] Moreover, the risk assessment upon which a WTO member relies need not have been carried out by that member. [FN204] A WTO member may base its SPS measure on a risk assessment conducted by another *613 member or by an international organization. [FN205]

If the “relevant scientific evidence is insufficient,” [FN206] Article 5.7 of the SPS Agreement authorizes the adoption of provisional SPS measures on the basis of “available pertinent information.” [FN207] However, the WTO member is mandated to “seek to obtain the additional information necessary for a more objective assessment of risk and review the [SPS measure] accordingly within a reasonable period of time.” [FN208] What constitutes a reasonable period of time will be determined on a case-by-case basis. [FN209]

B. THE BIOSAFETY PROTOCOL

The Biosafety Protocol is the first binding international agreement that applies specifically to the transnational transfer and use of GMOs. [FN210] The objective of the Biosafety Protocol is to “contribute to ensuring an adequate level of protection in the field of safe transfer, handling and use of biotechnology that may have adverse effects on conservation and sustainable use of biological diversity, taking also into account risk to human health, and specific-

ally focusing on transboundary movements.” [FN211]

The Biosafety Protocol requires the “advance informed agreement” of an importing country before GMOs intended to be introduced into the environment (such as seeds, fish and microorganisms) may be shipped to that country. [FN212] Like the SPS Agreement, the Biosafety Protocol calls for a “scientifically sound” risk assessment as the central basis for decisionmaking about whether to import GMOs. [FN213]

However, the Biosafety Protocol appears to differ from the SPS Agreement in two important respects. First, the Biosafety Protocol expressly incorporates the precautionary principle and permits countries to regulate in the face of scientific *614 uncertainty. [FN214] Articles 10.6 and 11.8 of the Biosafety Protocol provide as follows:

Lack of scientific uncertainty due to insufficient relevant information and knowledge regarding the extent of potential adverse effects of a living modified organism on the conservation and sustainable use of biological diversity in the Party of import, taking into account risks to human health, shall not prevent that Party from taking a decision, as appropriate, with regard to the import of the living modified organism [FN215]

Second, the Biosafety Protocol permits countries to consider, to a limited extent, the socioeconomic impact of GM crops when making decisions about the importation of GMOs. [FN216] Article 26 of the Biosafety Protocol permits countries to “take into account, consistent with their international obligations, socioeconomic considerations arising from the impact of [GMOs] on the conservation and sustainable use of biological diversity, especially with regard to the value of biological diversity to indigenous and local communities.” [FN217]

On closer examination, the SPS Agreement and the Biosafety Protocol are not as dissimilar as they first appear. Both agreements privilege science-based decisionmaking over precaution and socioeconomic considerations.

On the question of science versus precaution, the quoted language from Articles 10.6 and 11.8 of the Biosafety Protocol suggests that precautionary measures may be appropriate when there is scientific uncertainty about the extent of an adverse impact posed by GMOs rather than scientific uncertainty about whether an adverse impact exists. [FN218] As one commentator observes, “[t]his emphasis on the *extent* of an adverse impact can be interpreted as requiring prior scientific evidence of the existence of an adverse impact before precautionary action can legitimately be taken.” [FN219] In other words, the Biosafety Protocol can be construed to require a risk assessment before the precautionary principle may be invoked. [FN220]

The privileging of science is also evident in the very limited manner in which the Biosafety Protocol addresses socioeconomic considerations. A close reading of the Article 26 language quoted above reveals that the parties to the Biosafety Protocol may take into account only those socioeconomic impacts that result from harm to biodiversity. [FN221] This provision would permit developing countries *615 to consider the impact on small farmers and indigenous communities of harm to non-target organisms (such as the predators of target pests) and of the transfer of transgenes to non-GM crops, provided that the scientific evidence establishes the existence of these impacts. This provision would not permit developing countries to reject GMOs based on socioeconomic considerations not directly related to impacts on biodiversity, such as harm to the livelihoods of local and indigenous communities or increased dependence on proprietary seeds and other inputs produced by transnational corporations. [FN222] Furthermore, the Article 26 proviso that countries may take socioeconomic considerations into account “consistent with their international obligations” suggests that even this very limited recognition of the socioeconomic concerns of developing countries goes no further than what the WTO already permits. [FN223]

In short, both the SPS Agreement and the Biosafety Protocol appear to privilege science-based decisionmaking and to preclude consideration of socioeconomic concerns not directly related to scientifically demonstrable actual or potential harm to biodiversity.

C. THE EC-BIOTECH DECISION

An evaluation of the compatibility with environmental justice of the international regulatory framework applicable to GMOs would not be complete without an analysis of the WTO dispute settlement panel's recent decision in the EC-Biotech case. Although the dispute was primarily between developed countries (the United States and the EC), the panel's decision has significant implications for developing countries.

In August 2003, the United States, Canada, and Argentina invoked the WTO dispute resolution mechanism to challenge the European Communities' alleged general moratorium on the approval and marketing of biotech products, the EC's failure to approve certain specific biotech products, and individual EC Member states' prohibitions (safeguard measures) on GMO products previously approved for EC-wide distribution. [FN224] The complainants argued that the EC's general *616 moratorium, the EC's failure to approve certain specific biotech products, and the individual EC member states' safeguard measures violated the SPS Agreement, the 1994 General Agreement on Tariffs and Trade (GATT 1994), and the Agreement on Technical Barriers to Trade (TBT Agreement). [FN225]

In its long-awaited September 2006 decision, the WTO panel concluded that the EC had applied a *de facto* moratorium on the approval of biotech products between June 1999 and August 2003. [FN226] According to the panel, the European Commission and five EC member countries (Denmark, Greece, France, Italy, and Luxembourg) followed a common plan to prevent final approval of biotech products pending the adoption of new EC rules on labeling and traceability of GMOs. [FN227]

The panel determined that this general moratorium and the product-specific approval delays associated therewith resulted in "undue delay" in the EC's GMO pre-marketing approval procedures in violation of Article 8 and Annex C(1)(a), first clause, of the SPS Agreement. [FN228] The panel also struck down the individual EC Member states' safeguard measures prohibiting specific GM products on the ground that these states violated Article 5.1 of the SPS Agreement by failing to base these safeguard measures on risk assessments. [FN229]

In November 2006, the EC announced that it would not appeal the EC-Biotech decision because the moratorium had been lifted in 2004, and the panel's decision would therefore have no substantive impact on the EC's regulatory practices. [FN230]

The key findings of the panel and their implications for the regulatory choices of developing countries are discussed below.

1. Broad Scope of the SPS Agreement

As a threshold matter, the panel examined whether the SPS Agreement applies to the EC regulatory framework for GM food and agricultural products. The panel concluded that the EC pre-marketing approval procedures for GMOs and the individual EC member states' GMO prohibitions are SPS measures covered by the SPS Agreement. [FN231] Based upon an expansive interpretation of the SPS *617 Agreement's definition of an SPS measure, the panel reasoned that the EC legislation and the individual EC member prohibitions fell within the scope of the SPS Agreement because their purpose was to protect the life or health of humans, animals, or plants from the risks enumerated in Annex A(1) of the SPS Agreement. [FN232] The panel did note, however, that measures aimed at providing consumer information or at ensuring that GMO products were not nutritionally disadvantageous would not be covered by the SPS Agreement. [FN233]

The implications of the decision for developing countries adopting GMO legislation are two-fold. First, dispute resolution panels are likely to adopt a broad interpretation of the SPS Agreement's scope and to evaluate most GMO legislation under the SPS Agreement's stringent science-based standards. According to the panel, the SPS Agreement is likely to be triggered even if the primary purpose of the GMO legislation is to protect farmers from economic damage resulting from the "pest-like" quality of GMOs, including economic losses *618 arising from the contamination of non-GM crops by GM crops, from the transfer of undesired traits (such as insect- or herbicide-resistance) to con-

ventional crops or wild flora, and from the acceleration of insect resistance. [FN234] Second, labeling and other measures aimed at consumer information are likely to fall outside the scope of the SPS Agreement and arguably within the scope of the TBT Agreement or the GATT.

2. Narrow Interpretation of Justified Delay in the Implementation of GMO Approval Procedures

The panel determined that the EC had maintained a general moratorium on the approval of biotech products between June 1999 and August 2003 as well as certain product-specific delays consistent with the general moratorium. [FN235] However, the panel concluded that the decision to delay final approval of biotech products did not constitute a substantive SPS measure, as defined in the SPS Agreement, and was therefore not subject to the SPS Agreement provisions applicable to SPS measures, including the risk assessment and science-related requirements. [FN236] Consequently, the panel rejected the complainants' claims under the substantive provisions of the SPS Agreement, including Articles 2.2 and 5.1 (imposing risk assessment and science-related requirements); Articles 2.3, 5.5, *619 and 5.6 (prohibiting arbitrary and unjustifiable discrimination and disguised restrictions on international trade); and Article 7 and Annex B(1) (requiring transparency and publication of SPS measures). [FN237]

The panel then proceeded to examine the complainants' claims under the procedural requirements of the SPS Agreement. The panel concluded that the general moratorium and the failure to approve certain specific biotech products resulted in undue delay in the completion of product approval procedures in violation of Article 8 and Annex C(1)(a), first clause, of the SPS Agreement. [FN238] Article 8 of the SPS Agreement requires WTO members to "observe the provisions of Annex C in the operation of control, inspection and approval procedures ... and otherwise ensure that their procedures are not inconsistent with the provision of this Agreement." [FN239] Annex C(1)(a), first clause, requires that "any procedure to check and ensure the fulfilment of sanitary or phytosanitary measures" be "undertaken and completed without undue delay." [FN240]

Characterizing the Annex C(1)(a) requirement as a good faith obligation to "proceed with their approval procedures as promptly as possible," [FN241] the panel rejected the EC's claim that the delay was justified by the perceived inadequacy of the EC legislation, specifically, the absence at the time of EC-level legislation regarding labeling and traceability of GMOs. [FN242] The panel noted that the EC could have granted conditional approval of GMO products, subject to new and additional requirements regarding labeling and traceability. [FN243]

The panel also rejected the EC's attempt to justify the delay on the basis of the evolving and incomplete scientific knowledge about the potential risks of GMOs and the application of a prudent and precautionary approach. [FN244] The panel found that the EC, confronted with inadequate scientific information, could have exercised other options, such as requesting further information from the applicant; adopting a provisional measure under Article 5.7 of the SPS Agreement; granting time-limited or conditional approvals; or rejecting the application subject to further review upon the availability of additional scientific information. [FN245] The panel did acknowledge that a moratorium on approvals might be acceptable under certain circumstances, such as the emergence of new scientific information that conflicts with the available scientific information and is relevant to all pending pre-marketing approval applications. [FN246]

*620 The EC-Biotech decision has important implications for developing countries with evolving biotech regulatory regimes and limited capacity to process premarketing approval applications. First, the panel's decision suggests that developing countries may not justify delays in the approval process on the ground that they are revising their biotech laws or adopting new legislation. Developing countries must grant or reject applications based on the legislation currently on the books, but may grant conditional approvals subject to compliance with additional requirements. Second, developing countries may not use lack of scientific knowledge as a justification for delaying substantive approval decisions. Instead, developing countries should request additional scientific information from the applicant, adopt provisional measures under Article 5.7 of the SPS Agreement, grant conditional approvals, or reject applica-

tions pending the availability of additional scientific information. However, these conclusions are subject to one important caveat. The EC-Biotech panel emphasized that whether a delay is “undue” depends on the reasons for the delay rather than the length of the delay and must be determined “on a case-by-case basis, taking account of relevant facts and circumstances.” [FN247] This suggests that future panels may consider the limited capacity of developing countries to process GMO pre-marketing approval applications in determining whether a particular delay is “undue.”

3. Narrow Scope of Provisional Measures Under Article 5.7 of the SPS Agreement

The panel next examined the WTO consistency of the individual EC member states' safeguard measures prohibiting biotech products previously approved for EC-wide marketing. Having concluded that these prohibitions constituted SPS measures as defined in the SPS Agreement, [FN248] the panel proceeded to examine whether the prohibitions were justified under Article 5.7 and Article 5.1 of the SPS Agreement.

The panel noted that Article 5.7 authorizes provisional SPS measures where the relevant scientific evidence is insufficient. [FN249] Relying on the Appellate Body's reasoning in the Japan-Apples case, [FN250] the panel stated that relevant scientific evidence will be deemed insufficient within the meaning of Article 5.7 if the available scientific evidence does not allow the performance of a risk assessment as required under Article 5.1 and as defined in Annex A(4) to the SPS Agreement. [FN251]

***621** The panel found that the scientific evidence in this case was not insufficient within the meaning of Article 5.7 because EC member states and the relevant EC scientific committees had conducted risk assessments when the biotech products at issue were approved for EC-wide marketing. [FN252] Thus, the safeguard measures could not be justified as provisional measures under Article 5.7. [FN253]

The panel then considered whether the EC member states' safeguard measures were “based on a risk assessment” as required by Article 5.1 of the SPS Agreement. The panel noted that the risk assessments conducted when the biotech products were approved at the EC level were favorable and did not suggest that the biotech products presented any greater risk to human health and the environment than their conventional counterparts. [FN254] Thus, in order to justify the safeguard measures prohibiting these biotech products, the individual EC member states would have to explain why the existing risk assessments were inadequate and would have to supply risk assessments that supported their safeguard measures. [FN255]

The panel concluded that the scientific evidence relied upon by the EC member states to justify their safeguard measures did not constitute risk assessments within the meaning of Article 5.1 and Annex A(4) of the SPS Agreement. [FN256] Because the safeguard measures were not supported by the existing EC risk assessments or by any other risk assessments, the panel concluded that the safeguard measures were not “based upon” a risk assessment as required under Article 5.1. [FN257] Finally, the panel found that the application of SPS measures inconsistent with Article 5.1 also violates the SPS Agreement's Article 2.2 obligation to base measures on scientific principles and to refrain from maintaining them without sufficient scientific evidence. [FN258]

The panel's narrow interpretation of Article 5.7 severely restricts the ability of WTO members to impose provisional SPS measures in the face of new scientific evidence of risk to human health and the environment. If a risk assessment has previously been conducted, WTO members may not invoke Article 5.7 to justify provisional restrictions on GMOs. Instead, WTO members must explain why the existing risk assessment is inadequate and must present risk assessments of their own or of third parties that support the members' GMO restrictions.

Developing countries will be particularly affected by the panel's narrow interpretation of Article 5.7 because they may lack the resources to conduct a comprehensive risk assessment within the meaning of Article 5.1 and Annex A(4) ***622** of the SPS Agreement. This is particularly troubling because risk assessments conducted in developed countries may not take into account unique environmental risks present in developing countries, such as the

heightened risk of genetic pollution in countries with numerous wild relatives of the GM crop in question, which occurs particularly in countries that are the place of origin for certain crops (for example, maize in Mexico and potatoes in Peru and Bolivia).

The EC-Biotech decision fails to fully come to terms with the problem of scientific uncertainty in the evaluation of new technology and novel risks. The panel emphasized that Article 5.7 is triggered by insufficiency of scientific evidence and not by scientific uncertainty. [FN259] The panel's reasoning fails to address the fact that scientific knowledge is constantly evolving and that novel risks involving new technologies are often characterized by high levels of scientific disagreement over how to assess the risks of new technology and over the proper interpretation of limited scientific data. [FN260] In the context of GMOs, scientific disagreements about the safety of GMOs are reflected in the long-range stalemate at the Codex Alimentarius Commission over the development of GMO risk assessment guidelines and in the adoption of the precautionary principle in the Cartagena Biosafety Protocol. [FN261] GMOs represent an emerging set of technologies whose biological properties and environmental impacts are poorly understood and highly contested. [FN262] Under these circumstances, it seems entirely appropriate to permit countries to adopt provisional measures under Article 5.7 of the SPS Agreement.

4. Limited Relevance of International Law in Interpreting WTO Rules

Finally, the panel's conclusions with respect to the role of international law in interpreting WTO agreements are highly relevant to the relationship among international trade law, international human rights law, and international environmental law.

The panel began its analysis by recognizing that Article 3.2 of the WTO Dispute Settlement Understanding requires the interpretation of WTO agreements “in accordance with customary rules of interpretation of public international law.” [FN263] Among the customary rules to be consulted are those set forth in the Vienna Convention on the Law of Treaties (the Vienna Convention). [FN264]

*623 Article 31(3)(c) of the Vienna Convention requires that treaty interpretation take into account “any relevant rules of international law applicable in the relations between the parties.” [FN265] The panel recognized that treaties, customary international law, and general principles of law are “rules of international law” within the meaning of Article 31(3)(c). [FN266] However, the panel interpreted the term “applicable in the relations between the parties” to limit the relevant international law rules to those that are binding on all parties to the treaty being interpreted. [FN267] In other words, the panel concluded that it was obligated to take into account only those international law rules applicable to all WTO members. [FN268]

The EC identified two multilateral treaties and one customary rule or general principle directly relevant to the instant GMO dispute: the Convention on Biological Diversity, the Biosafety Protocol, and the precautionary principle. [FN269] Because the United States is not a party to the Convention on Biological Diversity and because the United States, Canada, and Argentina are not parties to the Biosafety Protocol, the panel concluded that it was not required to take these treaties into account in interpreting the SPS Agreement. [FN270] Relying on the Appellate Body's reasoning in the Beef-Hormones case, [FN271] the panel emphasized that the legal status of the precautionary principle remains unsettled, and declined to decide whether or not the precautionary principle has evolved into a customary international law rule, a general principle of international law, or both. [FN272]

The panel then turned to Article 31(1) of the Vienna Convention, which requires that the terms of a treaty be interpreted in accordance with their “ordinary meaning.” [FN273] The panel acknowledged that other relevant rules of international law may shed light on the ordinary meaning of terms contained in WTO agreements, including treaties that are not applicable to all of the disputing parties. [FN274] The panel emphasized that a dispute settlement panel may consider these treaties if it finds them informative, but is not obligated to do so. [FN275] Without explanation, the panel concluded that it “did not find it necessary or appropriate” to consider the provisions of the Convention on

Biological Diversity and the Biosafety Protocol identified by the EC in interpreting the WTO agreements at issue in this dispute. [FN276]

*624 The EC-Biotech decision suggests that WTO dispute settlement panels are likely to disregard international environmental law and international human rights law in interpreting WTO agreements. Rather than attempting to harmonize the international law obligations of WTO members, WTO dispute settlement panels are unlikely to take into account non-trade-related rules of international law unless they are binding on all 150 WTO members. [FN277] The EC-Biotech panel's restrictive interpretation of the role of international law in the interpretation of WTO agreements is at odds with past WTO jurisprudence. In the U.S.-Shrimp case, for example, the Appellate Body took into account a number of environmental treaties in order to clarify the meaning of the GATT Article XX environmental exceptions. [FN278] One of the treaties considered by the Appellate Body was the Convention on Biological Diversity, which has not been ratified by the United States, a party to the dispute. [FN279] Furthermore, in the Beef-Hormones case, the Appellate Body declined to rule on the precautionary principle's status in international law, but nevertheless acknowledged that the precautionary principle "found reflection" in Article 5.7 of the SPS Agreement. [FN280] In so doing, the Appellate Body implicitly recognized that other sources of international law (such as relevant environmental treaties) might shed light on the interpretation and application of Article 5.7's precautionary approach. [FN281] In short, the EC-Biotech panel was extremely dismissive of other bodies of international law. The Appellate Body will not have the opportunity to review the panel's approach because the EC-Biotech decision has not been appealed.

D. THE GMO REGULATORY FRAMEWORK THROUGH AN ENVIRONMENTAL JUSTICE LENS

Neither the SPS Agreement (with its emphasis on sound science) nor the Biosafety Protocol (with its mixture of science and precaution and its limited recognition of socioeconomic considerations) adequately addresses the environmental justice implications of GMOs for developing countries.

As explained in Part II of this article, the cultivation of GM crops in developing countries raises serious environmental justice concerns, including concerns about the impact of this technology on the livelihoods of small farmers and about the consequences of increasing dependence on the transnational corporations that supply patented seeds and other inputs. These socioeconomic concerns are not measurable or quantifiable through the techniques of scientific *625 risk assessment. Under the SPS Agreement and the Biosafety Protocol, these concerns are not permissible grounds for restricting or prohibiting the importation of GMOs.

While the SPS Agreement and the Biosafety Protocol might permit developing countries to take into account the socioeconomic consequences of scientifically demonstrated harm to biodiversity (such as harm to non-target organisms) in crafting SPS measures, these agreements do not permit trade restrictions based on socioeconomic considerations alone.

Both the SPS Agreement and the Biosafety Protocol privilege science as the arbiter of trade disputes to the exclusion of other forms of normative discourse. The EC-Biotech decision takes this privileging of science one step further by broadly interpreting the scope of the SPS Agreement, narrowly construing the scope of permissible provisional measures under Article 5.7 of the SPS Agreement, and refusing to consider other relevant rules of international law (including the precautionary principle and the Biosafety Protocol) in interpreting the SPS Agreement.

By privileging science-based decisionmaking over other forms of normative discourse and by privileging international trade law over other areas of international law, the international regulatory regime governing GMOs appears to exclude the justice and fairness concerns that are central to an environmental justice analysis. In effect, developing countries may not justify GMO restrictions on the basis of food security (international human rights law); protection of the cultural integrity of indigenous communities (international human rights law); or precaution in the face of scientific uncertainty (international environmental law). All of these legal obligations are subsumed to the imperative of

promoting free trade. This approach is particularly troubling in the context of GMOs because the privileged discourse (science) is highly contested and fraught with uncertainty.

The final Part of this article suggests ways in which the international legal regime governing trade in GMOs might be reformed in order to promote rather than frustrate international environmental justice.

IV. ALTERNATIVE APPROACHES TO PROMOTE INTERNATIONAL ENVIRONMENTAL JUSTICE

A re-conceptualization of the international regulatory framework for trade in GMOs must begin with the premise that trade is a means toward important social ends rather than an end in itself. Instead of single-mindedly seeking to minimize government regulation of GMOs by imposing stringent science-based requirements, international trade law must be harmonized with international human rights law and international environmental law. Indeed, the preamble to the Agreement Establishing the World Trade Organization explicitly recognizes that trade relations should be conducted so as to raise standards of living, ensure full *626 employment, and protect and preserve the environment. [FN282]

This Part discusses several key elements of an international environmental justice approach to environmental problems and examines the implications of this approach for the regulation of agricultural biotechnology. The objective of this Part is not to provide a detailed blueprint for an alternative regulatory strategy, but to highlight several key elements of such a strategy and to situate the GMO controversy in the broader debate over agricultural trade policy and economic development.

A. RECOGNITION OF THE PRIMACY OF HUMAN RIGHTS LAW

Environmental justice is grounded in fundamental human rights, including the rights to life, health, and cultural integrity; the right to food; the right to be free from racial discrimination; the right to self-determination; and the emerging rights to a healthy environment, to public participation in environmental decisionmaking, to environmental information, and to redress for environmental harm. [FN283] Nearly sixty years after the Universal Declaration of Human Rights proclaimed that “the inherent dignity and ... the equal and inalienable rights of all members of the human family [are] the foundation of freedom, justice and peace in the world,” [FN284] the widespread adoption of human rights conventions and other human rights instruments has confirmed that promotion of human rights is a fundamental obligation of all states. [FN285]

Human rights law is premised on the intrinsic dignity and worth of every individual, and human rights claims are therefore not subject to compromise in the pursuit of other social goals, such as economic efficiency. [FN286] The inalienable nature of human rights claims and their recognition by the international community in human rights conventions and other legal instruments can be understood to require the interpretation of international trade law in a way that effectuates fundamental human rights. [FN287] In other words, in the event of a conflict between international trade law and international human rights law, international human rights law should be given priority. [FN288]

In the context of GMOs, the fundamental human rights implicated by biotechnology include the right to food and the right to cultural integrity. As explained in Part II of this article, the cultivation of GM crops in developing countries is likely *627 to aggravate poverty and hunger by jeopardizing the precarious livelihoods of local and indigenous farming communities. Moreover, the displacement of traditional farming systems by transgenic monocultures threatens to erode the cultural integrity of these communities by accelerating the loss of the knowledge and skills required to grow subsistence crops using traditional methods. The right to food is recognized as a fundamental human right in the Universal Declaration of Human Rights, the International Covenant on Economic Social and Cultural Rights, and the United Nations Convention on the Rights of the Child. [FN289] The Convention on Biological Diversity obligates states to protect and preserve the traditional practices and lifestyles of indigenous and local com-

munities. [FN290] The Biosafety Protocol permits countries to consider the socioeconomic implications of GMOs' impacts on biodiversity, "especially with regard to the value of biological diversity to indigenous and local communities." [FN291] The right of all peoples to cultural integrity, self-determination, and free use of their natural resources (including the right not to be deprived of their own means of subsistence) is recognized in the International Covenant on Economic, Social and Cultural Rights [FN292] and in the International Covenant on Civil and Political Rights. [FN293] Finally, the International Labour Organization Convention Concerning Indigenous and Tribal Peoples in Independent Countries requires governments to protect the cultural integrity and the land and resource rights of indigenous peoples. [FN294]

The primacy of international human rights claims over trade norms can be recognized in any number of ways. One approach is to amend the WTO agreements, including the SPS Agreement, to include a hierarchy of norms provision that expressly provides that human rights norms shall prevail in the event of a conflict with trade norms. [FN295] International environmental law should likewise be given priority because the fulfillment of fundamental human rights depends on the protection of the planet's finite natural resources. [FN296] Such an approach is not without precedent. The North American Free Trade Agreement (NAFTA) contains a hierarchy of norms provision that gives priority to certain *628 enumerated environmental treaties in the event a conflict with the requirements of NAFTA. [FN297] The European Community conditions membership on participation in and observance of treaty-based human rights obligations. [FN298]

While a hierarchy of norms provision in the WTO would be an important step toward reconciling trade, human rights, and environmental protection, it is also important to amend the Biosafety Protocol to expressly permit developing countries to take into account both socioeconomic and environmental impacts when deciding whether or not to permit the importation of GM agricultural products. Furthermore, developing countries should be provided with technical and financial assistance to evaluate socioeconomic impacts as a means of integrating human rights norms into the biosafety decisionmaking process. Pursuant to a hierarchy of norms provision, the right to take into account socioeconomic considerations would override any contrary WTO requirement.

These recommendations will certainly encounter resistance from GMO-producing developed countries on the ground of potential protectionist abuse. Indeed, during the negotiation of the Biosafety Protocol, developing countries repeatedly called for the inclusion of non-science-based socioeconomic considerations in the Biosafety Protocol's provision for advanced informed agreement. [FN299] Developed countries rejected these demands on the ground that inclusion of socioeconomic considerations would conflict with WTO requirements. [FN300]

In order to address developed countries' concerns about protectionism, it is important to ground the controversy over GMOs in the broader context of North-South inequality, to situate the GMO controversy in the debate over trade in conventional agricultural products, and to highlight well-established legal principles originating in international environmental law and international trade law that support the right of developing countries to utilize trade-restrictive measures to promote food security, protect the livelihoods of small farmers, and promote economic development.

B. MITIGATION OF NORTH-SOUTH INEQUALITY

One important goal of international environmental justice is to mitigate the structural inequities that impose a disproportionate share of the environmental and socioeconomic burdens of globalization on developing countries and on the most vulnerable communities in the developing world. [FN301] An environmental justice analysis must openly examine the historical underpinnings and socioeconomic dimensions of contemporary environmental conflicts in order to arrive at *629 solutions that protect the environment and promote social and economic justice.

As this article has emphasized, the rules governing the international trade in GMOs cannot be considered in clinical isolation from the ongoing controversy over the rules governing international trade in conventional agricultural

products. As a consequence of colonialism, the Green Revolution, and structural adjustment, the most food insecure developing countries rely on agro-export production to obtain the export revenues necessary to finance the purchase of food and manufactured goods. These countries are structurally disadvantaged in world trade due to the volatility of global agricultural commodity markets and to the declining terms of trade for agricultural products vis-à-vis manufactured goods. Poor weather, bad harvests, and declining agricultural commodity prices can deprive these countries of the foreign exchange earnings needed to feed their populations and to engage in productive investment. Economic diversification and industrialization are necessary to promote food security and economic development.

Food insecurity in the developing world is aggravated by the double standard in the rules governing international agricultural trade that permit protectionism in wealthy countries while requiring market openness in poor countries. These inequities in global agricultural trade render small farmers in the developing world destitute by forcing them to compete with highly subsidized U.S. and EU agricultural producers. In addition, the quasi-monopolistic power of transnational agribusiness enables these companies to depress agricultural output prices while demanding high prices for agricultural inputs. Squeezed between low output prices and high input prices, many small farmers in the developing world have been forced to abandon agricultural production and to migrate to urban areas at a rate that exceeds the capacity of governments to provide housing, employment, and other services.

As I have argued elsewhere, the reform of the rules governing international trade must begin by requiring developed countries to phase out agricultural subsidies and reduce import barriers. [FN302] This will increase agricultural commodity prices, boost the income of small farmers in the developing world, and increase the export revenues of developing countries. [FN303]

However, it would be a mistake to assume that “leveling the playing field” by imposing the same free market reforms on rich and poor countries will be sufficient to overcome structural inequities (such as agro-export specialization) that perpetuate poverty, hunger, and environmental degradation in the developing world. [FN304] The declining terms of trade for agricultural products vis-à-vis manufactured goods and the power of transnational agribusiness to influence agricultural *630 input and output prices will systematically disadvantage developing countries even if developed country protectionism is eliminated. [FN305]

In order to ensure that international trade in agricultural products promotes rather than frustrates the fundamental right to food, developing countries must be given the opportunity enjoyed for decades by wealthy countries to use tariffs and subsidies to protect and nurture the agricultural sector. Specifically, developing countries must be permitted to use tariffs and subsidies to protect the livelihoods of small farmers, to encourage domestic food production, to protect producers of particularly sensitive products (such as food staples) from well-established foreign competitors, to nurture higher value-added food processing industries, and to promote rural development. [FN306] Similarly, because the cultivation of GM crops may threaten the livelihoods of poor farmers and increase the power of transnational agribusiness, developing countries should be permitted to take into account socioeconomic considerations in deciding whether to permit the importation of GM agricultural products.

In addition, the rules governing international trade must give developing countries the policy flexibility to make the transition from agro-export specialization to a more diversified economic base. Nearly all developed countries (including the United States, the United Kingdom, Japan, Germany, and France) diversified and industrialized their economies through aggressive state intervention in the form of tariffs, subsidies, state financing of major industries, and even state-sponsored acquisition of intellectual property through industrial espionage. [FN307] Furthermore, the developing countries that rapidly industrialized in the aftermath of World War II (including Taiwan, Korea, Mexico, Brazil, India, and Chile) did so through selective industrial policy--the use of state intervention and market incentives to promote those industries most likely to contribute to long-term economic development. [FN308] Regrettably, the current WTO framework would preclude developing countries from adopting many of the trade-related policies used successfully by both developed and developing countries in the *631 past. [FN309] As a matter of fairness and justice, the regulatory framework for international trade must be modified to permit developing countries to make use

of tariffs, subsidies, and other protectionist measures to end their dangerous and debilitating dependence on agro-export specialization.

In sum, only an asymmetrical set of international trade obligations permitting protectionism in the developing world while requiring market openness in developed countries will give developing countries the necessary policy space to protect the livelihoods of small farmers, promote food security, and industrialize and diversify their economies. Furthermore, as discussed above, promotion of food security requires serious efforts to address the market distortions caused by the domination of agricultural trade by a handful of transnational corporations.

Fortunately, both international environmental law and international trade law contain principles that can be deployed to mitigate the structural inequities that exacerbate North-South inequality.

1. Common But Differentiated Responsibility

Amendment of the Biosafety Protocol to permit developing countries to consider the socioeconomic implications of agricultural biotechnology is consistent with the principle of common but differentiated responsibility. The principle of common but differentiated responsibility has been used in international environmental law to impose asymmetrical obligations on developed and developing countries in light of (1) developed countries' disproportionate contribution to global environmental degradation; (2) developed countries' superior financial and technical resources; and/or (3) developing countries' economic and ecological vulnerability. [FN310]

Principle 7 of the Rio Declaration on Environment and Development articulates the principle of common but differentiated responsibility as follows:

In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command. [FN311]

Principle 6 of the Rio Declaration recognizes the particular vulnerability of developing countries by providing that “[t]he special situation and needs of *632 developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority.” [FN312]

The principle of common but differentiated responsibility is contained in a variety of environmental treaties, including the United Nations Convention on the Law of the Sea (UNCLOS), [FN313] the Vienna Convention for the Protection of the Ozone Layer, [FN314] the Montreal Protocol on Substances that Deplete the Ozone Layer, [FN315] the United Nations Framework Convention on Climate Change (UNFCCC), [FN316] the Kyoto Protocol, [FN317] and the Convention on Biological Diversity. [FN318]

In view of the ecological and economic vulnerability of most developing countries and of the unique risks posed by GMOs to farmers in the developing world, it is imperative to invoke the principle of common but differentiated *633 responsibility to permit developing countries to integrate socioeconomic considerations into the biosafety decisionmaking process. The Biosafety Protocol should be amended to expressly permit developing countries to take into account both the environmental and the socioeconomic impacts of GMOs. Furthermore, because social scientists have developed a wide array of approaches toward analyzing the socioeconomic impacts of biotechnology, [FN319] the Conference of the Parties, with the assistance of appropriate experts, should offer guidance to developing countries on the available social science methodologies and on the incorporation of socioeconomic assessments into regulatory decisions about biotechnology. As a starting point, the Conference of the Parties might consider the regulatory practices of several countries that already integrate socioeconomic considerations into decisionmaking about biosafety, including Norway, New Zealand, and the Philippines. [FN320] Finally, the Biosafety Protocol should be amended to explicitly recognize the obligation of developed countries to provide technical and financial resources

and capacity-building assistance for the performance of socioeconomic impact assessments and the incorporation of these assessments into the biosafety decisionmaking process. [FN321]

2. Special and Differential Treatment

The principle of common but differentiated responsibility has an analogue in international trade law that supports the imposition of asymmetrical obligations on developed and developing countries. The international trade law principle is known as special and differential treatment. [FN322]

The 1947 General Agreement on Tariffs and Trade (GATT 1947) [FN323] initially *634 imposed uniform obligations on developed and developing countries. [FN324] However, in recognition of the disadvantages faced by developing countries in international trade due to the legacy of colonialism, [FN325] the GATT was subsequently amended to permit developing countries to protect their infant industries from the more technologically advanced industries of developed countries, [FN326] to allow developing countries to impose trade restrictions in the event of balance of payments problems, [FN327] and to encourage developed countries to grant enhanced market access opportunities to developing countries. [FN328]

In 1979, the GATT contracting parties established the legal foundation for special and differential treatment by adopting the Decision of 28 November 1979 on Differential and More Favorable Treatment, commonly known as the "Enabling Clause." [FN329] The Enabling Clause sought to provide the requisite policy space for economic development by authorizing (but not requiring) developed countries to provide preferential market access to developing countries and by recognizing the principle of non-reciprocity between developed and developing countries. [FN330] Pursuant to the non-reciprocity principle, developing countries were not required to make concessions on tariff levels, non-tariff barriers and subsidies equivalent to those of developed countries; nor were they required to become parties to all of the side agreements resulting from the Tokyo Round of trade negotiations. [FN331]

The Enabling Clause did not live up to developing countries' expectations. The beneficial effect of preferential market access declined as overall tariff levels were reduced. [FN332] Moreover, the most economically significant products of developing countries (such as clothing, textiles, and agricultural products) were often excluded or received less preference. [FN333] Finally, the benefits of preferential market access were diminished by stringent rules of origin or were made contingent on compliance with specific political conditions. [FN334] Above all, the Enabling Clause was strictly voluntary, creating no binding obligations whatsoever for developed countries and imposing no sanctions in the event that the *635 Enabling Clause commitments were violated. [FN335]

In 1995, the WTO, which succeeded the GATT and expanded the international trade regime to include new topics such as services, agriculture, subsidies, and trade-related aspects of intellectual property rights, [FN336] eroded the non-reciprocity element of special and differential treatment in two distinct ways. First, the WTO became a single undertaking, requiring prospective WTO members to sign on to virtually all WTO Agreements. [FN337] Second, the WTO imposed the same substantive obligations on all countries, but merely gave developing countries additional time to comply. [FN338] Developing countries agreed to forego non-reciprocity and to undertake new obligations in areas of interest to the developed world (such as services, investment, and intellectual property) in exchange for better market access for developing country textiles and agricultural products. [FN339]

Regrettably, the results of the WTO were decidedly one-sided. The WTO did not succeed in phasing out the import barriers that excluded developing country agricultural products and textiles from lucrative developed country markets. [FN340] However, the WTO did succeed in restricting the flexibility of developing countries to use tariffs and subsidies to promote economic development, dismantling the import barriers that had previously protected developing country industries from technologically advanced competitors in the developed world, and imposing new and expensive legal obligations on developing countries in the areas of intellectual property, investment, and services. [FN341] The extra time accorded developing countries to comply with WTO requirements has not been sufficient

(particularly for countries with low levels of industrialization), and the technical assistance promised by developed countries to facilitate compliance has not materialized. [FN342] In short, the WTO has generally been regarded as a bad bargain for developing countries. [FN343]

The time has come to reinvigorate the principle of special and differential treatment as a means of ensuring that the international trade regime promotes rather than frustrates economic development, environmental protection, and the fulfillment of basic human rights. Indeed, in recognition of the dissatisfaction of developing countries with the current WTO regulatory framework, the ministerial declaration that launched the Doha Round of WTO negotiations explicitly re-affirmed the commitment of WTO members to special and differential treatment and provided that “all special and differential treatment provisions shall be *636 reviewed with a view to strengthening them and making them more precise, effective, and operational.” [FN344]

In addition to modifying the WTO agreements to incorporate the hierarchy of norms provision discussed in Section A of this Part, it is imperative that the WTO be amended to impose enforceable obligations on developed countries to open their markets to developing country producers, particularly in the areas of agriculture and textiles. [FN345] Furthermore, in order to promote food security, the WTO Agreement on Agriculture must be modified to permit developing countries to utilize tariffs, subsidies, and other protectionist measures in order to protect the livelihoods of small farmers, encourage domestic food production, nurture infant food processing industries, and promote rural development. [FN346]

While these measures are important starting points, it is important to recognize that they will not be sufficient to address the problem of poverty and hunger unless the broader regulatory framework for international trade facilitates economic diversification and industrialization. Developing countries must be given the policy space to break away from the agro-export specialization imposed during the colonial era and reinforced through subsequent aid, trade, and debt relief policies. Successful industrialization has historically involved the use of tariffs and subsidies to protect key industries until they were strong enough to withstand foreign competition. [FN347] Rather than binding and reducing tariffs in accordance with WTO requirements, developing countries must be permitted to increase tariffs to protect infant industries. [FN348] Similarly, many of the subsidies historically used to promote industrialization are currently prohibited by the WTO subsidy rules (the Agreement on Subsidies and Countervailing Measures). [FN349] In accordance with special and differential treatment, developing countries should be permitted to deviate from these rules in order to promote those industries most likely to lead to long-term economic development. [FN350] While a detailed discussion of additional specific proposals to reform the WTO agreements is beyond the scope of this paper, [FN351] it is important to recognize that differential treatment of developed and developing countries must be a guiding principle in any effort to integrate trade, environmental protection, and human rights.

*637 C. MITIGATING THE ABUSIVE PRACTICES OF TRANSNATIONAL CORPORATIONS

An environmental justice approach to global environmental problems recognizes that environmental injustice is often perpetrated by transnational corporations headquartered in the developed world and attempts to mitigate abuses of corporate power. [FN352] As explained in Parts I and II of this article, a handful of transnational corporations dominate international trade in pesticides, grains, and both conventional and GM seeds. These companies use their market power to distort the price of agricultural inputs and outputs to the detriment of poor farmers in developing countries who are caught in the vise of low agricultural commodity prices and high prices for seeds and agrochemicals. Even if the WTO agreements are modified to reinvigorate the principle of special and differential treatment, the market distortions caused by transnational agribusiness are likely to impede the realization of food security and the protection of the economic and cultural integrity of local and indigenous farming communities. [FN353]

While the WTO has focused on market distortions caused by government intervention, antitrust law has traditionally been used to address market distortions caused by private anti-competitive practices. [FN354] Recognizing the

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