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Genetically Modified Organisms and Justice: The International Environmental Justice Implications of Biotechnology

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Genetically Modified Organisms and Justice: The International Environmental Justice Implications of Biotechnology

Carmen G. Gonzalez*

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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).¹ 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).² The panel also struck down individual EC Member states’ national GMO bans on the grounds that these measures were not based on risk assessments.³

The trade impasse over GMOs has its genesis in the conflicting approaches of the United States and the EC to the regulation of biotechnology.⁴ 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.⁵ 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.⁶ 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.⁷ Genetically altered products are therefore subject to a pre-marketing approval process involving extensive risk evaluation and public input.⁸ 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.⁹

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

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¹ See Panel Report, *European Communities—Measures Affecting the Approval and Marketing of Biotech Products*, WT/DS/291/R, WT/DS/292/R, WT/DS/293/R (Sept. 29, 2006), available at http://www.wto.org/english/news_e/news06_e/291r_e.html [hereinafter EC—Biotech Panel Report].

² See *id.* ¶¶ 8.6-8.7.

³ See *id.* ¶¶ 8.8-8.10.

⁴ See David Winickoff et al., *Adjudicating the GM Food Wars: Science, Risk and Democracy in World Trade Law*, 30 YALE J. INT’L L. 81, 86-87 (2005).

⁵ See *id.* at 87; Douglas A. Kysar, *Preferences for Processes: The Process/Product Distinction and the Regulation of Consumer Choice*, 118 HARV. L. REV. 525, 557-59 (2004).

⁶ See Winickoff et al., *supra* note 4, at 87; Kysar, *supra* note 5, at 557-59. For a detailed discussion of the U.S. regulatory framework for GMOs, see Thomas O. McGarity, *Seeds of Distrust: Federal Regulation of Genetically Modified Foods*, 35 U. MICH. J. L. REFORM 403, 432-34, 439-41 (2002); Emily Marden, *Risk and Regulation: U.S. Regulatory Policy on Genetically Modified Food and Agriculture*, 44 B.C. L. REV. 733, 734-36 (2003); Ved P. Nanda, *Genetically Modified Food and International Law—the Biosafety Protocol and Regulations in Europe*, 28 DENV. J. INT’L L. & POL’Y 235, 243-48 (2000).

⁷ See Kysar, *supra* note 5, at 562-63.

⁸ See *id.* at 563.

⁹ See *id.*

legislation with WTO obligations.¹⁰ The panel did not rule on the legal status of the precautionary principle¹¹ or explain why it did not find the leading biodiversity and biosafety treaties relevant to its interpretation of the SPS Agreement.¹² 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.¹³ 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 practices¹⁴ and declined to seek appellate review.¹⁵

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,

¹⁰ See Panel Report, EC-Biotech, *supra* note 1, ¶ 8.3.

¹¹ The EC argued that the WTO agreements at issue in this dispute must be interpreted by reference to other relevant rules of international law, including the precautionary principle. *See id.* ¶¶ 7.52, 7.76-7.79. While there is no authoritative definition of the precautionary principle, the environmental treaty specifically addressing GMOs (the Cartagena Biosafety Protocol) expressly adopts the precautionary approach articulated in Principle 15 of the Rio Declaration on Environment and Development. *See* Cartagena Protocol on Biosafety to the Convention on Biodiversity, pmbl., Jan. 29, 2000, 39 I.L.M. 1027 [hereinafter Biosafety Protocol]. According to Principle 15, "[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." United Nations Conference on Environment and Development, Rio Declaration on Environment and Development, princ. 15, June 14, 1992, U.N. Doc. A/CONF.151/5/Rev.1, reprinted in 31 I.L.M. 874 [hereinafter Rio Declaration]. In the context of the GMO dispute, the panel declined to express a view on the legal status of the precautionary principle, claiming that this matter remains unsettled and that resolution of this contentious issue is not necessary to resolve the legal claims at issue in this case. *See* Panel Report, EC-Biotech, *supra* note 1, ¶¶ 7.87-7.89. For a general discussion of the precautionary principle, see PROTECTING PUBLIC HEALTH AND THE ENVIRONMENT: IMPLEMENTING THE PRECAUTIONARY PRINCIPLE (Carolyn Raffensperger & Joel Tickner eds., 1999).

¹² *See* Panel Report, EC-Biotech, *supra* note 1, ¶ 7.95. As explained more fully in Part III below, the EC argued that the panel, in interpreting the WTO agreements at issue in this dispute, was required to take into account the Convention on Biological Diversity and the Cartagena Biosafety Protocol to the Convention on Biological Diversity. Relying on article 31(3)(c) of the Vienna Convention on the Law of Treaties (VCLT), the panel found that it was not required to take these treaties into account because they were not binding on all WTO members. *See id.* ¶¶ 7.50-7.75. The panel then considered whether these treaties might nevertheless be relevant pursuant to Article 31(1) of the VCLT as evidence of the "ordinary meaning" of the words contained in the WTO Agreements. Without explanation, the panel concluded that it "did not find it necessary or appropriate to rely on these particular provisions in interpreting the WTO agreements at issue in this dispute." *See id.* ¶¶ 7.90-96.

¹³ *See* Panel Report, EC-Biotech, *supra* note 1, ¶¶ 8.13-8.20; ¶¶ 8.33-8.40; and ¶¶ 8.49-8.55; Agreement on the Application of Sanitary and Phytosanitary Measures, Apr. 15, 1994, Agreement Establishing the World Trade Organization, Annex C(1)(a), Art. 8 (1994), available at http://www.wto.org/english/docs_e/legal_e/15-sps.pdf [hereinafter SPS Agreement].

¹⁴ *See* WTO Panel Provisionally Rules Against EU Moratorium on Biotech Approval, BRIDGES WKLY. TRADE NEWS DIGEST, Feb. 8, 2006 at 1.

¹⁵ *See* EU Decides Not to Appeal Biotech Ruling, BRIDGES TRADE BIORES, Dec. 1, 2006, at 6.

and soil salinity.¹⁶ 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.¹⁷

Developing countries attempting to devise appropriate biotechnology regulation must contend with the economic power and influence of the United States and the EC.¹⁸ Although the vast majority of GM crops are grown in the United States, Canada, Argentina, China, and South Africa,¹⁹ U.S. agribusiness has been promoting the cultivation of GMOs in the developing world.²⁰ The United States has conditioned bilateral free trade agreements and development assistance on the acceptance of GMOs.²¹ 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.²² Many African countries refused the proffered “aid” out of concern about the potential human health and environmental impacts of GMOs.²³ Likewise, the EC’s stringent food safety rules, particularly the traceability and labeling requirements, have compelled many developing countries to

¹⁶ See, e.g., NUFFIELD COUNCIL ON BIOETHICS, THE USE OF GENETICALLY MODIFIED CROPS IN DEVELOPING COUNTRIES 4-5 (2004), available at http://www.nuffieldbioethics.org/fileLibrary/pdf/GM_Crops_Discussion_Paper_2004.pdf; Norman E. Borlaug, *Ending World Hunger: The Promise of Biotechnology and the Threat of Antiscience Zealotry*, 124 PLANT PHYSIOLOGY 487, 487-490 (2000); PER PINSTRUP-ANDERSON & EBBE SCHOLER, SEEDS OF CONTENTION: WORLD HUNGER AND THE GLOBAL CONTROVERSY OVER GM CROPS 1-2 (2001).

¹⁷ See, e.g., NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 6-7; LIZ ORTON, GM CROPS—GOING AGAINST THE GRAIN 3-6 (2003), available at http://www.actionaid.org/docs/gm_against_grain.pdf; VANDANA SHIVA, STOLEN HARVEST: THE HIJACKING OF THE GLOBAL FOOD SUPPLY 95-114 (2000).

¹⁸ See Ernestine Meijer & Richard Stewart, *The GM Cold War: How Developing Countries Can Go from Being Dominos to Being Players*, 13 REV. EUR. COMM. & INT’L ENVTL. L. 247, 252 (2004).

¹⁹ See U.N. FOOD & AGRIC. ORG., THE STATE OF FOOD AND AGRICULTURE 2003-2004, 36 (2004), available at <http://www.fao.org/docrep/006/y5160e/y5160e00.htm> [hereinafter FAO, The State of Food and Agriculture 2003-2004].

²⁰ See HELENA PAUL & RICARDA STEINBRECHER, HUNGRY CORPORATIONS: TRANSNATIONAL BIOTECH COMPANIES COLONISE THE FOOD CHAIN 184-220 (2003).

²¹ See Meijer & Stewart, *supra* note 18, at 253.

²² See Calestous Juma, *The New Age of Biodiplomacy*, 6 GEO. J. INT’L AFF. 105, 110 (2005); See generally GRAIN, MAKING THE WORLD HUNGRY FOR GM CROPS 19 (2005), available at http://www.grain.org/briefings_files/usaaid-04-2005-en.pdf; AFRICA CENTER FOR BIODIVERSITY ET AL., GM FOOD AID: AFRICA DENIED CHOICE AGAIN? 6 (2004), available at http://www.grain.org/research_files/GE-food-aid-briefing-2004-en.pdf; WTO Agreement on Agriculture Silent on GMOs, HERALD (Harare, Zimbabwe), June 19, 2003; Katrin Dauenhauer, *Africans Challenge Bush Claim that GM Food Good for Them*, INTER PRESS SERVICE, June 19, 2003; Robert Weissman, *Biotech Food Fight: The Front*, MULTINATIONAL MONITOR, June 2003, at 6.

²³ See U.N. ENV’T PROGRAMME, AFRICA ENVIRONMENT OUTLOOK 2: OUR ENVIRONMENT, OUR WEALTH at 305-06, U.N. Sales No. 02.III.D.20 (2006), available at http://www.unep.org/DEWA/Africa/docs/en/AEO2_Our_Environ_Our_Wealth.pdf. For a detailed analysis of Zambia’s decision to reject genetically modified food aid, see Reece Walters, *Crime, Bio-Agriculture and the Exploitation of Hunger*, 46 BRIT. J. CRIMINOLOGY 26 (2006). The United States has also offered GMOs as food aid to India. Like its African counterparts, the Indian government, too, has rejected this aid. See Edward Luce, *India Rejects Gene-Modified Food Aid*, FIN. TIMES, Jan. 3, 2003, available at <http://search.ft.com/ftArticle?id=030103000573>.

forego all GM crops for fear of losing lucrative EC markets due to the difficulty of segregating GM and non-GM products.²⁴

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.²⁵ 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 GMOs, particularly the SPS Agreement and the Cartagena Protocol on Biosafety to the Convention on Biological Diversity.²⁶ 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.²⁷ 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.²⁸ 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

²⁴ See Meijer & Stewart, *supra* note 18, at 253.

²⁵ See *id.* at 254-256.

²⁶ See, e.g., Michelle K. McDonald, *International Trade Law and the U.S.-E.U. GMO Debate: Can Africa Weather this Storm?*, 32 GA. J. INT'L & COMP. L. 501 (2004); Patrick J. Vallely, *Tension between the Cartagena Protocol and the WTO: The Significance of Recent Developments in an Ongoing Debate*, 5 CHI. J. INT'L L. 369 (2004); Olivette Rivera-Torres, *The Biosafety Protocol and the WTO*, 26 B.C. INT'L & COMP. L. REV. 263 (2003); Terence P. Stewart & David Johanson, *A Nexus of Trade and the Environment: The Relationship Between the Cartagena Protocol on Biosafety and the SPS Agreement of the WTO*, 14 COLO. J. INT'L ENVTL. L. & POL'Y 1 (2003); Lakshman Guruswamy, *Sustainable Agriculture: Do GMOs Imperil Biosafety*, 9 IND. J. GLOBAL LEGAL STUD. 461 (2002); Sabrina Safrin, *Treaties in Collision? The Biosafety Protocol and the World Trade Organization Agreements*, 96 A.J.I.L. 606, 607 (2002); Brett Grosko, *Genetic Engineering and International Law: Conflict or Harmony? An Analysis of the Biosafety Protocol, GATT, and WTO Sanitary and Phytosanitary Agreement*, 20 VA ENVTL L. J. 295, 297-98 (2001); Steve Charnovitz, *The Supervision of Health and Biosafety Regulation by World Trade Rules*, 13 TUL. ENVTL. L.J. 271 (2000); Gretchen L. Gaston & Randall S. Abate, *The Biosafety Protocol and the World Trade Organization: Can the Two Coexist?*, 12 PACE INT'L L. REV. 107 (2000).

²⁷ See Meijer & Stewart, *supra* note 18, at 256.

²⁸ The scholarly literature on GMOs has generally failed to examine the relationship between the conflict over GMOs and the deadlock between developed and developing countries over agricultural subsidies and import barriers that resulted in the collapse of WTO negotiations in July 2006. For a discussion of the GMO controversy in the context of the larger WTO dispute over agricultural trade, see Carmen G. Gonzalez, *Trade Liberalization, Food Security, and the Environment: The Neoliberal Threat to Sustainable Rural Development*, 14 J. TRANSNAT'L L. AND CONTEMP. PROBS. 419, 450-456, 486, 486 n. 363, 471 (2004). For an analysis of the disputes over trade in conventional agricultural products that brought the Doha Round of WTO negotiations to a standstill, see Mark Trumbull, *How Farms Stymied Doha*, CHRISTIAN SCI. MONITOR, July 27, 2007, at 2; Paul Blustein, *Trade Talks Fail After Stalemate Over Farm Issues*, WASH. POST, July 25, 2006, at D1; Paul Blustein, *Trade Ministers Give Up on Compromise; Geneva Conference Collapses Over Agricultural Tariffs and Subsidies*, WASH. POST, July 2, 2006, at A18.

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 agricultural 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 countries²⁹ and an increasingly important paradigm through which to evaluate domestic and international environmental law.³⁰ Much of the environmental justice literature in the United States has emphasized the disproportionate concentration of environmental hazards in poor and minority communities.³¹ The location of hazardous

²⁹ See LUKE W. COLE & SHEILA R. FOSTER, FROM THE GROUND UP: ENVIRONMENTAL RACISM AND THE RISE OF THE ENVIRONMENTAL JUSTICE MOVEMENT 19-33 (2001); RAMACHANDRA GUHA, ENVIRONMENTALISM: A GLOBAL HISTORY 98-108 (2000); Ramachandra Guha & J. Martinez-Alier, *Varieties of Environmentalism: Essays North and South* xxi (1997); Juan Martinez-Alier and Lori Ann Thrupp, *A Political Ecology of the South*, 19 LATIN AM. PERSP. 148, 150 (1992).

³⁰ See, e.g., RUCHI ANAND, INTERNATIONAL ENVIRONMENTAL JUSTICE: A NORTH-SOUTH DIMENSION (2004) (evaluating environmental treaties through the framework of environmental justice); Richard Lazarus, *Environmental Justice and the Teaching of Environmental Law*, 96 W. VA. L. REV. 1025 (1994) (explaining that an environmental justice approach to environmental protection requires an assessment of the distributional implications of environmental regulation).

³¹ See, e.g., CLIFFORD RECHTSCHAFFEN & EILEEN GAUNA, ENVIRONMENTAL JUSTICE: LAW, POLICY & REGULATION 3-5, 56-76 (2002); COLE & FOSTER, *supra* note 29, at 54-58, 167-183; UNEQUAL PROTECTION: ENVIRONMENTAL JUSTICE AND COMMUNITIES OF COLOR (Robert D. Bullard ed., 1994); Paul Mohai & Bunyan Bryant, *Environmental Injustice: Weighing Race and Class as Factors in the Distribution of Environmental Hazards*, 63 U. COLO. L. REV. 921, 921-27 (1992).

waste landfills, polluting industry, and other undesirable facilities in these communities exposes the most socially and economically disadvantaged populations to the health risks associated with high levels of air and water pollution.³² Environmental justice is also concerned with the inequitable distribution of environmental amenities (such as parks, recreation areas, and open space)³³ and vital environmental services (such as flood control and emergency response).³⁴ 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.³⁵

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.³⁶ 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.³⁷

This distributional inequity is most evident in the export of polluting industries and hazardous wastes from wealthy, developed countries to poor developing countries in

³² See, e.g., COLE & FOSTER, *supra* note 29, at 54-58, 167-83; Eileen Gauna, *The Environmental Justice Misfit: Public Participation and the Paradigm Paradox*, 17 STAN. ENV'T L.J. 3, 9-12 (1998); Carolyn Graham & Jennifer B. Grills, *Environmental Justice: A Survey of Federal and State Responses*, 8 VILL. ENV'T L.J. 237, 240 (1997); Audrey Wright, *Unequal Protection Under the Environmental Laws: Reviewing the Evidence on Environmental Racism and the Inequities on Environmental Legislation*, 39 WAYNE L. REV. 1725, 1729 (1993); Mohai & Bryant, *supra* note 31, at 922; Paul Mohai & Bunyon Bryant, *Environmental Racism: Reviewing the Evidence*, in RACE AND THE INCIDENCE OF ENVIRONMENTAL HAZARDS: A TIME FOR DISCOURSE 163, 173-74 (Bunyon Bryant & Paul Mohai eds., 1992); Marianne Lavelle & Marcia Coyle, *Unequal Protection: The Racial Divide in Environmental Law*, NAT'L L.J., Sept. 21, 1992, at S2.

³³ See, e.g., David H. Getches & David N. Pellow, *Beyond "Traditional" Environmental Justice*, in JUSTICE AND NATURAL RESOURCES: CONCEPTS, STRATEGIES, AND APPLICATIONS 3, 4-5 (Kathryn M. Mutz, Gary C. Bryner, & Douglas S. Kenney eds., 2002); Samara Swanston, *Environmental Justice and Environmental Quality Benefits: The Oldest, Most Pernicious Struggle and Hope for Burdened Communities*, 23 VT. L. REV. 545 (1999).

³⁴ See MEMBER SCHOLARS OF THE CENTER FOR PROGRESSIVE REFORM, AN UNNATURAL DISASTER: THE AFTERMATH OF HURRICANE KATRINA 24-26, 34-40 (2005), available at http://www.progressivereform.org/Unnatural_Disaster_512.pdf.

³⁵ See *id.* at 26-28, 34-40.

³⁶ See, e.g., Carmen G. Gonzalez, *Beyond Eco-Imperialism: An Environmental Justice Critique of Free Trade*, 78 DENV. U. L. REV. 979, 986-87, 992 (2001); ANAND, *supra* note 30, at 128-131; Tseming Yang, *International Environmental Protection: Human Rights and the North-South Divide*, in JUSTICE AND NATURAL RESOURCES: CONCEPTS, STRATEGIES AND APPLICATIONS 87, 87-89 (Kathryn M. Mutz, Gary C. Bryner, & Douglas S. Kenney eds., 2002); Carmen G. Gonzalez, *Markets, Monocultures, and Malnutrition: Agricultural Trade Policy Through and Environmental Justice Lens*, 14 MICH. ST. J. INT'L L. 345, 378 (2006).

³⁷ See Gonzalez, *Beyond Eco-Imperialism*, *supra* note 36, at 986-1000.

Asia, Africa, and Latin America.³⁸ Developing countries have become attractive sites for hazardous waste disposal due to weak environmental regulation and lax enforcement.³⁹ 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.⁴⁰ 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.⁴¹ 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.⁴² 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.⁴³

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.⁴⁴ 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.⁴⁵ 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.⁴⁶ 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.⁴⁷ 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, their livelihoods, and the health of their ecosystems.⁴⁸ These environmental justice struggles draw their activist

³⁸ See *id.* at 989-90.

³⁹ See *id.*

⁴⁰ See *id.*

⁴¹ See *id.* at 992.

⁴² See *id.* at 989-90.

⁴³ See Lydia Polgreen & Marlise Simons, *Global Sludge Ends in Tragedy for Ivory Coast*, N.Y. TIMES, Oct. 2, 2006, at A-1.

⁴⁴ WORLD RESOURCES INST. ET AL., WORLD RESOURCES 2005: THE WEALTH OF THE POOR: MANAGING ECOSYSTEMS TO FIGHT POVERTY viii (2005) [hereinafter WRI, THE WEALTH OF THE POOR].

⁴⁵ See *id.* at 16-171; GUHA, *supra* note 29, at 105-06.

⁴⁶ See WRI, THE WEALTH OF THE POOR, *supra* note 44, at 4.

⁴⁷ See GUHA, *supra* note 29, at 105-07; Guha & Martinez-Alier, *supra* note 29, at xxi; Charles Zerner, *Toward a Broader Vision of Justice and Nature Conservation*, in PEOPLE, PLANTS, & JUSTICE: THE POLITICS OF NATURE CONSERVATION 3, 14-15 (Charles Zerner ed., 2000).

⁴⁸ See Gonzalez, *supra* note 36, at 345-48; GUHA, *supra* note 29, at 99-100, 117 (analyzing the fierce resistance of Malaysian hunters and farmers to commercial logging of their forests and describing the struggles of the Brazilian rubber tappers to preserve the Amazon rain forest); Genevieve Michon et al., *The Damar Agroforests of Krui, Indonesia: Justice for Forest Farmers*, in PEOPLE, PLANTS, & JUSTICE: THE POLITICS OF NATURE CONSERVATION, *supra* note 47, at 159-203 (Charles Zerner ed., 2000) (describing the struggle of Indonesian farmers against the conversion of their forests to specialized oil palm or acacia

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.⁴⁹

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.⁵⁰ 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.⁵¹

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 Rights⁵² and in Article 11 of the International Covenant on Economic, Social and Cultural Rights.⁵³ The United Nations Convention on the Rights of the Child also imposes a duty on governments to provide adequate food.⁵⁴ Food security is therefore an important environmental justice issue.⁵⁵

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 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 ENVIRONMENTAL INJUSTICE: POVERTY, HUNGER AND ENVIRONMENTAL DEGRADATION

plantations); Aidan Rankin, *"The Land of our Ancestor's Bones": Wichi People's Struggle in the Argentine Chaco*, in GREEN GUERRILLAS: ENVIRONMENTAL CONFLICTS AND INITIATIVES IN LATIN AMERICA AND THE CARIBBEAN 40, 40-46 (Helen Collinson ed., 1997) (discussing the efforts of the Wichi Indians of northern Argentina to claim the land cultivated by their ancestors for thousands of years); Lucy Jarosz, *Defining Deforestation in Madagascar*, in LIBERATION ECOLOGIES: ENVIRONMENT, DEVELOPMENT AND SOCIAL MOVEMENTS 148, 148-164 (Richard Peet & Michael Watts eds., 1996) (explaining how shifting cultivators in Madagascar resisted government efforts to deprive them of their livelihoods by blaming them for the country's massive deforestation while failing to address the devastating impact on Madagascar's forests of coffee cash-cropping); MADHAV GADGIL & RAMACHANDRA GUHA, *ECOLOGY AND EQUITY: THE USE AND ABUSE OF NATURE IN CONTEMPORARY INDIA* (1995).

⁴⁹ See GUHA, *supra* note 29, at 105-06 (describing the characteristics of environmental justice activists in developing countries).

⁵⁰ See Gonzalez, *supra* note 36, at 378.

⁵¹ See *id.*

⁵² Universal Declaration of Human Rights, G.A. Res. 217A, at 71, U.N. GAOR, 3d Sess., 1st plen. mtg., U.N. Doc A/10, art. 25 (Dec. 12, 1948), available at <http://www.unhchr.ch/udhr/lang/eng.pdf>.

⁵³ See International Covenant on Economic, Social and Cultural Rights, art. 11, G.A. Res. 2200A (XXI), U.N. Doc. A/6316, 993 U.N.T.S. 3 (Dec. 16, 1966).

⁵⁴ See Convention on the Rights of the Child, G.A. Res. 44/25, arts. 24 & 27, U.N. Doc. A/44/49, 1577 U.N.T.S. 3 (Nov. 20, 1989).

⁵⁵ See Gonzalez, *supra* note 36, at 348-49, 349 n. 23.

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.⁵⁶ Malnutrition contributes to the death of nearly six million children every year in developing countries⁵⁷ and costs developing countries billions of dollars in foregone economic activity.⁵⁸ 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.⁵⁹

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.⁶⁰ 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.⁶¹ 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.⁶²

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

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,⁶³ and many developing countries experiencing chronic malnutrition are net food exporters.⁶⁴ People go hungry because they are poor—because they lack the means with which to purchase or grow food.⁶⁵ Efforts to tackle undernourishment must therefore focus on poverty reduction rather than merely boosting food production.

⁵⁶ See U.N. FOOD & AGRIC. ORG., THE STATE OF FOOD INSECURITY IN THE WORLD 2004, 6 (2004), available at <http://www.fao.org/docrep/007/y5650e/y5650e00.htm> [hereinafter FAO, STATE OF FOOD INSECURITY 2004] (quantifying global food insecurity); E.M. YOUNG, WORLD HUNGER 151 (1997) (explaining the increases in world food production).

⁵⁷ U.N. FOOD & AGRIC. ORG., THE STATE OF FOOD INSECURITY IN THE WORLD 2005, 18 (2005), available at <http://www.fao.org/docrep/008/a0200e/a0200e00.htm> [hereinafter FAO, STATE OF FOOD INSECURITY 2005].

⁵⁸ See FAO, STATE OF FOOD INSECURITY 2004, *supra* note 56, at 12-13.

⁵⁹ U.N. FOOD & AGRIC. ORG., THE STATE OF FOOD INSECURITY IN THE WORLD 2006, 8 (2006), available at <http://www.fao.org/docrep/009/a0750e/a0750e00.htm> [hereinafter FAO, STATE OF FOOD INSECURITY 2006].

⁶⁰ FAO, STATE OF FOOD INSECURITY 2005, *supra* note 57, at 25.

⁶¹ *Id.*

⁶² See UNITED NATIONS MILLENNIUM ECOSYSTEM ASSESSMENT 16-17, 90-99 (2005).

⁶³ FRANCES MOORE LAPPE ET AL., WORLD HUNGER: TWELVE MYTHS 9 (1998).

⁶⁴ *Id.*

⁶⁵ See GEORGE KENT, FREEDOM FROM WANT: THE RIGHT TO ADEQUATE FOOD 11-12 (2005). See generally, AMARTYA SEN, POVERTY AND FAMINES: AN ESSAY ON ENTITLEMENT AND DEPRIVATION (1981); GORDON CONWAY, THE DOUBLY GREEN REVOLUTION: FOOD FOR ALL IN THE 21ST CENTURY 4-5 (1997).

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.⁶⁶ The majority are small farmers whose livelihoods depend on marketing their agricultural products.⁶⁷ 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.⁶⁸

Third, economic diversification and industrialization are necessary to promote food security at the national level.⁶⁹ 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.⁷⁰ 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.⁷¹ Consequently, developing countries must resist development strategies that reinforce agro-export specialization.

Fourth, biological diversity is necessary for the health and resilience of the world's food supply.⁷² 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

⁶⁶ See U.N. FOOD & AGRIC. ORG., THE STATE OF FOOD INSECURITY IN THE WORLD 2003, 16 (2003), available at <http://www.fao.org/docrep/006/j0083e/j0083e00.htm> [hereinafter FAO, STATE OF FOOD INSECURITY 2003]; INT'L FUND FOR AGRIC. DEV., RURAL POVERTY REPORT 2001: THE CHALLENGE OF ENDING RURAL POVERTY (2001), available at <http://www.ifad.org/poverty/index.htm>.

⁶⁷ See KEVIN WATKINS & JOACHIM VON BRAUN, TIME TO STOP DUMPING ON THE WORLD'S POOR 2 (2003-2003), available at <http://www.ifpri.org/pubs/books/ar2002/ar02e1.pdf>.

⁶⁸ See, e.g., *Harvesting Poverty: The Unkept Promise*, N.Y. TIMES, Dec. 30, 2003, at A20; JAMES WESSEL, TRADING THE FUTURE: FARM EXPORTS AND THE CONCENTRATION OF ECONOMIC POWER IN OUR FOOD ECONOMY 168 (1983).

⁶⁹ See JEAN DREZE & AMARTYA SEN, HUNGER AND PUBLIC ACTION 76-77, 168-170 (1989); Eric S. Reinert, *Increasing Poverty in a Globalized World: Marshall Plans and Morgenthau Plans as Mechanisms of Polarization of World Incomes*, in RETHINKING DEVELOPMENT ECONOMICS 453, 470 (Ha-Joon Chang ed., 2003).

⁷⁰ See CHRISTOPHER STEVENS ET AL., THE WTO AGREEMENT ON AGRICULTURE AND FOOD SECURITY 14 (2000); U.N. FOOD & AGRIC. ORG., THE STATE OF AGRICULTURAL COMMODITY MARKETS 2004, 19 (2004), available at <http://www.fao.org/docrep/007/y5419e/y5419e00.htm> [hereinafter FAO, STATE OF AGRICULTURAL COMMODITY MARKETS 2004].

⁷¹ See PETER ROBBINS, STOLEN FRUIT: THE TROPICAL COMMODITIES DISASTER 2-3, 7-15 (2003); JAMES M. CYPHER & JAMES L. DIETZ, THE PROCESS OF ECONOMIC DEVELOPMENT 86 (1997); FAO, STATE OF AGRICULTURAL COMMODITY MARKETS 2004, *supra* note 70, at 12-13; YOUNG, *supra* note 56, at 41-42. The deterioration in the price of agricultural commodities in relation to the price of manufactured goods was first noted approximately fifty years ago by economists Raul Prebisch and Hans Singer, and has been corroborated by subsequent empirical data. See FAO, STATE OF AGRICULTURAL COMMODITY MARKETS 2004, *supra* note 70, at 12, 20-21; CYPHER & DIETZ, *supra* note 71, at 87, 177-80. As a consequence of this phenomenon, agro-exporting developing countries have experienced severe economic losses and mounting debt. See FAO, STATE OF AGRICULTURAL COMMODITY MARKETS 2004, *supra* note 71, at 12, 20-21.

⁷² See LORI ANN THRUPP, LINKING BIODIVERSITY AND AGRICULTURE: CHALLENGES AND OPPORTUNITIES FOR SUSTAINABLE FOOD SECURITY 5-20 (1997).

nutrition by reducing the variety of foods consumed.⁷³ 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.⁷⁴ Just four of these crops (corn, wheat, rice and potatoes) supply over sixty percent of the world's dietary energy needs.⁷⁵ 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.⁷⁶

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.⁷⁷ As a consequence of colonialism, most developing countries were integrated into the world economy as producers of natural resources and consumers of imported manufactured goods.⁷⁸ 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.⁷⁹ 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.⁸⁰ 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.⁸¹

⁷³ See *id.* at 26-32; CARY FOWLER & PAT MOONEY, *SHATTERING: FOOD, POLITICS, AND THE LOSS OF GENETIC DIVERSITY* 82-3 (1996).

⁷⁴ LORI ANN THRUPP, *CULTIVATING DIVERSITY: AGROBIODIVERSITY AND FOOD SECURITY* 1-2 (1998).

⁷⁵ See Danielle Nierenberg & Brian Halweil, *Cultivating Food Security*, in *STATE OF THE WORLD 2005*, 62, 64 (Worldwatch Inst. ed., 2005).

⁷⁶ See FOWLER & MOONEY, *supra* note 73, at 42-5 (discussing the underlying causes of the Irish potato famine).

⁷⁷ See Yang, *supra* note 36, at 94-95; Gonzalez, *Markets, Monocultures, and Malnutrition*, *supra* note 36, at 378-379.

⁷⁸ See YOUNG, *supra* note 56, at 41-42; ERIC C. WOLF, *EUROPE AND THE PEOPLE WITHOUT HISTORY* 140-141, 310-315 (1997); See FOWLER & MOONEY, *supra* note 73, at 40-1.

⁷⁹ See WESSEL, *supra* note 68, at 166-67.

⁸⁰ See YOUNG, *supra* note 56, at 66; FOWLER & MOONEY, *supra* note 73, at 95-96.

⁸¹ See FOWLER & MOONEY, *supra* note 73, at 180-81; VANDANA SHIVA, *MONOCULTURES OF THE MIND: PERSPECTIVES ON BIODIVERSITY AND BIOTECHNOLOGY* 78 (1993).

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.⁸² 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.⁸³ When political independence was finally achieved, the former colonies were at an enormous disadvantage in the global marketplace,⁸⁴ and most continued to specialize in agro-export production and to import manufactured goods.⁸⁵

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 to reduce world hunger by increasing global crop yields.⁸⁶ 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.⁸⁷

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.⁸⁸ 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.⁸⁹ First, the Green Revolution disproportionately benefited

⁸² See Yang, *supra* note 36, at 94-95.

⁸³ See ROBBINS, *supra* note 71, at 2-3, 7-15; CYPHER & DIETZ, *supra* note 71, at 86; YOUNG, *supra* note 56, at 41-42; FAO, STATE OF FOOD INSECURITY, *supra* note 56, at 12-13.

⁸⁴ See Yang, *supra* note 36, at 94-95.

⁸⁵ See YOUNG, *supra* note 56, at 41.

⁸⁶ See CONWAY, *supra* note 65, at 44; KEITH GRIFFIN, ALTERNATIVE STRATEGIES FOR ECONOMIC DEVELOPMENT 144 (2d ed. 1990).

⁸⁷ See CONWAY, *supra* note 65, at 47-52, 61.

⁸⁸ See *id.* at 44; GRIFFIN, *supra* note 86, at 148.

⁸⁹ See KEITH GRIFFIN, THE POLITICAL ECONOMY OF AGRARIAN CHANGE: AN ESSAY ON THE GREEN REVOLUTION 51-52 (1974); CONWAY, *supra* note 65, at 69-72; YOUNG, *supra* note 56, at 72; LAPPE ET AL., *supra* note 63, at 60; FOWLER & MOONEY, *supra* note 73, at 58-9. According to one analyst, approximately eighty percent of the published reports on the Green Revolution concluded that its socioeconomic impact was negative. See Donald K. Freebairn, *Did the Green Revolution Concentrate Incomes?: A Quantitative Study of Research Reports*, 23 WORLD DEV. 265, 265-279 (1995). As the Freebairn analysis acknowledges, only a minority of studies determined that the Green Revolution's overall socioeconomic impact was

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.⁹⁰ Second, the glut in world food production resulting from the Green Revolution depressed agricultural prices and rendered many small farmers destitute.⁹¹ 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 enhancing food security.⁹² 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 veritable army of landless peasants.”⁹³

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.⁹⁴ 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

positive. See, e.g., Rita Sharma & Thomas T. Poleman, *THE NEW ECONOMICS OF INDIA'S GREEN REVOLUTION: INCOME AND EMPLOYMENT DIFFUSION IN UTTAR PRADESH* 16-18, 239, 241-44 (1993); YUJIRO HAYAMI & MASEO KIKUCHI, *A RICE VILLAGE SAGA: THREE DECADES OF GREEN REVOLUTION IN THE PHILIPPINES* 121-24, 227-38 (2000); MURRAY J. LEAF, *SONG OF HOPE: THE GREEN REVOLUTION IN A PUNJAB VILLAGE* (1984); PETER B. R. HAZELL & C. RAMASAMY, *THE GREEN REVOLUTION RECONSIDERED* 239-44 (1991); Robert W. Herdt, *A Retrospective View of Technological and Other Changes in Philippine Rice Farming 1965-1982*, 35 *ECON. DEV. & CULTURAL CHANGE* 329, 347-48 (1989).

⁹⁰ See FOWLER & MOONEY, *supra* note 73, at 58-9; LAPPE ET AL., *supra* note 63, at 60; FRANCINE R. FRANKEL, *INDIA'S GREEN REVOLUTION* 193-194 (1971); ANDREW PEARSE, *SEEDS OF PLENTY, SEEDS OF WANT* 161-63 (1980); VANDANA SHIVA, *THE VIOLENCE OF THE GREEN REVOLUTION: THIRD WORLD AGRICULTURE, ECOLOGY, AND POLITICS* 45 (1991).

⁹¹ See LAPPE ET AL., *supra* note 63, at 62; GRIFFIN, *supra* note 86, at 158; SHIVA, *supra* note 90, at 176-77; Frederick H. Buttel & Laura T. Reynolds, *Population Growth, Agrarian Structure, Food Production and Distribution*, in *FOOD AND NATURAL RESOURCES* 325, 344 (David Pimentel & Carl W. Hall eds., 1989); FRANCES MOORE LAPPE & JOSEPH COLLINS, *FOOD FIRST: BEYOND THE MYTH OF SCARCITY* 135-48 (1978).

⁹² See U.N. FOOD & AGRIC. ORG., *THE STATE OF FOOD INSECURITY IN THE WORLD 2002*, 26 (2002), available at <http://www.fao.org/docrep/005/y7352e/y7352e00.htm>, [hereinafter *FAO, STATE OF FOOD INSECURITY 2002*]; Klaus Deininger et al., *How Land Reform Can Contribute to Economic Growth and Poverty Reduction: Empirical Evidence From International and Zimbabwean Experience* (2002), available at http://www.oxfam.co.uk/what_we_do/issues/livelihoods/landrights/africa_south.htm; DANIEL MAXWELL & KEITH WIEBE, *LAND TENURE CTR., LAND TENURE AND FOOD SECURITY: A REVIEW OF CONCEPTS, EVIDENCE, AND METHODS* 4-6 (1998), available at <http://agecon.lib.umn.edu>; TIMOTHY BESLEY & ROBIN BURGESS, *LAND REFORM, POVERTY REDUCTION, AND GROWTH: EVIDENCE FROM INDIA* 20-21 (1998), available at <http://sticerd.lse.ac.uk/dps/de/dedps13.pdf>; PETER M. ROSSET, *THE MULTIPLE FUNCTIONS AND BENEFITS OF SMALL FARM AGRICULTURE IN THE CONTEXT OF GLOBAL TRADE NEGOTIATIONS* 11-14 (1999), <http://www.foodfirst.org/pubs/policybs/pb4.pdf>.

⁹³ VERONICA BENNHOLDT-THOMSEN & MARIA MIES, *THE SUBSISTENCE PERSPECTIVE: BEYOND THE GLOBALISED ECONOMY* 82 (Patrick Camiller, Marie Mies & Gerd Weih trans., 1999).

⁹⁴ See FOWLER & MOONEY, *supra* note 73, at 75-6, 130-31; THRUPP, *LINKING BIODIVERSITY AND AGRICULTURE*, *supra* note 72, at 35.

of the genetic basis of the world's food supply, and heightened vulnerability of the global food supply to catastrophic blight.⁹⁵ Indeed, in many areas of the world, the deterioration in soil quality associated with the Green Revolution ultimately depressed agricultural productivity.⁹⁶

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.⁹⁷

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 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.⁹⁸ By contrast, most developing countries taxed the agricultural sector to finance industrialization and lacked the resources to provide farmers with significant subsidies.⁹⁹ 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.¹⁰⁰

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.¹⁰¹ 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.¹⁰² Under U.S. Public Law 480 (the so-called "Food for Peace Program"),¹⁰³ surplus agricultural production was made

⁹⁵ See CONWAY, *supra* note 65, at 86-104; FOWLER & MOONEY, *supra* note 73, at 63-81; THRUPP, LINKING BIODIVERSITY AND AGRICULTURE, *supra* note 72, at 32-33.

⁹⁶ See THRUPP, *supra* note 74, at 27; LAPPE ET AL., *supra* note 63, at 70-71; WRI, THE WEALTH OF THE POOR, *supra* note 44, at 19.

⁹⁷ See Mohsen Al Attar Ahmed, *Monocultures of the Law: Legal Sameness in the Restructuring of Global Agriculture*, 11 DRAKE J. AGRIC. L. 139, 145 (2006).

⁹⁸ See THE GATT URUGUAY ROUND: A NEGOTIATING HISTORY (1986-1992) 125, 141, 155-56 (Terence P. Stewart ed., 1993) [hereinafter GATT URUGUAY ROUND]; M. Ataman Aksoy, *Global Agricultural Trade Policies*, in GLOBAL AGRICULTURAL TRADE AND DEVELOPING COUNTRIES 37 (M. Ataman Aksoy & John C. Beghin eds., 2004).

⁹⁹ See GATT URUGUAY ROUND, *supra* note 98, at 154-157; Aksoy, *supra* note 98, at 37.

¹⁰⁰ See Carmen G. Gonzalez, *Institutionalizing Inequality: The WTO Agreement on Agriculture, Food Security, and Developing Countries*, 27 COLUM. J. ENVTL. L. 433, 440-46 (2002) (explaining why the measures adopted by industrialized countries to protect the agricultural sector were largely permitted under the 1947 GATT); Jonathan Carlson, *Hunger, Agricultural Trade Liberalization, and Soft International Law: Addressing the Legal Dimensions of a Political Problem*, 70 IOWA L. REV. 1187, 1222-57 (1985) (analyzing the 1947 GATT's failure to curb agricultural protectionism).

¹⁰¹ See WESSEL, *supra* note 68, at 29.

¹⁰² See *id.* at 29-31, 52-55, 168-176.

¹⁰³ Agricultural Trade Development and Assistance Act of 1954, 7 U.S.C. §§ 1691-1736e (1982); Food for Peace Act of 1966, Pub. L. No. 89-808, § 3(c), 80 Stat. 1526 (codified at 7 U.S.C. §§ 1427, 1431, 1431b, 1446a-7, 1691-1736e (1982)).

available to developing countries free of charge or at reduced prices.¹⁰⁴ 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.¹⁰⁵ 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.¹⁰⁶

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 1973.¹⁰⁷ Many developing countries borrowed money from commercial banks simply to pay for fuel and for petroleum-based agricultural inputs.¹⁰⁸ 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.¹⁰⁹ By the mid-1980s, two-thirds of African countries and nearly three-quarters of Latin American countries had adopted structural adjustment programs mandated by the World Bank and the IMF in order to restructure existing debt or to obtain new loans.¹¹⁰

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.¹¹¹ The drive to increase agricultural exports harmed the environment by promoting the expansion of chemical-intensive industrial agriculture.¹¹² Ironically, the glutting of world markets by developing country exporters depressed agricultural prices even further and reduced the export earnings available for debt servicing.¹¹³

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

¹⁰⁴ See WESSEL, *supra* note 68, at 153-55.

¹⁰⁵ See Gonzalez, *supra* note 100, at 447-49.

¹⁰⁶ See Gonzalez, *supra* note 36, at 361.

¹⁰⁷ RICHARD PEET ET AL., UNHOLY TRINITY: THE IMF, WORLD BANK, AND WTO 71 (2003).

¹⁰⁸ See *id.*; see also SUSAN GEORGE, A FATE WORSE THAN DEBT: THE WORLD FINANCIAL CRISIS AND THE POOR 28-29 (1990).

¹⁰⁹ See GEORGE, *supra* note 108, at 28; PEET ET AL., *supra* note 107, at 72-75.

¹¹⁰ PEET ET AL., *supra* note 107, at 75.

¹¹¹ See GEORGE, *supra* note 108, at 59-60; YOUNG, *supra* note 56, at 43; JOHN MADELEY, FOOD FOR ALL: THE NEED FOR A NEW AGRICULTURE 117 (2002).

¹¹² STRUCTURAL ADJUSTMENT PARTICIPATORY REVIEW INT'L NETWORK (SAPRI), THE POLICY ROOTS OF ECONOMIC CRISIS AND POVERTY: A MULTI-COUNTRY PARTICIPATORY ASSESSMENT OF STRUCTURAL ADJUSTMENT 124-126 (2002), available at http://www.sapri.org/SAPRI_Findings.pdf. [hereinafter SAPRI].

¹¹³ See ROBBINS, *supra* note 71, at 29-30; MADELEY, *supra* note 111, at 154-155; GEORGE, *supra* note 108, at 60-61; BELINDA COOTE, THE TRADE TRAP 34-35 (1992).

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.¹¹⁴ No such requirements were imposed on developed countries. Indeed, developed countries continued to subsidize and protect their agricultural producers¹¹⁵ while benefiting from the relative market openness in developing countries.¹¹⁶ 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.¹¹⁷ 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.¹¹⁸

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.¹¹⁹ 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.¹²⁰

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.¹²¹ 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.¹²²

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.¹²³ Low agricultural

¹¹⁴ See MICHEL CHOSSUDOVSKY, *THE GLOBALISATION OF POVERTY* 62-63 (1997); GEORGE, *supra* note 108, at 52.

¹¹⁵ See David Reed, *An Instrument of Global Economic Policy*, in *STRUCTURAL ADJUSTMENT, THE ENVIRONMENT, AND SUSTAINABLE DEVELOPMENT* 3, 13 (1995).

¹¹⁶ See U.N. FOOD & AGRIC. ORG., *STATE OF FOOD AND AGRICULTURE* 2000 26 (2000), available at <http://www.fao.org/docrep/x4400e/x4400e00.htm>.

¹¹⁷ See MADELEY, *supra* note 111, at 119-120; MICHAEL E. CONROY ET AL., *A CAUTIONARY TALE: FAILED U.S. DEVELOPMENT IN CENTRAL AMERICA* 14 (1996).

¹¹⁸ See MADELEY, *HUNGRY FOR TRADE: HOW THE POOR PAY FOR FREE TRADE* 77 (2000); SAPRIN, *supra* note 112, at 116-118.

¹¹⁹ Agreement on Agriculture, Apr. 15, 1994, pmbl. at ¶ 2, 1867 U.N.T.S. 410, available at http://www.wto.org/english/docs_e/legal_e/14-ag.pdf [hereinafter Agreement on Agriculture]; see also Gonzalez, *supra* note 100, at 452-58 (discussing the main provisions of the Agreement on Agriculture).

¹²⁰ See Gonzalez, *supra* note 100, at 459-68.

¹²¹ See SOPHIA MURPHY ET AL., *INSTITUTE FOR AGRICULTURAL TRADE & POLICY, WTO AGREEMENT ON AGRICULTURE: A DECADE OF DUMPING* 1 (2005), available at <http://www.tradeobservatory.org/library.cfm?RefID=48532>.

¹²² See *id.* at 2.

¹²³ See PETER M. ROSSET, *FOOD IS DIFFERENT: WHY WE MUST GET THE WTO OUT OF AGRICULTURE* 44 (2006); Timothy A. Wise, *The Paradox of Agricultural Subsidies: Measurement Issues*, *Agricultural*

commodity prices are due, at least in part, to the market power of the agribusiness conglomerates that dominate world agricultural trade.¹²⁴ Three companies carry out 82 percent of all U.S. corn exporting.¹²⁵ Four companies control 61 percent of U.S. flour milling capacity.¹²⁶ Four companies own 60 percent of U.S. terminal grain handling facilities.¹²⁷ The global seed and pesticide markets are similarly concentrated.¹²⁸ 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.¹²⁹ 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.¹³⁰ 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.¹³¹

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.¹³² The exodus from rural areas has been so dramatic that urban employment has been unable keep pace with the influx of migrants.¹³³ 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 herbicides, and producing crops that can withstand environmental stresses such as drought, heat, frost, and soil

Dumping, and Policy Reform (Global Dev. & Env't Inst. Working Paper No. 04-02, 2004), available at <http://www.ase.tufts.edu/gdae/Pubs/wp/04-02AgSubsidies.pdf>.

¹²⁴ See ROSSET, *supra* note 123, at 45-49; Raj Patel & Sanaz Memarsadeghi, *Agricultural Restructuring and Concentration in the United States: Who Wins? Who Loses?* 34-36 (Inst. for Food & Policy Dev. Policy Brief No. 6, 2003), available at <http://www.foodfirst.org/pubs/policy/pb6.pdf>; Wise, *supra* note 123, at 8, 24.

¹²⁵ See ROSSET, *supra* note 123, at 46.

¹²⁶ See *id.*

¹²⁷ See *id.*

¹²⁸ See Sophia Murphy, *Concentrated Market Power and Agricultural Trade* 10 (Ecofair Trade Dialogue Discussion Paper No. 1, 2006), available at <http://www.tradeobservatory.org/library.cfm?refid=89014>.

¹²⁹ See Patel & Memarsadeghi, *supra* note 124, at 34-36; See ROSSET, *supra* note 123, at 46-48; Wise, *supra* note 123, at 8; SOPHIA MURPHY, *MANAGING THE INVISIBLE HAND: MARKETS, FARMERS AND INTERNATIONAL TRADE* 21-29, 32 (2002), available at <http://www.tradeobservatory.org/library.cfm?RefID=25497>.

¹³⁰ See ROSSET, *supra* note 123, at 49.

¹³¹ See *id.* at 47-48.

¹³² See ROBIN HAHNEL, *THE ABCS OF POLITICAL ECONOMY* 189 (2002).

¹³³ See *id.* at 190.

salinity.¹³⁴ 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.¹³⁵

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.¹³⁶ The industry is highly concentrated and is characterized by oligopolistic competition among a few large corporations.¹³⁷ Approximately 88 percent of all GM crops grown worldwide in 2004 were the product of Monsanto seeds.¹³⁸ Six corporations (BASF, Dow, Bayer, DuPont, Monsanto, and Syngenta) control 75-80 percent of the global pesticides market.¹³⁹ Two corporations (Monsanto and DuPont) dominate world seed markets for corn and soybeans.¹⁴⁰

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.¹⁴¹ Most of the industry's research is devoted to export crops grown in large-scale monocultures.¹⁴² Only one percent of the industry's research targets small-scale producers.¹⁴³ 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.¹⁴⁴ It is no coincidence that these widely commercialized GM crops are the lucrative export crops cultivated by U.S. agribusiness.¹⁴⁵ 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

¹³⁴ See, e.g., NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 4-5; Borlaug, *supra* note 16, at 487-90; Pinstrup-Anderson & Scholer, *supra* note 16, at 1-2.

¹³⁵ See, e.g., NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 6-7; Orton, *supra* note 17, at 3-6; SHIVA, *STOLEN HARVEST*, *supra* note 17, at 90-104.

¹³⁶ See generally HELENA PAUL & RICARDA STEINBRECHER, *supra* note 20.

¹³⁷ See FRIENDS OF THE EARTH INTERNATIONAL (FOEI), WHO BENEFITS FROM GM CROPS? AN ANALYSIS OF THE GLOBAL PERFORMANCE OF GM CROPS (1996-2006) 11 (2007), available at <http://www.foei.org/publications/pdfs/gmcrops2007full.pdf> [hereinafter FOEI].

¹³⁸ See Murphy, *Concentrated Market Power and Agricultural Trade*, *supra* note 128, at 10.

¹³⁹ See ACTIONAID, POWER HUNGRY: SIX REASONS TO REGULATE GLOBAL FOOD CORPORATIONS 13 (2005), available at http://www.actionaid.org/docs/power_hungry.pdf.

¹⁴⁰ See *id.*

¹⁴¹ See Orton, *supra* note 17, at 12, 16.

¹⁴² See ACTIONAID, *supra* note 139, at 36.

¹⁴³ See *id.*

¹⁴⁴ See FOEI, *supra* note 137, at 6.

¹⁴⁵ See *id.* at 11.

traditional rights to save, share, and modify these seeds; farmers are also contractually bound to use agrochemicals of a particular seed manufacturer.¹⁴⁶

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.¹⁴⁷ Second, the obligation to purchase new seeds every season, rather than saving seeds for replanting, erodes farmers' traditional rights to save and exchange seeds, and may be financially prohibitive.¹⁴⁸ Indeed, farmers may not understand this restriction until the biotechnology industry takes aggressive measures to collect royalties for these seeds.¹⁴⁹ 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.¹⁵⁰ 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.¹⁵¹ 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).¹⁵² 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

¹⁴⁶ See Ahmed, *supra* note 97, at 153-159; Peter Straub, *Farmers in the IP Wrench: How Patents on Gene-Modified Crops Violate the Right to Food in Developing Countries*, 29 HASTINGS INT'L & COMP. L. REV. 187, 196-199 (2006); Keith Aoki, *Malthus, Mendel, and Monsanto: Intellectual Property and the Law and Politics of the Global Food Supply: An Introduction*, 19 J. ENVTL. L. & LITIG. 397, 413-414 (2004).

¹⁴⁷ Shelley Hurt, "Seed Wars": *The Promises and Pitfalls of Agricultural Biotechnology for a Hungry World*, MILLER CENTER REPORT, Spring/Summer 2004, at 29, 32, available at http://webstorage1.mcpa.virginia.edu/library/mc/mcreport/vol20_num1.pdf.

¹⁴⁸ See FELICIA WU & WILLIAM BUTZ, *THE FUTURE OF GENETICALLY MODIFIED CROPS: LESSONS FROM THE GREEN REVOLUTION* 52 (2004), available at http://www.rand.org/pubs/monographs/2004/RAND_MG161.pdf.

¹⁴⁹ See Orton, *supra* note 17, at 20 (discussing South African farmers' widespread misunderstanding of the seed contracts for GM cotton and of the technology itself).

¹⁵⁰ Jerry Cayford, *Breeding Sanity into the GM Food Debate*, ISSUES IN SCIENCE AND TECHNOLOGY, Winter 2003, <http://www.issues.org/issues/20.2/cayford.html>.

¹⁵¹ See *id.*

¹⁵² See Orton, *supra* note 17, at 16.

biotechnology industry may suffer financial losses because these seeds may not be suitable for local conditions, such as drought and salinity.¹⁵³ 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.¹⁵⁴ Regrettably, the proprietary nature of GM seeds limits the ability of farmers to modify and adapt these seeds to unique local requirements.¹⁵⁵ 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.¹⁵⁶ 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.¹⁵⁷ 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.¹⁵⁸

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, have not to date boosted food production.¹⁵⁹ Studies suggest that yields are either lower than or at most equivalent to non-GM varieties.¹⁶⁰

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.¹⁶¹ Indeed, increased

¹⁵³ See Orton, *supra* note 17, at 22.

¹⁵⁴ See FOEI, *supra* note 137, at 38.

¹⁵⁵ See Orton, *supra* note 17, at 23.

¹⁵⁶ See Ahmed, *supra* note 97, at 161-162.

¹⁵⁷ See Orton, *supra* note 17, at 28.

¹⁵⁸ See *id.* at 18.

¹⁵⁹ See NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 4-5 (discussing the potential of GM crops to increase agricultural production); FOEI, *supra* note 137, at 17, 34, 56, 86 (explaining that GM crops have generally not succeeded in boosting food production); Jules Pretty, *The Rapid Emergence of Genetic Modification in World Agriculture: Contested Risks and Benefits*, 28 ENVTL. CONSERVATION 248, 255 (2001); MIGUEL ALTIERI, GENETIC ENGINEERING IN AGRICULTURE: THE MYTHS, THE ENVIRONMENTAL RISKS, AND ALTERNATIVES 7-10 (2001).

¹⁶⁰ See FOEI, *supra* note 137, at 17.

¹⁶¹ See *id.*

food production could further marginalize poor farmers by glutting markets and depressing agricultural prices.¹⁶²

3. Enhancement of the Nutritional Quality of Food

Genetic modifications that enhance the nutritional quality of food could be of considerable benefit to malnourished 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.¹⁶³ 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.¹⁶⁴ 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.¹⁶⁵ Second, the yellow color of the rice may cause it to be rejected for cultural reasons.¹⁶⁶ 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.¹⁶⁷

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,¹⁶⁸ 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.¹⁶⁹

¹⁶² See Mark Sagoff, *Biotechnology and Agriculture: The Common Wisdom and Its Critics*, 9 IND. J. GLOBAL LEGAL STUD. 13, 22 (2001).

¹⁶³ See Orton, *supra* note 17, at 17.

¹⁶⁴ See *id.*

¹⁶⁵ See NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 38.

¹⁶⁶ See NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 38; ALTIERI, *supra* note 159, at 7.

¹⁶⁷ See ALTIERI, *supra* note 159, at 26-29. GM technology threatens to replicate the one-dimensional technological fix approach of the Green Revolution. While the Green Revolution's high-yield varieties produced an increase in caloric and protein intake, the Green Revolution also narrowed the variety of foods consumed and thereby contributed to widespread micronutrient deficiencies. As a consequence of the Green Revolution, over 2 billion people consume diets that are deficient in essential micronutrients, including Vitamin A, iron, iodine, zinc, and selenium. Rather than genetically modifying one staple crop to provide one micronutrient, it would be better to encourage diversification of the food supply in order to address the underlying problem. See generally GRAIN, ENGINEERING SOLUTIONS TO MALNUTRITION 4-13, 21-22 (March 2000), available at http://www.grain.org/briefings_files/malnutrition.pdf.

¹⁶⁸ See NUFFIELD COUNCIL ON BIOETHICS, *supra* note 16, at 35 (discussing research on GM rice that could withstand cold, drought, and salinity).

¹⁶⁹ See *id.* at 6.

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.¹⁷⁰ 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.¹⁷¹ 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.¹⁷²

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 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.¹⁷³ 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.¹⁷⁴ 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

¹⁷⁰ See Pretty, *The Rapid Emergence of Genetic Modification*, *supra* note 159, at 249.

¹⁷¹ See Orton, *supra* note 17, at 9.

¹⁷² See *id.*

¹⁷³ See FOEI, *supra* note 137, at 18.

¹⁷⁴ See *id.*

corn.¹⁷⁵ 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.¹⁷⁶ 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.¹⁷⁷ 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.

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.¹⁷⁸

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.¹⁷⁹ The ecological consequences of creation and dissemination of such superweeds within the farm and into the broader environment are difficult to predict.¹⁸⁰ 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.¹⁸¹

This risk of gene transfer is particularly high for crops grown in close proximity to wild relatives.¹⁸² 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.¹⁸³ Genetic transfers may pose particular threats in countries that are the centers of diversity for certain crops (such as corn in Mexico) if

¹⁷⁵ See *id.*

¹⁷⁶ See ALTIERI, *supra* note 159, at 26-29.

¹⁷⁷ See Pretty, *The Rapid Emergence of Genetic Modification*, *supra* note 159, at 252.

¹⁷⁸ See Miguel Altieri, *The Ecological Impacts of Transgenic Crops on Agroecosystem Health*, 6 ECOSYSTEM HEALTH 13, 14 (2000).

¹⁷⁹ See ALTIERI, *supra* note 159, at 23-25; Holly Saigo, *Agricultural Biotechnology and the Negotiation of the Biosafety Protocol*, 12 GEO. INT'L ENVTL. L. REV. 779, 790 (2000).

¹⁸⁰ Miguel Altieri, *Transgenic Crops: Implications for Biodiversity and Sustainable Agriculture*, 25 BULL. SCI., TECH. & SOC'Y 335, 343 (2005).

¹⁸¹ See Saigo, *supra* note 179, at 591.

¹⁸² See ALTIERI, *supra* note 159, at 24.

¹⁸³ See *id.* at 24-25.

they result in a loss of the genetic variability that future generations will need in order to adapt crops to changing environmental conditions.¹⁸⁴ 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.¹⁸⁵ 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.¹⁸⁶

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.¹⁸⁷ If the cultivation of GM crops by farmers in developing countries harms natural predators of the 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.¹⁸⁸ Similarly, if the cultivation of GM crops by farmers in developing countries harms beneficial soil organisms, those most affected 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.¹⁸⁹ The disruption of natural pest control and the reduction of soil fertility will depress agricultural production.¹⁹⁰ 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.¹⁹¹

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)

¹⁸⁴ See JANE RISSLER & MARGARET MELLON, *THE ECOLOGICAL RISKS OF ENGINEERED CROPS* 56-58 (1996).

¹⁸⁵ See FOEI, *supra* note 137, at 80.

¹⁸⁶ See Altieri, *Transgenic Crops*, *supra* note 178, at 346.

¹⁸⁷ See *id.* at 343-345.

¹⁸⁸ See *id.* at 344.

¹⁸⁹ See *id.* at 344-345.

¹⁹⁰ See *id.*

¹⁹¹ See *id.*

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 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)¹⁹² and by the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (the Biosafety Protocol).¹⁹³ 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.

¹⁹² SPS Agreement, *supra* note 13, at Annex A(1).

¹⁹³ See Biosafety Protocol, *supra* note 11.

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 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.¹⁹⁴

The primary purpose of the SPS Agreement is to prevent WTO members from enacting protectionist measures disguised as health and safety regulations.¹⁹⁵ The SPS Agreement seeks to achieve this objective by promoting harmonization of international health and safety standards¹⁹⁶ 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.¹⁹⁷

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.¹⁹⁸

SPS measures that are more protective than international standards require scientific justification.¹⁹⁹ Article 2.2 of the SPS Agreement requires that SPS measures be “based on scientific principles” and “not maintained without sufficient scientific evidence.”²⁰⁰ Article 5.1 elaborates on this obligation by requiring that SPS measures be “based on” a risk assessment.²⁰¹ The risk assessment must take into account the available scientific information²⁰² and will only justify the SPS measure if there is a “rational relationship between the measure and the risk assessment.”²⁰³ Moreover, the risk assessment upon which a WTO member relies need not have been carried out by that member.²⁰⁴ A WTO member may base its SPS measure on a risk assessment conducted by another member or by an international organization.²⁰⁵

¹⁹⁴ See SPS Agreement, *supra* note 13, at Annex A(1).

¹⁹⁵ See *id.* at pmbl., art. 2; see generally J.M. Migai Akech, *Developing Countries at Crossroads: Aid, Public Participation, and the Regulation of Trade in Genetically Modified Organisms*, 29 FORDHAM INT’L L.J. 265, 279 (2006).

¹⁹⁶ See SPS Agreement, *supra* note 13, at art. 3; see generally Graham Mayeda, *Developing Disharmony? The SPS and TBT Agreements and the Impact of Harmonization on Developing Countries*, 7 J. INT’L ECON. L. 737, 746 (2004).

¹⁹⁷ See SPS Agreement, *supra* note 13, at arts. 2.2, 5.1; see generally David A. Wirth, *The Role of Science in the Uruguay Round and NAFTA Trade Disciplines*, 27 CORNELL INT’L L.J. 817, 826 (1994).

¹⁹⁸ See *id.* art. 3.2.

¹⁹⁹ See *id.* art. 3.3.

²⁰⁰ See *id.* art. 2.2.

²⁰¹ See *id.* art. 5.1; see also Appellate Body Report, *European Communities—Measures Concerning Meat and Meat Products (Hormones)*, ¶ 98, WT/DS26/AB/R (Jan. 16, 1998) (adopted Feb. 13, 1998) (explaining the relationship between Article 2.2 and Article 5.1 of the SPS Agreement) [hereinafter EC—Hormones Appellate Body Report].

²⁰² SPS Agreement, *supra* note 13, art. 5.2.

²⁰³ See EC—Hormones Appellate Body Report, *supra* note 201.

²⁰⁴ See *id.*

²⁰⁵ *Id.*

If the “relevant scientific evidence is insufficient,”²⁰⁶ Article 5.7 of the SPS Agreement authorizes the adoption of provisional SPS measures on the basis of “available pertinent information.”²⁰⁷ 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.”²⁰⁸ What constitutes a reasonable period of time will be determined on a case-by-case basis.²⁰⁹

B. THE BIOSAFETY PROTOCOL

The Biosafety Protocol is the first binding international agreement that applies specifically to the transnational transfer and use of GMOs.²¹⁰ 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 specifically focusing on transboundary movements.”²¹¹

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.²¹² 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.²¹³

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 uncertainty.²¹⁴ 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 organism²¹⁵

²⁰⁶ SPS Agreement, *supra* note 13, art. 5.7.

²⁰⁷ *See id.*

²⁰⁸ *See* SPS Agreement, *supra* note 13, art. 5.7.

²⁰⁹ *See* Appellate Body Report, *Japan—Measures Affecting Agricultural Products*, ¶ 93, WT/DS76/AB/R (Feb. 22, 1999) (adopted Mar. 19, 1999) [hereinafter Japan Agricultural Products Appellate Body Report].

²¹⁰ *See* Aarti Gupta, *Advance Informed Agreement: A Shared Basis for Governing Trade in Genetically Modified Organisms?*, 9 IND. J. GLOBAL LEGAL STUD. 265, 265 (2000); Barbara Eggers & Ruth Mackenzie, *The Cartagena Protocol on Biosafety*, 3 J. INT’L ECON. L. 525, 527 (2000).

²¹¹ Biosafety Protocol, *supra* note 11, art. 1.

²¹² *See id.* arts. 7-10, 12. The Biosafety Protocol distinguishes between GMOs intended to be introduced into the environment (such as seeds, fish, and microorganisms) and GMOs intended for use as food, feed, or for processing. Only the former are governed by the advance informed agreement procedure. However, GMOs intended for use as food, feed, or for processing must nevertheless comply with the Biosafety Protocol’s labeling and documentation requirements, including labeling which specifies that the GMOs are not intended for introduction into the environment. *See id.* arts. 7-11, 18.

²¹³ *See id.* arts. 10.1, 15.

²¹⁴ *See id.* pmbl., art. 1 (reaffirming the precautionary principle articulated in Principle 15 of the Rio Declaration); arts. 10.6, 11.8 (authorizing precautionary measures in the face of scientific uncertainty).

²¹⁵ *Id.* arts. 10.6, 11.8.

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.²¹⁶ 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.”²¹⁷

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.²¹⁸ 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.”²¹⁹ In other words, the Biosafety Protocol can be construed to require a risk assessment before the precautionary principle may be invoked.²²⁰

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.²²¹ This provision would permit developing countries 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.²²² 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.²²³

²¹⁶ See *id.* art. 26.

²¹⁷ *Id.*

²¹⁸ See Gupta, *supra* note 210, at 277-278.

²¹⁹ *Id.* at 278.

²²⁰ See *id.*

²²¹ See *id.* at 278.

²²² See *id.*

²²³ See *id.* at 278-279. Indeed, the Biosafety Protocol is hopelessly compromised with respect to its relationship to other instruments of international law. One clause in the preamble recognizes “that trade and environment agreements should be mutually supportive with a view to achieving sustainable development.” The very next clause of the preamble emphasizes “that this Protocol shall not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements.” This is followed by a clause stating that

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.²²⁴ The complainants argued that the EC's general 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).²²⁵

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 2003.²²⁶ 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.²²⁷

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.²²⁸ The panel also struck down the individual EC Member states' safeguard measures prohibiting specific GM products on the ground that these states

"the above recital is not intended to subordinate this Protocol to any other international agreements." It is apparent that the negotiators of the Biosafety Protocol could not agree on the relationship between the WTO and the Biosafety Protocol. *See* Biosafety Protocol, *supra* note 11, pmb1.

²²⁴ *See* Request for the Establishment of a Panel by the United States, *European Communities—Measures Affecting the Approval and Marketing of Biotech Products*, WT/DS291/23 (Aug. 7, 2003); Request for the Establishment of a Panel by Canada, *European Communities—Measures Affecting the Approval and Marketing of Biotech Products*, WT/DS292/17 (Aug. 7, 2003); Request of the Establishment of a Panel by Argentina, *European Communities—Measures Affecting the Approval and Marketing of Biotech Products*, WT/DS293/17 (Aug. 7, 2003). *See also* John W. Boscariol & Orlando E. Silva, *Genetically Modified Organisms at the Center of Major WTO Dispute*, LAW. WKLY., Mar. 26, 2004.

²²⁵ *See* EC—Biotech Panel Report, *supra* note 1, ¶¶ 4.155-4.193 (summarizing the U.S. claims); ¶¶ 4.204-4.252 (summarizing the claims of Canada); ¶¶ 4.253-4.329 (summarizing the claims of Argentina).

²²⁶ *See id.* ¶¶ 8.6-8.7.

²²⁷ *See id.* ¶¶ 7.474-7.540, 7.1262-7.1285.

²²⁸ *See id.* ¶¶ 7.1570, 7.1792-7.2207.

violated Article 5.1 of the SPS Agreement by failing to base these safeguard measures on risk assessments.²²⁹

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.²³⁰

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.²³¹ Based upon an expansive interpretation of the SPS 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.²³² The panel did note, however, that measures

²²⁹ See *id.* ¶¶ 8.8-8.10.

²³⁰ *EU Decides Not to Appeal WTO Biotech Ruling*, BRIDGES TRADE BIORES, Dec. 1, 2006, at 21; *WTO Panel Provisionally Rules against EU Moratorium on Biotech Approval*, BRIDGES WKLY. TRADE NEWS DIGEST, Feb. 8, 2006.

²³¹ Mindful of the potentially onerous nature of the SPS Agreement's science-based requirements, the EC maintained that the EC pre-marketing approval procedures for biotech products "fall in part within the scope of the SPS Agreement, and in part outside the scope of the SPS Agreement." See EC—Biotech Panel Report, *supra* note 1, ¶ 7.147. The EC argued, and the panel agreed, that "to the extent the relevant EC approval legislation is applied for purposes which are identified in Annex A(1) [of the SPS Agreement], it is governed by the SPS Agreement; to the extent the legislation is applied for other purposes, it falls within the scope of another WTO Agreement, possibly the TBT Agreement." See *id.* ¶ 7.172. Based on a careful evaluation of the EC legislation governing the deliberate release of genetically modified organisms into the environment (EC Directives 90/220 and 2001/18), the panel concluded that the potential adverse health and environmental consequences that the legislation sought to avoid fell within the scope of Annex A(1) of the SPS Agreement. See *id.* ¶¶ 7.212-7.286. The panel then analyzed the EC regulatory regime dealing with food safety (Regulation 258/97) and concluded that it, too, fell within the scope of the SPS Agreement to the extent that it sought to ensure that novel foods do not pose a health risk to consumers; however, it fell outside the scope of the SPS Agreement to the extent that it sought to "ensure that novel foods not mislead the consumer or that they not be nutritionally disadvantageous to the consumer." See *id.* ¶¶ 7.145-7.146. Finally, the panel concluded that the pre-marketing approval procedures satisfied the "form" and "nature" elements of the SPS Agreement's definition of SPS measures because they constituted legally binding governmental measures attributable to the EC that imposed specific requirements and procedures. See *id.* ¶ 7.431. Applying the same reasoning to its assessment of the GMO prohibitions adopted by individual EC member states, the panel concluded that these prohibitions likewise constituted SPS measures. See *id.* ¶¶ 7.2552-7.2922.

²³² See *id.* ¶¶ 7.212-7.286, 7.145-7.146, 7.2552-7.2908. The EC emphasized that Directives 90/220 and 2001/18 expressly list environmental protection as one of their purposes. Annex A(1) of the SPS Agreement does not refer to environmental protection. By contrast, Article 2.2 of the TBT Agreement does expressly mention the environment. The EC argued that the drafters' inclusion of environmental protection measures in one WTO instrument (the TBT Agreement) suggests that the drafters intended to exclude environmental protections measures from other potentially applicable WTO instruments (the SPS Agreement). See *id.* ¶¶ 7.198-7.200. The panel rejected the EC's argument on the ground that the EC

aimed at providing consumer information or at ensuring that GMO products were not nutritionally disadvantageous would not be covered by the SPS Agreement.²³³

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 arising from the contamination of non-GM crops by GM crops, from the transfer of undesired traits (such as insect- or herbicide-resistance) to conventional crops or wild flora, and from the acceleration of insect resistance.²³⁴ 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.²³⁵ 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.²³⁶ Consequently, the panel rejected the

measures implementing the goal of environmental protection were applied to protect animals and plants and were thus not *a priori* excluded from the SPS Agreement. *See id.* ¶ 7.207. The panel then concluded that EC's GMO legislation fell within the scope of Annex A(1) of the SPS Agreement because it sought to protect "animal or plant life or health" from risks arising from "pests," and "diseases" and to protect "human or animal life or health" from risks arising from "additives," "contaminants" or "toxins" in food, beverages or feedstuffs. *See id.* ¶¶ 7.212-7.362. For example, GMOs could be considered "pests" when they i) grow where they are undesired (due to seed spillage or invasiveness or persistence); ii) transfer undesired genetic traits to other plants (such as herbicide or insect resistance); and iii) promote pesticide resistance in target organisms. *See id.* ¶¶ 7.242-7.267.

²³³ *See id.* ¶¶ 7.408-7.414.

²³⁴ The panel concluded that the term "other damage" in Annex A(1)(d) must comprise something other than damage to plant, animal, or human life or health covered in Annex A(1)(a)-(c). The panel noted that "other damage" is potentially quite broad and could include property damage (such as harm to water intake systems or other infrastructure) and economic damage in the form of sales lost by farmers due to the pest-like qualities of GMOs. *See id.* ¶¶ 7.369-7.371.

²³⁵ *See* EC—Biotech Panel Report, *supra* note 1, ¶¶ 8.6-8.7.

²³⁶ *See id.* ¶¶ 7.1403-7.1465, 7.1680-7.1766. The panel reasoned that an SPS measure is one that meets the Annex A(1) "SPS measure" definition with respect to the purpose of the measure, its legal form, and its nature. The panel first addressed the purpose element, explaining that this element is satisfied if the measure is applied to protect against the risks enumerated in paragraphs (a)–(d) of Annex A(1). The panel next divided the language of the second paragraph of Annex (A)(1) into a form element and a nature element. The form element is satisfied if the measure consists of legally binding government actions, such as "laws, decrees or regulations." The nature element is satisfied if the measure imposes either a substantive "requirement" or a "procedure." The panel concluded that the decision to delay final approval on individual biotech products constituted neither a substantive requirement in relation to pending or future

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, 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).²³⁷

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.²³⁸ 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."²³⁹ 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."²⁴⁰

Characterizing the Annex C(1)(a) requirement as a good faith obligation to "proceed with their approval procedures as promptly as possible,"²⁴¹ 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.²⁴² The panel noted that the EC could have granted conditional approval of GMO products, subject to new and additional requirements regarding labeling and traceability.²⁴³

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.²⁴⁴ The panel found that the EC, confronted with inadequate scientific information, could have exercised other options,

applications (such as a rejection of the pending biotech product applications or an across-the-board marketing ban) nor a new or amended approval procedure. Consequently, the panel found that the moratorium did not satisfy the nature element and did not meet the Annex A(1) definition of an SPS measure. *See id.* ¶¶ 7.1332-7.1383. Finally, the panel considered whether the moratorium might nevertheless constitute an SPS measure under Article 5.1 of the SPS Agreement. The panel stated that an SPS measure under Article 5.1 is one that is applied for the purpose of achieving a particular level of sanitary or phytosanitary protection. Since the moratorium was a procedural decision to delay product approval rather than a substantive measure designed to achieve a particular level of protection, the panel found that the moratorium did not constitute an SPS measure under Article 5.1 of the SPS Agreement. *See id.* ¶¶ 7.1384-7.1407. The panel therefore rejected the complainants' claims under the SPS Agreement provisions applicable to SPS measures—Articles 2.2, 2.3, 5.1, 5.5, and 5.6 as well as Article 7 and Annex B(1). *See id.* ¶¶ 7.1393-7.1395, 7.1403-7.1407, 7.1415-7.1421, 7.1441-7.1443, 7.1465. The panel applied the same reasoning to the product-specific measures challenged by the complainants because these measures were the means through which the relevant EC entities gave effect to the general moratorium. *See id.* ¶¶ 7.1680-7.1714.

²³⁷ *See id.* ¶¶ 7.1384-7.1448, 7.1680-7.1766, 7.1449-7.1465.

²³⁸ *See id.* ¶¶ 7.1570, 7.1792-7.2207.

²³⁹ *See* SPS Agreement, *supra* note 13, art. 8.

²⁴⁰ *See id.* Annex C(1)(a).

²⁴¹ *See* EC—Biotech Panel Report, *supra* note 1, ¶¶ 7.1271-7.1275.

²⁴² *See* ¶¶ 7.1511-7.1518.

²⁴³ *See id.* ¶ 7.1515.

²⁴⁴ *See id.* ¶¶ 7.1519-7.1529.

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.²⁴⁵ 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.²⁴⁶

The EC-Biotech decision has important implications for developing countries with evolving biotech regulatory regimes and limited capacity to process pre-marketing 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 applications 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."²⁴⁷ 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,²⁴⁸ 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.²⁴⁹ Relying on the Appellate Body's reasoning in the Japan-Apples case,²⁵⁰ 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.²⁵¹

²⁴⁵ See *id.*

²⁴⁶ See *id.* ¶ 7.1532.

²⁴⁷ See *id.* ¶¶ 7.1492-7.1497.

²⁴⁸ See *id.* ¶¶ 7.2561-7.2922.

²⁴⁹ See *id.* ¶ 7.2939.

²⁵⁰ See Appellate Body Report, *Japan—Measures Affecting the Importation of Apples*, ¶ 179, WT/DS245/AB/R (November 26, 2003) (*adopted* Dec. 10, 2003).

²⁵¹ See EC—Biotech Panel Report, *supra* note 1, ¶ 7.2990.

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.²⁵² Thus, the safeguard measures could not be justified as provisional measures under Article 5.7.²⁵³

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.²⁵⁴ 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.²⁵⁵

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.²⁵⁶ 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 5.1.²⁵⁷ 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.²⁵⁸

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) 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).

²⁵² See *id.* ¶¶ 7.3026-7.3027, 7.3258-7.3371.

²⁵³ See *id.* ¶¶ 7.3262, 7.3275, 7.3288, 7.3302, 7.3316, 7.3329, 7.3343, 7.3358, 7.3371.

²⁵⁴ See *id.* ¶ 7.3064.

²⁵⁵ See *id.* ¶¶ 7.3065-7.3066.

²⁵⁶ See *id.* ¶¶ 7.3036-7.3209.

²⁵⁷ See *id.* ¶¶ 7.3069, 7.3086, 7.3107, 7.3128, 7.3138, 7.3158, 7.3178, 7.3197, 7.3212.

²⁵⁸ See *id.* ¶¶ 7.3386-7.3399.

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.²⁵⁹ 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.²⁶⁰ 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.²⁶¹ GMOs represent an emerging set of technologies whose biological properties and environmental impacts are poorly understood and highly contested.²⁶² 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."²⁶³ Among the customary rules to be consulted are those set forth in the Vienna Convention on the Law of Treaties (the Vienna Convention).²⁶⁴

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."²⁶⁵ 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).²⁶⁶ 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.²⁶⁷ In other words, the panel concluded that it was obligated to take into account only those international law rules applicable to all WTO members.²⁶⁸

²⁵⁹ See *id.* ¶ 7.2941.

²⁶⁰ See Winickoff et al., *supra* note 4, at 104-6.

²⁶¹ See *id.* at 118-20.

²⁶² See *id.* at 119.

²⁶³ See EC—Biotech Panel Report, *supra* note 1, ¶ 7.65 (quoting the Understanding on Rules and Procedures Governing the Settlement of Disputes, Agreement Establishing the World Trade Organization, Annex 2, art. 3.2, *reprinted in* 33 I.L.M. 1225 (1994)).

²⁶⁴ See *id.* (citing the Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331 (1969) [hereinafter Vienna Convention]).

²⁶⁵ Vienna Convention, *supra* note 263, art. 31(3)(c).

²⁶⁶ See EC—Biotech Panel Report, *supra* note 1, ¶ 7.67.

²⁶⁷ See *id.* ¶¶ 7.68, 7.70.

²⁶⁸ See *id.* ¶ 7.71.

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.²⁶⁹ 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.²⁷⁰ Relying on the Appellate Body's reasoning in the Beef-Hormones case,²⁷¹ 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.²⁷²

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."²⁷³ 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.²⁷⁴ The panel emphasized that a dispute settlement panel may consider these treaties if it finds them informative, but is not obligated to do so.²⁷⁵ 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.²⁷⁶

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.²⁷⁷ 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.²⁷⁸ 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.²⁷⁹ 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

²⁶⁹ See *id.* ¶¶ 7.53-7.55, 7.73, 7.76-7.79.

²⁷⁰ See *id.* ¶¶ 7.74-7.75.

²⁷¹ See EC—Hormones Appellate Body Report, *supra* note 201, ¶ 121.

²⁷² See EC—Biotech Panel Report, *supra* note 1, ¶¶ 7.86-7.89.

²⁷³ See *id.* ¶ 7.92.

²⁷⁴ See *id.* ¶¶ 7.92-7.94.

²⁷⁵ See *id.* ¶ 7.93.

²⁷⁶ See *id.* ¶ 7.95.

²⁷⁷ See World Trade Organization, Understanding the WTO, The Organization, Members and Observers, http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (last visited May 4, 2007).

²⁷⁸ See Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, ¶¶ 130-134, WT/DS58/AB/R (Oct. 12, 1998) (*adopted* Nov. 6, 1998).

²⁷⁹ See *id.* ¶ 168.

Article 5.7 of the SPS Agreement.²⁸⁰ 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.²⁸¹ 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 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

²⁸⁰ See EC—Hormones Appellate Body Report, *supra* note 201, ¶ 29.

²⁸¹ See Caroline Henckels, *GMOs in the WTO: A Critique of the Panel's Legal Reasoning in EC—Biotech*, 7 MELB. J. INT'L L. 278, 299-300 (2006).

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 employment, and protect and preserve the environment.²⁸²

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.²⁸³ 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,”²⁸⁴ 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.²⁸⁵

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.²⁸⁶ The inalienable nature of human rights claims and their recognition by the international community in human

²⁸² See Marrakesh Agreement Establishing the World Trade Organization, pmbl., Apr. 15, 1994, 1867 U.N.T.S. 154 (1994).

²⁸³ See Gonzalez, *Markets, Monocultures, and Malnutrition*, *supra* note 36, at 378.

²⁸⁴ Universal Declaration of Human Rights, pmbl., G.A. Res. 217A, at 71, U.N. GAOR, 3d Sess., 1st plen. Mtg., U.N. Doc. A/810 (Dec. 12, 1948).

²⁸⁵ See Ernst-Ulrich Petersmann, *Theories of Justice, Human Rights, and the Constitution of International Markets*, 37 LOY. L.A. L. REV. 407, 409-412 (2003).

²⁸⁶ See Frank J. Garcia, *Trading Away the Human Rights Principle*, 25 BROOK. J. INT'L L. 51, 69-76 (1999).

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.²⁸⁷ 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.²⁸⁸

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 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.²⁸⁹ The Convention on Biological Diversity obligates states to protect and preserve the traditional practices and lifestyles of indigenous and local communities.²⁹⁰ 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."²⁹¹ 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 Rights²⁹² and in the International Covenant on Civil and Political Rights.²⁹³ 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.²⁹⁴

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.²⁹⁵ 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.²⁹⁶ Such an approach is not without precedent. The North American

²⁸⁷ See Petersmann, *supra* note 285, at 409-411.

²⁸⁸ See Garcia, *supra* note 286, at 85-86.

²⁸⁹ See *supra* notes 52-54 and accompanying text.

²⁹⁰ Convention on Biological Diversity, arts. 8(j), 10, *adopted* May 22, 1992, 1760 U.N.T.S. 143.

²⁹¹ Biosafety Protocol, *supra* note 11, art. 26.

²⁹² International Covenant on Economic, Social and Cultural Rights, *supra* note 53, arts. 1, 15, 25.

²⁹³ International Covenant on Civil and Political Rights, arts. 1, 27, 47, G.A. Res. 220A (XXI), 21 U.N. GAOR Supp. (No. 16) at 52, U.N. Doc. A/6316, 999 U.N.T.S. 171 (Dec. 16, 1966).

²⁹⁴ International Labour Organisation, Convention Concerning Indigenous and Tribal Peoples in Independent Countries, arts. 1-8, 12-20, 24-31, June 27, 1989, 28 I.L.M. 1384.

²⁹⁵ For an analysis of this approach and other ways of giving priority to human rights norms, see Garcia, *supra* note 286, at 86-95.

²⁹⁶ See, e.g., U.N. Conference on Environment and Development at Rio de Janeiro, June 3-14, 1992, *Agenda 21*, art. 15.2, U.N. Doc. A/CONF. 151/26 (June 13, 1992) (explaining that loss of biological

Free Trade Agreement (NAFTA) contains a hierarchy of norms provision that gives priority to certain enumerated environmental treaties in the event a conflict with the requirements of NAFTA.²⁹⁷ The European Community conditions membership on participation in and observance of treaty-based human rights obligations.²⁹⁸

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.²⁹⁹ Developed countries rejected these demands on the ground that inclusion of socioeconomic considerations would conflict with WTO requirements.³⁰⁰

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.³⁰¹ An environmental justice analysis must openly examine the historical underpinnings and socioeconomic dimensions of contemporary environmental conflicts in order to arrive at 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

diversity "represents a serious threat to human development" because it deprives human beings of the natural resources that provide food, clothing, medicine, housing and spiritual nourishment).

²⁹⁷ North American Free Trade Agreement, art. 104, U.S.-Can.-Mex., Dec. 17, 1992, 32 I.L.M. 289 (1993).

²⁹⁸ See, e.g., Garcia, *supra* note 286, at 61; James F. Smith, *NAFTA and Human Rights: A Necessary Linkage*, 27 U.C. DAVIS L. REV. 793, 818-19 (1994).

²⁹⁹ See Gupta, *supra* note 210, at 269.

³⁰⁰ See *id.* at 269-70.

³⁰¹ See Gonzalez, *Markets, Monocultures and Malnutrition*, *supra* note 36, at 378-79.

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.³⁰² This will increase agricultural commodity prices, boost the income of small farmers in the developing world, and increase the export revenues of developing countries.³⁰³

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.³⁰⁴ The declining terms of trade for agricultural products vis-à-vis manufactured goods and the power of transnational agribusiness to influence agricultural input and output prices will systematically disadvantage developing countries even if developed country protectionism is eliminated.³⁰⁵

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

³⁰² See *id.* at 368; Gonzalez, *Trade Liberalization, Food Security and the Environment*, *supra* note 28, at 488-89.

³⁰³ See Gonzalez, *Markets, Monocultures and Malnutrition*, *supra* note 36, at 368.

³⁰⁴ See *id.* at 368-373.

³⁰⁵ See *id.* at 369-370; HAHNEL, *supra* note 132, at 182-83.

products (such as food staples) from well-established foreign competitors, to nurture higher value-added food processing industries, and to promote rural development.³⁰⁶ 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.³⁰⁷ 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.³⁰⁸ 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 past.³⁰⁹ 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.

³⁰⁶ See Gonzalez, *Institutionalizing Inequality*, *supra* note 100, at 484-489. Both developing countries and nongovernmental organizations have proposed exceptions to the WTO Agreement on Agriculture that would permit developing countries to utilize a wide array of protectionist measures to promote food security. These proposed exceptions to the WTO rules are generally referred to collectively as the “Development Box” proposal. See SOPHIA MURPHY & STEVE SUPPAN, INT’L INST. FOR SUSTAINABLE DEV., INTRODUCTION TO THE DEVELOPMENT BOX: FINDING SPACE FOR DEVELOPMENT CONCERNS IN THE WTO’S AGRICULTURE NEGOTIATIONS 1 (2003), *available at* http://www.iisd.org/pdf/2003/trade_intro_dev_box.pdf.

³⁰⁷ See, e.g., HA-JOON CHANG, GLOBALISATION, ECONOMIC DEVELOPMENT, AND THE ROLE OF THE STATE 258-259, 276-277 (2003); HA-JOON CHANG, KICKING AWAY THE LADDER: DEVELOPMENT IN HISTORICAL PERSPECTIVE 19-51, 59-66 (2002); PAUL BAIROCH, ECONOMICS AND WORLD HISTORY: MYTHS AND PARADOXES 44-55 (1993).

³⁰⁸ See, e.g., ALICE H. AMSDEN, THE RISE OF “THE REST”: CHALLENGES TO THE WEST FROM LATE INDUSTRIALIZING ECONOMIES 8-13, 125-160 (2001); Ha-Joon Chang, *The East Asian Development Experience*, in RETHINKING DEVELOPMENT ECONOMICS, at 107, 111-117 (Ha-Joon Chang ed., 2003); HA-JOON CHANG & ILENE GRABEL, RECLAIMING DEVELOPMENT: AN ALTERNATIVE ECONOMIC POLICY MANUAL 70-75 (2004).

³⁰⁹ See YONG-SHIK LEE, RECLAIMING DEVELOPMENT IN THE WORLD TRADING SYSTEM 9-13 (2006).

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.³¹⁰

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.³¹¹

Principle 6 of the Rio Declaration recognizes the particular vulnerability of developing countries by providing that “[t]he special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority.”³¹²

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),³¹³ the Vienna Convention for the Protection of the Ozone Layer,³¹⁴ the Montreal Protocol on Substances that Deplete the Ozone Layer,³¹⁵ the United Nations

³¹⁰ LAVANYA RAJAMANI, *DIFFERENTIAL TREATMENT IN INTERNATIONAL ENVIRONMENTAL LAW* (2006); Christopher D. Stone, *Common But Differentiated Responsibilities in International Law*, 98 AM. J. INT’L L. 276, 279-80 (2004); ANITA MARGRETHE HALVORSEN, *EQUALITY AMONG UNEQUALS IN INTERNATIONAL ENVIRONMENTAL LAW* (1999).

³¹¹ See Rio Declaration, *supra* note 11, princ. 7.

³¹² See *id.* princ. 6.

³¹³ UNCLOS contains numerous provisions that impose asymmetrical obligations on developed and developing countries in recognition of the unique circumstances of developing countries and of vulnerable communities within those countries. See United Nations Convention on the Law of the Sea, arts. 61(3), 62(3), 69(4), 70(5), 82, 140, 144, 148, 150, and 152, Dec. 10, 1982, 1833 U.N.T.S. 397.

³¹⁴ The Vienna Convention for the Protection of the Ozone Layer expressly acknowledges the need to consider the “circumstances and particular requirements of developing countries.” Convention for the Protection of the Ozone Layer, pmbl., Mar. 22, 1985, T.I.A.S. No. 11,097, 1513 U.N.T.S. 293, 324.

³¹⁵ In accordance with the Vienna Convention for the Protection of the Ozone Layer, the Montreal Protocol gives developing countries additional time to phase out ozone-depleting substances and provides funds to compensate developing countries for the incremental costs incurred in complying with these obligations. Montreal Protocol on Substances that Deplete the Ozone Layer, art. 5.1, Sept. 16, 1987, 1522 U.N.T.S. 3; London Adjustments and Amendments to the Montreal Protocol on Substances that Deplete the Ozone

Framework Convention on Climate Change (UNFCCC),³¹⁶ the Kyoto Protocol,³¹⁷ and the Convention on Biological Diversity.³¹⁸

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 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,³¹⁹ 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.³²⁰ 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

Layer, art. 10, June 29, 1990, 30 I.L.M. 537; *see also* Anand, *supra* note 30, at 90-121 (discussing the ways in which the ozone regime comports with international environmental justice principles).

³¹⁶ The United Nations Framework Convention on Climate Change explicitly adopts the principle of common but differentiated responsibility. Article 31 (1) provides that “the Parties should protect the climate system . . . on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.” *See* United Nations Framework Convention on Climate Change, art. 31(1), May 9, 1992, 1771 U.N.T.S. 165.

³¹⁷ The Kyoto Protocol implements the principle of common but differentiated responsibility by imposing asymmetrical greenhouse gas reduction obligations on developed and developing countries. The Annex I (developed country) parties must reduce their collective greenhouse gas emissions by at least 5 percent below 1990 levels in the 2008-2012 compliance period. The non-Annex I (developing country) parties do not have binding emissions reduction obligations. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, art. 3, Dec. 11, 1997, U.N. Doc. FCCC/CP/1997/L.7/Add.1, 37 I.L.M. 22 (1998); *see also* Anand, *supra* note 30, at 21-60 (discussing the problem of climate change through the framework of environmental justice).

³¹⁸ The Convention on Biological Diversity recognizes the overriding priority that developing countries place on economic and social development and poverty eradication, the need for special financing to meet the needs of developing countries, and the traditional dependence of many indigenous and local communities on biological resources. Convention on Biological Diversity, *supra* note 290, pmbl. The Convention goes on to require the equitable sharing of the benefits arising from biotechnology based on resources provided by developing countries, including the transfer under fair and most favorable terms of technology relevant to the sustainable use and conservation of biodiversity and technology making use of genetic resources. *Id.* arts. 16, 19(2). Finally, the Convention requires developed countries to provide “new and additional financial resources to enable developing country parties to meet the agreed full incremental costs to them of implementing measures which fulfill the obligations of this Convention,” and conditions the obligations of developing countries on the provision of financing and technology by developed countries. *Id.* arts. 20(2), 20(4).

³¹⁹ *See* LINDSEY FRANSEN ET AL., WORLD RESOURCES INSTITUTE, INTEGRATING SOCIO-ECONOMIC CONSIDERATIONS INTO BIOSAFETY DECISIONS: THE ROLE OF PUBLIC PARTICIPATION 21-29 (2005), available at http://pdf.wri.org/fransen_lavina_biosafetywhitepaper.pdf.

³²⁰ *See id.* at 28.

assessments and the incorporation of these assessments into the biosafety decisionmaking process.³²¹

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.³²²

The 1947 General Agreement on Tariffs and Trade (GATT 1947)³²³ initially imposed uniform obligations on developed and developing countries.³²⁴ However, in recognition of the disadvantages faced by developing countries in international trade due to the legacy of colonialism,³²⁵ the GATT was subsequently amended to permit developing countries to protect their infant industries from the more technologically advanced industries of developed countries,³²⁶ to allow developing countries to impose trade restrictions in the event of balance of payments problems,³²⁷ and to encourage developed countries to grant enhanced market access opportunities to developing countries.³²⁸

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.”³²⁹ The

³²¹ Articles 22 and 28 of the Biosafety Protocol require developed countries to provide technical and financial resources to developing countries in accordance with the financial mechanism established in Articles 20 and 21 of the Convention on Biological Diversity. Biosafety Protocol, *supra* note 11, arts. 22, 28. In view of the potential complexity of socioeconomic impact assessments and the additional costs that developing countries will incur to undertake such assessments, it is important that the Biosafety Protocol expressly require the provision of additional resources to developing countries. Since the transnational corporations that seek to promote GMOs are generally headquartered in developed countries, developed countries will presumably have an economic incentive to provide such assistance. However, in case these incentives are insufficient, the Biosafety Protocol should be amended to permit developing countries, out of an abundance of caution, to prohibit GMOs pending the receipt of financial and technical assistance necessary to conduct the requisite environmental and socioeconomic impact assessments.

³²² See, e.g., LEE, *supra* note 309, at 39-43 (discussing the WTO provisions designed to facilitate economic development); Frank J. Garcia, *Beyond Special and Differential Treatment*, 27 B.C. INT’L & COMP. L. REV. 291, 292-97 (2004) (describing the history of special and differential treatment).

³²³ General Agreement on Tariffs and Trade, Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 [hereinafter GATT]. The GATT 1947 has been incorporated into the WTO as part of the GATT 1994. See Agreement Establishing the World Trade Organization, *supra* note 282, Annex 1A.

³²⁴ See Peter Lichtenbaum, *Reflections on the WTO Doha Ministerial: “Special Treatment” vs. “Equal Participation”*: Striking a Balance in the Doha Negotiations, 17 AM. U. INT’L L. REV. 1003, 1010-11 (2002).

³²⁵ See *id.* at 1009; see also Garcia, *supra* note 322; Asoke Mukerji, *Developing Countries and the WTO: Issues of Implementation*, 34 J. WORLD TRADE 33, 35 (2000).

³²⁶ See GATT, *supra* note 323, art. XVIII.

³²⁷ See *id.*

³²⁸ See *id.* part IV.

³²⁹ See Differential and More Favorable Treatment Reciprocity and Fuller Participation of Developing Countries, Nov. 28, 1979, GATT B.I.S.D. (26th Supp.) at 191 (1980) [hereinafter Enabling Clause]; LEE, *supra* note 309, at 36-39 (discussing the significance of the Enabling Clause); Garcia, *supra* note 322, at 294-95.

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.³³⁰ 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.³³¹

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.³³² Moreover, the most economically significant products of developing countries (such as clothing, textiles, and agricultural products) were often excluded or received less preference.³³³ Finally, the benefits of preferential market access were diminished by stringent rules of origin or were made contingent on compliance with specific political conditions.³³⁴ 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 Enabling Clause commitments were violated.³³⁵

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,³³⁶ 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.³³⁷ Second, the WTO imposed the same substantive obligations on all countries, but merely gave developing countries additional time to comply.³³⁸ 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.³³⁹

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.³⁴⁰ 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

³³⁰ See Garcia, *supra* note 322, at 294-95.

³³¹ See *id.*; JOHN JACKSON ET AL., LEGAL PROBLEMS OF INTERNATIONAL ECONOMIC RELATIONS 214-15 (2002) (discussing the Tokyo Round side agreements).

³³² LEE, *supra* note 309, at 37.

³³³ See *id.*

³³⁴ See *id.*

³³⁵ See *id.* at 38.

³³⁶ See *id.* at 15-17.

³³⁷ See *id.* at 17; Garcia, *supra* note 322, at 297.

³³⁸ See LEE, *supra* note 309, at 41; Garcia, *supra* note 322, at 297.

³³⁹ See Garcia, *supra* note 322, at 297-98

³⁴⁰ See *id.* at 298.

on developing countries in the areas of intellectual property, investment, and services.³⁴¹ 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.³⁴² In short, the WTO has generally been regarded as a bad bargain for developing countries.³⁴³

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 reviewed with a view to strengthening them and making them more precise, effective, and operational.”³⁴⁴

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.³⁴⁵ 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.³⁴⁶

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.³⁴⁷ Rather than binding and reducing tariffs in accordance with WTO requirements, developing countries must be permitted to increase tariffs to protect infant industries.³⁴⁸ 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).³⁴⁹ In

³⁴¹ See *id.*; LEE, *supra* note 309, at 41-42.

³⁴² See Garcia, *supra* note 322, at 299, 308-09.

³⁴³ See *id.* at 297-98.

³⁴⁴ See World Trade Organization, Ministerial Declaration of 14 November 2001, ¶ 44, WT/MIN(01)/DEC/1, 41 I.L.M. 746 (2002).

³⁴⁵ See Garcia, *supra* note 322, at 302-03; Gonzalez, *Markets, Monocultures, and Malnutrition*, *supra* note 36, at 368.

³⁴⁶ See Gonzalez, *Trade Liberalization, Food Security, and the Environment*, *supra* note 28, at 497.

³⁴⁷ See LEE, *supra* note 309, at 49-59.

³⁴⁸ See *id.* at 62-74.

³⁴⁹ See *id.* at 74-79.

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.³⁵⁰ While a detailed discussion of additional specific proposals to reform the WTO agreements is beyond the scope of this paper,³⁵¹ 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.

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.³⁵² 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.³⁵³

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.³⁵⁴ Recognizing the need to restrain the anti-competitive practices of transnational corporations through some type of international regulatory framework, nearly all of the advocates of a global antitrust regime have proposed that competition issues be added to the mandate of the WTO.³⁵⁵ Indeed, since 1996, the European Community has been advocating a Multilateral Agreement on Competition (MAC) under the auspices of the WTO that would incorporate WTO principles of non-discrimination, transparency, and procedural fairness in competition policy, as well as capacity-building for developing countries.³⁵⁶

Developing countries and development-oriented NGOs have opposed the EC's proposed agreement on competition for several reasons. First, many opponents of the

³⁵⁰ See *id.* at 79-81.

³⁵¹ For very thoughtful analyses of specific ways in which the WTO might be amended to reinvigorate special and differential treatment, see LEE, *supra* note 309, at 49-140; Garcia, *supra* note 322, at 302-15.

³⁵² See Yang, *supra* note 36, at 88.

³⁵³ See, e.g., ACTIONAID, COMPETITION POLICY AND THE WTO 5-8 (2004), available at http://www.actionaid.org.uk/_content/documents/competition2_3132004_122256.pdf (explaining how corporate domination of the food supply destroys the livelihoods of small farmers and aggravates food insecurity); PAUL & STEINBRECHER, *supra* note 20, at 184-220 (describing the efforts of transnational agribusiness to promote the cultivation of GMOs in the developing world and discussing the threats that GM crops pose to food security).

³⁵⁴ See Eleanor M. Fox, *International Antitrust and the Doha Dome*, 43 VA. J. INT'L L. 911, 915 (2003).

³⁵⁵ See *id.* at 925.

³⁵⁶ See Aditya Battacharjea, *The Case for a Multilateral Agreement on Competition Policy: A Developing Country Perspective*, 9 J. INT'L ECON. L. 293, 293-96 (2006).

EC's competition policy proposal suspect that its real aim is to open up developing countries' agricultural and industrial sectors to foreign competition by precluding developing countries from giving preferences to their own industries.³⁵⁷ Second, undertaking new WTO commitments in the area of competition policy would impose serious financial burdens on developing countries.³⁵⁸ Third, many developing countries object to the imposition of a one-size-fits-all competition policy that does not take into account national development strategies, such as the need to promote economic development by encouraging the concentration of domestic industries or by providing discriminatory support to domestic infant industries.³⁵⁹ Finally, lacking experience with competition policy, developing countries are concerned about exposing themselves to trade sanctions in the event that compliance proves too onerous or that the promised benefits of competition policy fail to materialize.³⁶⁰ As a consequence of opposition by most developing countries to the EC's competition policy proposal, the WTO General Council agreed in July 2004 to take competition policy out of the work program for the Doha Round of trade negotiations.³⁶¹

One of the lessons of the WTO debacle over competition policy is the importance of incorporating special and differential treatment into any new WTO initiative. Any effort to integrate competition policy into the WTO regime must support rather than hinder developing countries' attempts to achieve economic diversification and industrialization. In particular, competition policy must not thwart developing countries' use of industrial policy to move away from agro-export specialization.

It is important to recognize that most developed countries enacted antitrust legislation only after these countries had achieved a high level of economic development.³⁶² Even Japan and Western Europe traditionally subordinated competition policy to industrial policy.³⁶³ Japan, for example, encouraged mergers among leading firms in strategically significant industries in order to enable these industries to compete more effectively against foreign counterparts.³⁶⁴ Following Japan's example, South Korea, Taiwan, and Thailand protected domestic companies from foreign competition, legalized cartels, and fixed prices.³⁶⁵ Having benefited from policies that gave preferential treatment to domestic industries and promoted corporate consolidation, developed countries must not deprive developing countries of these successful strategies in the name of one-size-fits-all restrictions on anti-competitive behavior.

An agreement on competition policy will benefit developing countries only to the extent that it invokes the principle of special and differential treatment to give developing countries ample policy space to adopt the anti-competitive development strategies successfully deployed by more developed countries in order to promote economic diversification and industrialization. Domestic industries in developing countries must be given sufficient time to "catch up" to their foreign counterparts before being subjected to

³⁵⁷ See ACTIONAID, *supra* note 353, at 2.

³⁵⁸ See *id.*

³⁵⁹ See *id.* at 4-5; Battacharjea, *supra* note 356, at 296-97.

³⁶⁰ See Battacharjea, *supra* note 356, at 297.

³⁶¹ See *id.* at 293, 297-98.

³⁶² See *id.* at 316.

³⁶³ See ACTIONAID, *supra* note 353, at 3.

³⁶⁴ See *id.*

³⁶⁵ See Battacharjea, *supra* note 356, at 316.

the full force of international competition. Furthermore, any agreement on competition policy that might be of relevance to developing countries must specifically target the anti-competitive practices of transnational corporations that influence prices for products of particular interest to developing countries, including the practices of transnational agribusiness that distort the prices of agricultural inputs and agricultural commodities and that systematically marginalize small farmers. Finally, in view of developing country resource constraints, such an agreement must require aggressive antitrust enforcement by developed countries (even if the anti-competitive effects are felt entirely in developing countries) as well as the provision of technical and financial assistance to enable developing countries to develop competition policy suitable to their unique circumstances.

D. EMPOWERMENT OF HISTORICALLY SUBORDINATED COMMUNITIES

An environmental justice approach to environmental protection seeks to empower the communities directly affected by environmental degradation or inequitable access to natural resources.³⁶⁶ Throughout the developing world, local and indigenous farming communities have little input into development decisions but are expected to bear the destructive impacts of development projects on the natural resources upon which their lives and livelihoods depend.³⁶⁷ The demand for community empowerment is a common thread running through a variety of environmental justice struggles, including the Zapatista uprising to protest Mexico's participation in the North American Free Trade Agreement (NAFTA)³⁶⁸ and the struggle of the Ogoni people in Nigeria against the environmentally devastating oil drilling by Royal Shell.³⁶⁹

Principle 10 of the Rio Declaration on Environment and Development articulates the right to public participation in environmental decision-making as follows:

Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decisionmaking processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.³⁷⁰

Public participation is particularly important in the context of decisionmaking regarding GMOs for two reasons. First, the scientific uncertainty regarding the human health and environmental impacts of GMOs makes science a poor arbiter of trade and regulatory disputes. Scientific uncertainty pervades all environmental and human health risk assessments, and scientific "experts" are frequently required to make value choices and

³⁶⁶ See Gonzalez, *Markets, Monocultures, and Malnutrition*, *supra* note 36, at 380-81.

³⁶⁷ See *id.* at 345-348; WRI, *THE WEALTH OF THE POOR*, *supra* note 44, at 23.

³⁶⁸ See Gonzalez, *Markets, Monocultures, and Malnutrition*, *supra* note 36, at 345-47.

³⁶⁹ GUHA, *supra* note 29, at 100; Michael J. Watts, *Contested Communities, Malignant Markets, and Gilded Governance: Justice, Resource Extraction, and Conservation in the Tropics*, in PEOPLE, PLANTS, AND JUSTICE: THE POLITICS OF NATURE CONSERVATION, *supra* note 47, at 21, 23-29.

³⁷⁰ See Rio Declaration, *supra* note 11, princ. 10.

policy decisions in the risk assessment process that are not grounded in science.³⁷¹ As scientific uncertainty increases, the role of the public assumes additional significance because decisionmakers exercise even greater political discretion.³⁷² Because the scientific consensus regarding the human health and environmental hazards of GMOs is particularly low, public perceptions of risk and public values should play a significant role in establishing regulatory standards for GMOs.³⁷³

Second, an environmental justice approach to the GMO controversy requires the integration of socioeconomic considerations into biosafety decisions. This involves a two-step process. The first step is to assess the socioeconomic impact of GMOs in particular national and local contexts using a combination of accepted social science methodologies.³⁷⁴ The second step is to implement a regulatory mechanism that ensures that this information is in fact taken into account when biosafety decisions are made.³⁷⁵ Public participation is an essential aspect of both steps of this process.³⁷⁶ Public participation can assist decisionmakers in identifying the socioeconomic issues to be assessed and can enhance the quality of the social science research by ensuring that it is informed by the knowledge and experience of the local and indigenous farming communities whose livelihoods will be most affected by biotechnology.³⁷⁷ Public participation also helps decisionmakers determine what weight to give competing socioeconomic considerations and produces decisions that are perceived as legitimate because they are the result of an inclusive political process with meaningful participation by those whose stake in the regulatory decision is greatest.

The Biosafety Protocol acknowledges the importance of public awareness and education about GMOs and requires that states consult the public in the biosafety decisionmaking process.³⁷⁸ However, the Biosafety Protocol diminishes the role of public participation by privileging science over other normative discourses and by permitting consideration of only those socioeconomic impacts arising from scientifically demonstrable harm to biodiversity. In addition, contrary to Principle 10 of the Rio Declaration, the Biosafety Protocol does not address liability and redress for harm caused by GMOs, but merely directs the Conference of the Parties to adopt appropriate rules and procedures at a later date.³⁷⁹

An environmental justice approach to agricultural biotechnology must give rural and indigenous communities adequate information and a meaningful opportunity to participate in decisions that affect their health, their livelihoods, and their natural resources. An important first step toward the achievement of this goal is to amend the

³⁷¹ See Winickoff et al., *supra* note 4, at 94-96. For example, among the policy decisions to be made in the human health risk assessment process are (1) whether to identify hazards on the basis of mortality, morbidity, economic consequence or other values; (2) what model to use when extrapolating from animal studies to human toxicity studies; (3) what population will serve as the basis of exposure assessments; and (4) the appropriate level of precaution in particular situations. *Id.*

³⁷² See *id.* at 105-106, 112-13.

³⁷³ See *id.* at 118-20 (describing the lack of scientific consensus regarding GMO risk assessment).

³⁷⁴ See WRI, INTEGRATING SOCIOECONOMIC CONSIDERATIONS, *supra* note 319, at 21-26.

³⁷⁵ See *id.* at 21, 27.

³⁷⁶ See *id.* at 24, 29 (discussing the importance of public participation in the social science research on the socioeconomic impacts of GMOs and in the biosafety decision-making process).

³⁷⁷ See *id.*

³⁷⁸ Biosafety Protocol, *supra* note 193, art. 23.

³⁷⁹ *Id.* art. 27.

Biosafety Protocol to enable developing countries to fully incorporate socioeconomic considerations into decisions about biosafety. A second step is to amend the Biosafety Protocol to impose specific requirements designed to foster a more deliberative decisionmaking process, including the requirement that the public be given the ability to challenge biosafety decisions in a court of law or other independent and impartial tribunal. Finally, in order to promote corporate accountability, the Biosafety Protocol must address liability and compensation for damages caused by GMOs.

CONCLUSION

The high profile WTO dispute between the United States and the EC over GMOs has obscured the ongoing controversy in developing countries over the benefits and perils of agricultural biotechnology. By reframing the debate over GMOs in environmental justice terms, this article has highlighted the unique environmental and socioeconomic risks posed by GMOs in the developing world, and has argued that the current regulatory framework governing the international trade in GMOs is inadequate to address these risks.

While scientific uncertainty continues to plague efforts to reach consensus on the human health and environmental hazards of GM food and agricultural products, the socioeconomic perils of biotechnology are far more certain. The cultivation of GM crops in developing countries threatens to replicate the anti-poor bias of the Green Revolution, further entrench industrial agriculture at the expense of more environmentally friendly alternatives, and accelerate corporate domination of the world's food supply. Wealthy farmers and transnational corporations are likely to reap the benefits of agricultural biotechnology. Poor farmers in the developing world will be disproportionately burdened by the environmental and economic costs.

The socioeconomic risks described above are not necessarily inherent in the technology. Biotechnology could benefit small farmers by producing crops capable of withstanding drought, frost, soil salinity, and other environmental stresses. However, the profit-driven nature of the biotechnology industry makes it unlikely that such crops will be widely marketed any time soon at prices that small farmers can afford.

The environmental justice movement has long emphasized that environmental issues are inextricably intertwined with social and economic issues. Consistent with this insight, this article has argued that the debate over GMOs must be situated in the context of the larger controversy between developed and developing countries over trade in conventional agricultural products and in the context of current disputes over special and differential treatment in the Doha Round of WTO negotiations. The dispute over GMOs is not *sui generis*. Rather, it is one manifestation of a larger conflict that has implications for fundamental human rights, including the right to food and the right to cultural integrity.

Only by placing the GMO controversy in social and economic context is it possible to arrive at solutions that promote international environmental justice by attempting to harmonize international trade law, international human rights law, and international environmental law.