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# BORDERS AND THE ENVIRONMENT

BY

ANDREW P. MORRISS\* & ROGER E. MEINERS\*\*

*Despite regular acknowledgement of the interconnectedness of global ecosystems, government policies at the national level focus on environmental problems within their borders. As a result, the level of public and private resources expended on environmental protection in rich and poor countries is dramatically different on both a per capita and an absolute basis. While this outcome is readily explained by the politics of environmental issues, in which voters reward governments for the domestic expenditures but are skeptical of expenditures outside the jurisdiction, these differences mean that the total amount of environmental quality purchased across nations is lower than it could be. It means that some nations are purchasing small, expensive increments in environmental quality while large, low-cost increments in other jurisdictions are not purchased. By applying the principles of marginal analysis from economics, this Article demonstrates that this produces less total environmental quality and treats residents of rich and poor countries differently in a morally unacceptable way. The authors propose that governments provide more transparent cost and benefit information to allow public discussion of such differential treatment and to encourage environmental gains wherever most efficiently achievable.*

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## I. INTRODUCTION

Environmental policy analyses often describe the world as a single, interconnected ecosystem.<sup>1</sup> Pollution emitted by coal burned in Chinese power plants darkens the skies in Seoul and Tokyo.<sup>2</sup> Swedish forests are injured by acid rain caused by sulfur and nitrogen oxide emissions in Britain.<sup>3</sup> Sewage from Tijuana pollutes San Diego's beaches.<sup>4</sup> Heavy metals in streams everywhere end up in the oceans.<sup>5</sup> Carbon dioxide emissions everywhere increase global greenhouse gas levels, which many believe is linked to climate change.<sup>6</sup> Emissions from within any nation

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<sup>1</sup> Lawrence O. Gostin, *Meeting Basic Survival Needs of the World's Least Healthy People: Toward a Framework Convention on Global Health*, 96 GEO. L.J. 331, 349 (2008) ("Ecosystem degradation in one geographic area affects other parts of the world; in this way, living systems (air, sea, forests, and soil) are interconnected . . ."); Charlotte de Fontaubert, David R. Downes & Tundi S. Agardy, *Biodiversity in the Seas: Implementing the Convention on Biological Diversity in Marine and Coastal Habitats*, 10 GEO. INT'L ENVTL. L. REV. 753, 830 (1998) ("The need for cooperation reflects the ecological and geographic realities of an interconnected world . . ."); Joseph L. Sax, *Nature and Habitat Conservation and Protection in the United States*, 20 ECOLOGY L.Q. 47, 55 (1993) ("The planet itself is an interconnected series of ecosystems.").

<sup>2</sup> Keith Bradsher & David Barboza, *Pollution From Chinese Coal Casts a Global Shadow*, N.Y. TIMES, June 11, 2006, <http://www.nytimes.com/2006/06/11/business/worldbusiness/11chinacoal.html> (last visited Jan. 25, 2009) (stating that coal-burning power plants in China darken the entire region's skies, giving the affected areas a "Dickensian feel").

<sup>3</sup> See generally Air Pollution & Climate Secretariat, Acidification, [http://www.airclim.org/acidEutrophications/sub3\\_1.php#Causes](http://www.airclim.org/acidEutrophications/sub3_1.php#Causes) (last visited Jan. 25, 2009) (acidifying pollutants result from airborne deposition of sulphur, nitrogen oxides, and ammonia which are able to carry long distances).

<sup>4</sup> Sandra Dibble, *Baja's Burden: Development Boom on Gold Coast Forces Scrutiny of Sewage Plight*, SAN DIEGO UNION TRIBUNE, Oct. 21, 2007, [http://www.signonsandiego.com/uniontrib/20071021/news\\_in21sewage.html](http://www.signonsandiego.com/uniontrib/20071021/news_in21sewage.html) (last visited Jan. 25, 2009) (discharging sediment from state-run sewage plant threatens new and developing communities upstream).

<sup>5</sup> See Ann E. Carlson, *Standing for the Environment*, 45 UCLA L. REV. 931, 989 (1998) (depositing lead and other metals in a Los Angeles storm drain directly pollutes the Santa Monica Bay via stormwater runoff); Am. Inst. of Biological Sciences, *Bringing Coastal Dead Zones Back to Life*, <http://www.actionbioscience.org/environment/howarth.html#primer> (last visited Jan. 25, 2009) (explaining rivers can carry pollutants great distances and result in coastal "dead zones").

<sup>6</sup> INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007 - THE PHYSICAL SCIENCE BASIS: CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE IPCC 2 (Susan Solomon et al. eds., 2007), available at <http://www.ipcc.ch/ipccreports/ar4-wg1.htm> [hereinafter WORKING GROUP I REPORT].

thus have global impacts. Yet environmental laws generally follow national boundaries. Japanese air pollution control laws cannot restrict Chinese power plants nor can Swedish emission control measures stop British exports of acid rain. Most environmental laws thus address only a part of larger environmental problems.

Those seeking to address this mismatch between legal jurisdictions and the environment generally suggest one of three types of solutions. One group of environmental protection advocates, typically those in developed countries with relatively stringent environmental protection laws, argues that countries with less stringent protection laws should raise their standards to the higher, developed-world standards.<sup>7</sup> This argument is often heard in the context of trade negotiations, with the developed country environmental pressure groups demanding—often successfully—that trade treaties aimed at reducing barriers to trade include environmental protection standards.<sup>8</sup> The environmental “side agreement” to the North American Free Trade Agreement (NAFTA) is an example of this reaction.<sup>9</sup>

The second reaction, also largely by environmental groups from wealthy nations, has been to call for international institutions to set standards for environmental protection to eliminate a “race to the bottom” among jurisdictions.<sup>10</sup> The Kyoto Protocol, for example, attempts to set levels of carbon dioxide emissions by signatories.<sup>11</sup> Similarly, the World Trade Organization (WTO) has been moving gradually to include environmental standards as a regular part of trade

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<sup>7</sup> See Paul Cough, *Trade-Environment Tensions: Options Exist for Reconciling Trade and Environment*, 19 EPA J. 28, 28–32 (1993) (expanding world trade creates problems with varying environmental standards and some suggest imposing duties on countries with relaxed standards to compensate).

<sup>8</sup> See Stephen P. Mummie, *NAFTA and Environment*, FOREIGN POL’Y IN FOCUS, Oct. 1999, at 1, available at <http://www.fpiif.org/pdf/vol4/26ifnaft.pdf> (analyzing the challenges free trade poses to North American environment and proposing to strengthen NAFTA’s environmental protection measures).

<sup>9</sup> See North American Agreement on Environmental Cooperation, U.S.-Can.-Mex., Sept. 14, 1993, 32 I.L.M. 1480. See generally Jack I. Garvey, *Trade Law and Quality of Life—Dispute Resolution under the NAFTA Side Accords on Labor and the Environment*, 89 AM. J. INT’L L. 439 (1995) (discussing the evolving attempt in international trade law to balance trade values with environmental and societal concerns).

<sup>10</sup> See, e.g., Michael J. Kelly, *Bringing a Complaint Under the NAFTA Environmental Side Accord: Difficult Steps Under a Procedural Paper Tiger, but Movement in the Right Direction*, 24 PEPP. L. REV. 71, 94 (1996) (“[A]nother Sierra Club attorney, said, ‘This is exactly what the NAFTA environmental agreements is supposed to prevent . . . . Many Americans feared that Mexico might lead a race to the bottom by lowering environmental standards to help its industries.’”); Joost Pauwelyn, *Recent Books on Trade and Environment: GATT Phantoms Still Haunt the WTO*, 15 EUR. J. INT’L L. 575, 578 (2004) (“[T]he competition brought about by free trade may put pressure on governments to lower environmental standards (the so-called ‘race to the bottom’).”); Aaron Schwabach, *From Schweizerhalle to Baia Mare: The Continuing Failure of International Law to Protect Europe’s Rivers*, 19 VA. ENVTL. L.J. 431, 459 (2000) (“The effective enforcement of some internationally determined minimum level of environmental standards . . . would prevent a ‘race to the bottom’ in environmental standards . . . .”); Richard B. Stewart, *Environmental Regulation and International Competitiveness*, 102 YALE L.J. 2039, 2097 (1993) (“Another potential response . . . regarding the impact on competitiveness of different national environmental standards and the perceived threat of a worldwide ‘race toward the bottom’ is to eliminate or reduce those differences through international agreements.”). For a general refutation of that view, see Robert K. Fleck & F. Andrew Hanssen, *Do Profits Promote Pollution?: The Myth of the Environmental Race to the Bottom*, PERC POL’Y SERIES, Aug. 2007, available at <http://www.perc.org/pdf/ps41.pdf>.

<sup>11</sup> Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, 37 I.L.M. 22, available at <http://unfccc.int/resource/docs/convkp/kpeng.pdf> [hereinafter Kyoto Protocol] (detailing the goals, mechanisms, and future of the Kyoto Protocol and global emission reduction).

agreements.<sup>12</sup> Such agreements also tend to emphasize the need for less-developed countries to impose more stringent environmental standards domestically.<sup>13</sup>

The third reaction, largely from interest groups and governments in emerging nations focused on improving the economic welfare of the poor, is to argue that developing countries should not be expected to bear the burden of restricting emissions to the same degree as developed economies.<sup>14</sup> Once these nations have solved their economic problems, only then will they be able to address environmental issues. Fairness is also an issue: the developed economies that call for restrictions today were major polluters in the past, during their own development.<sup>15</sup>

At the same time, there is a growing “environmental justice” literature that condemns the location of polluting facilities and use or disposal of hazardous materials in poorer areas, both within countries and across international borders.<sup>16</sup> This literature argues that it is unjust for poorer people to bear more of the risk of environmental harms than richer people do.<sup>17</sup> The solutions proposed are generally similar to those

<sup>12</sup> WTO, Trade and Environment, [http://www.wto.org/english/tratop\\_e/envir\\_e/envir\\_e.htm](http://www.wto.org/english/tratop_e/envir_e/envir_e.htm) (last visited Jan. 25, 2009) (“The WTO contributes to protection and preservation of the environment through its objective of trade openness, through its rules and enforcement mechanism, through work in different WTO bodies, and through ongoing efforts under the Doha Development Agenda.”).

<sup>13</sup> Joseph F. DiMento & Pamela M. Doughman, *Soft Teeth in the Back of the Mouth: The NAFTA Environmental Side Agreement Implemented*, 10 GEO. INT’L ENVTL. L. REV. 651, 654 (1998) (using trade agreements as affirmative vehicles to promote environmental policy); see Daniel T. Griswold, TRADE POLICY ANALYSIS NO. 15: *Trade, Labor, and the Environment: How Blue and Green Sanctions Threaten Higher Standards*, 1–2, available at <http://www.freetrade.org/pubs/pas/tpa-015b.pdf> (stating that environmentally conscious Americans want both open trade and higher environmental standards abroad); Berry F.C. Hsu & Anita M.M. Liu, *Trade, Sustainability, and the WTO: Environmental Protection in the Hong Kong SAR*, 20 UCLA J. ENVTL. L. & POL’Y 187, 190 (2001–2002) (discussing Hong Kong’s enforcement of environmental standards through trade restrictions as a policy instrument).

<sup>14</sup> See *India Focuses on Solar Energy in New Climate Plan*, THE TIMES OF INDIA, June 30, 2008, [http://timesofindia.indiatimes.com/Earth/India\\_focuses\\_on\\_renewables\\_in\\_new\\_plan/articleshow/3180537.cms](http://timesofindia.indiatimes.com/Earth/India_focuses_on_renewables_in_new_plan/articleshow/3180537.cms) (last visited Jan. 25, 2009) (reporting Indian Prime Minister wants energy efficient economic development, but the country must expend more energy to lift populace from poverty); Kristen Sheeran, *Beyond Kyoto: North-South Implications of Emissions Trading and Taxes*, 5 SEATTLE J. SOC. JUST. 697, 703–04 (2007) (detailing Kyoto Protocol’s willingness to assign different emission reduction responsibilities to developing countries based on ability to pay and historic contribution to build-up of greenhouse gases in atmosphere).

<sup>15</sup> Malini Mehra, Op-Ed., *Time to Stop the Climate Blame Game*, BRIT. BROADCASTING CORP. NEWS, Dec. 3, 2007, <http://news.bbc.co.uk/1/hi/sci/tech/7125047.stm> (last visited Jan. 25, 2009) (citing Indian and Chinese policy position that nonhistorical emitters with large poor populations should not be expected to reduce emissions).

<sup>16</sup> See Eileen Gauna, *Federal Environmental Citizen Provisions: Obstacles and Incentives on the Road to Environmental Justice*, 22 ECOLOGY L.Q. 1, 9 (1995) (detailing historical context of environmental justice movement starting in 1982); William A. Shutkin & Charles P. Lord, *Environmental Law, Environmental Justice, and Democracy*, 96 W. VA. L. REV. 1117, 1120 (1994) (“Environmental justice is principally about opening up discussion and the practice of environmental law and policy to traditionally underrepresented communities.”).

<sup>17</sup> See Rachel D. Godsil, Note, *Remediating Environmental Racism*, 90 MICH. L. REV. 394, 397 (1991) (identifying hazardous waste facilities distributed in predominantly minority communities); Naikang Tsao, *Ameliorating Environmental Racism: A Citizens’ Guide to Combating the Discriminatory Siting of Toxic Waste Dumps*, 67 N.Y.U. L. REV. 366, 366 (1992) (“One striking feature of our nation’s landscape is the prevalence of toxic waste dumps in areas where racial minorities and the poor live.”); Roberto Suro, *Pollution-Weary Minorities Try Civil Rights Tack*, N.Y. TIMES, Jan. 11, 1993, at A1, B7 (stating that discriminatory land use, environmental cleanup policies spur environmental justice movement).

proposed by those concerned with the transnational impact of polluting activities—either action by international institutions or restrictions on trade.<sup>18</sup>

Reliance on international institutions and restrictions on free trade to solve larger environmental problems are both problematic. International organizations from the United Nations to the *Codex Alimentarius* are subject to interest group manipulation and high transactions costs due to supermajority and unanimity voting rules.<sup>19</sup> International agreements on environmental issues are costly to negotiate and vulnerable to special interests as well.<sup>20</sup> Restrictions on free trade are costly because they reduce overall wealth;<sup>21</sup> worse, such restrictions often hurt poorer nations the most.<sup>22</sup>

We propose a new approach to both the “one Earth, many jurisdictions” and environmental justice dilemmas, one that has the virtue of not requiring creation of a new international agreement or institution or modification of trade agreements. Applying a simple economic principle, the notion that gains are possible by shifting expenditures from high-marginal-cost, low-marginal-benefit measures to low-marginal-cost, high-marginal-benefit measures to the idea of a global environment, we argue that citizens of rich nations with stringent environmental protection laws already on the books could do more for the environment, and for people, by shifting future expenditures to funding remediation measures in countries with less stringent, or poorly enforced, environmental laws. Such an approach is economically efficient, environmentally productive, and morally preferable to the alternative of continuing to buy increasingly expensive increments of environmental quality at home. It also has the significant virtue of not requiring additional international institutions or agreements, since it can be implemented

<sup>18</sup> See Robert F. Blomquist, *Globoecopragmatism: How to Think (and How Not to Think) About Trade and the Environment*, 55 U. KAN. L. REV. 129, 183 (2006) (“Trade sanctions in the name of environmental justice should not be anathema.”); Hari M. Osofsky, *Learning From Environmental Justice: A New Model for International Environmental Rights*, 24 STAN. ENVTL. L.J. 71, 108 (2005) (asserting that the United Nations Human Rights Committee is the primary international institution issuing decisions on environment-related harm to humans).

<sup>19</sup> See Natalie Avery, *How TNCs Influence Global Food Standards*, THIRD WORLD NETWORK FEATURES, Oct. 24, 1995, <http://www.hartford-hwp.com/archives/28/076.html> (last visited Jan. 25, 2009) (detailing agrochemical industry representation in the meetings of *Codex Alimentarius* and industry influence in general); Jonathan Baert Wiener, *On the Political Economy of Global Environmental Regulation*, 87 GEO. L.J. 749, 768 (1999) (describing how countries often seek environmental regulations not to benefit the planet but to burden economic rivals); *id.* at 771–72 (explaining how global environmental regulations are often spurred by benefitting industries and their lobbyists); Paul B. Stephan, *Accountability and International Lawmaking: Rules, Rents and Legitimacy*, 17 NW. J. INT’L L. & BUS. 681, 698–99 (1996–1997) (contending that international law has a relative lack of accountability and is vulnerable to interest group politics); Roland Vaubel, *A Public Choice View of International Organizations*, in THE POLITICAL ECONOMY OF INTERNATIONAL ORGANIZATIONS: A PUBLIC CHOICE APPROACH 27 (Roland Vaubel & Thomas D. Willett eds., 1991) (raising problems of rent-seeking and ineffective oversight). See generally Ofer Eldar, *Vote-Trading in International Institutions*, 19 EUR. J. INT’L L. 3 (2008) (describing vote trading in international organizations).

<sup>20</sup> Gary E. Marchant & Douglas J. Sylvester, *Transnational Models for Regulation of Nanotechnology*, 34 J.L. MED. & ETHICS 714, 718 (2006) (“These international environmental agreements have also proved difficult and time-consuming to negotiate.”); see Wiener, *supra* note 19, at 771–72.

<sup>21</sup> James M. Sheehan, *Free Trade is Green Trade*, in ECOLOGY, LIBERTY & PROPERTY 149 (Jonathan H. Adler ed., 2000) (“Free trade is essential for both wealth creation and environmental protection.”).

<sup>22</sup> See DOUGLAS A. IRWIN, *FREE TRADE UNDER FIRE* 160–66 (2d ed. 2005) (describing advantages of free trade for developing countries).

through market purchases of environmental quality in poorer countries by richer countries, thus economizing on transactions costs and allowing more resources to be devoted to improving environmental quality.

Part II argues that environmental issues should be considered as the purchase of environmental goods and services to enable transparent comparisons of the effectiveness of regulatory policies. It next argues that relevant comparison for environmental problems should be made without regard to political boundaries through an examination of the implications of marginal costs and marginal benefits. Part III then examines examples of the real world marginal benefits and marginal costs of various policies in developed and developing countries, arguing that the existence of large disparities favor shifting resources from environmental protection in the former to environmental protection in the latter. Part IV develops a policy framework to implement the analysis.

## II. RECHARACTERIZING THE DEBATE OVER ENVIRONMENTAL PROTECTION

The debate over environmental law initiatives, whether in developed nations or developing ones, is typically cast as a binary choice between being “green” (or “pro-environment”) and being, well, “not green.”<sup>23</sup> This is a misconception. In some cases there are greener and less green alternatives, but there is rarely a simple binary choice such as whether or not to eat the last breeding pair of an endangered species or dump a barrel of toxic waste into a river.<sup>24</sup> Most choices do not even fit the “more or less green” spectrum, since they include tradeoffs that affect the environment negatively no matter what choice is made. To take a simple example,

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<sup>23</sup> See Keith Johnson, *Walmart: “We Are Not Green,”* WALL ST. J., Mar. 13, 2008, <http://blogs.wsj.com/environmentalcapital/2008/03/13/walmart-we-are-not-green/> (last visited Jan. 25, 2009) (highlighting Wal-Mart CEO’s statement that the company is trying to reduce carbon emissions but needs to grow at same time); Mark Sagoff, *The Principles of Federal Pollution Control Law*, 71 MINN. L. REV. 19, 21 (1986) (“The ‘grand vision’ underlying pollution control law encompasses two basic approaches or attitudes toward pollution that have become so familiar and have gained such general acceptance that discussion of environmental legislation must begin with them. The first attitude is ethical and cultural; the second is prudential and economic.”); Christopher D. Stone, *Do Morals Matter? The Influence of Ethics on Courts and Congress in Shaping U.S. Environmental Policies*, 37 U.C. DAVIS L. REV. 13, 20 (2003) (“The grounds may be that [human-centered] welfarism is objectionably homocentric (‘speciesist’), or that although economics may be fit for decisions we make as consumers, it is unsuited for analyzing issues, such as environmental protection, that we resolve outside markets, in political arenas, as citizens.”); Barton H. Thompson, Jr., *What Good is Economics?*, 37 U.C. DAVIS L. REV. 175, 176 (2003) (“Those who believe in a strong code of environmental ethics, a group I will label ‘environmental moralists,’ frequently see the prevalence of economic analysis in current environmental policy debates as an error to be remedied.”).

<sup>24</sup> People engage in fraud and act in other bad ways, and the choice whether to do so is a binary choice. But when people engage in fraud or do other bad acts in ways that damage the environment directly they are often committing crimes, because doing something like killing an endangered animal or pouring a barrel of waste in a river are illegal. See Endangered Species Act of 1973, 16 U.S.C. § 1538(a)(1)(B) (2006) (taking (i.e., killing) of endangered species is generally prohibited); Federal Water Pollution Control Act, 33 U.S.C. § 1311(a) (2000) (unlawful discharge of pollutants prohibited). The problem in these cases is generally not a lack of laws, but a lack of enforcement or poor design of the statute in question, creating problematic incentives that encourage behavior that harms the environment. See, e.g., Andrew P. Morriss & Richard L. Stroup, *Quartering Species: The “Living Constitution,” The Third Amendment, and the Endangered Species Act*, 30 ENVTL. L. 769, 787 (2000) (discussing incentive problems in the Endangered Species Act).

the Toyota Prius, a major symbol of green transportation, has a total environmental impact at least arguably greater than that of a Hummer, perhaps the most visible symbol of consumer excess at the expense of the environment, once the total life-cycle costs to the environment of building, operating, and disposing of the vehicles are taken into account.<sup>25</sup> As this example suggests, there is often no simple answer to the question of which is the “greener” alternative, when the choices are the vehicle that operates more efficiently or whose construction and disposal creates a smaller environmental footprint. A policy framework built around labeling policies as “green/not green” approaches cannot resolve such choices.

In addition to the pervasiveness of tradeoffs, environmental policy issues have to be considered in the context of the overall set of policies in which they are embedded. Each policy choice should be considered on its own merits, but a comparative approach is also necessary if rational distributions of resources are to be made. For example, if reducing nonpoint source runoff into rivers and streams produces twice the environmental benefit of more stringent controls on point source discharges into the same rivers and streams for the same cost, surely the difference merits resources being shifted from the latter into the former regardless of the decision about the overall level of discharge reduction sought.<sup>26</sup> Even if the goal is eventual elimination of all discharges, as the Clean Water Act suggests,<sup>27</sup> the decision about where to make the next step toward that goal ought to be affected by the relative benefits and costs of the alternative policies.

Of course, one might respond by saying “do it all,” and, indeed, some people do so respond.<sup>28</sup> Alas, we cannot have it all. Advances in technology steadily reduce the detectable limits for various pollutants, making it possible to push standards further toward zero discharge.<sup>29</sup> Resources are limited and not all of them can be spent on the environment.<sup>30</sup> Our point is simple and does not depend on whether we spend Al Gore’s preferred level or Monty Burns’s: for any given level of expenditure on activity that impacts environmental quality, tradeoffs among the effectiveness of policies and the costs of policies suggest that the focus should be

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<sup>25</sup> The tradeoffs are complex. Chris Demorro, Editorial, *Prius Outdoes Hummer in Environmental Damage*, THE RECORDER ONLINE, Mar. 7, 2007, [http://clubs.ccsu.edu/Recorder/editorial/print\\_item.asp?NewsID=188](http://clubs.ccsu.edu/Recorder/editorial/print_item.asp?NewsID=188) (last visited Jan. 25, 2009); CarConnection.com, *Prius Versus HUMMER: Exploding the Myth*, [http://www.thecarconnection.com/article/1010861\\_prius-versus-hummer-exploding-the-myth](http://www.thecarconnection.com/article/1010861_prius-versus-hummer-exploding-the-myth) (last visited Jan. 25, 2009).

<sup>26</sup> See Andrew P. Morriss, Bruce Yandle & Roger E. Meinert, *The Failure of EPA’s Water Quality Reforms: From Environment-Enhancing Competition to Uniformity and Polluter Profits*, 20 UCLA J. ENVTL. L. & POL’Y 25, 63–65 (2001–2002) (discussing how trades between nonpoint and point sources in the Tar-Pamlico River Basin Association were possible where nonpoint reduction estimates were \$67–\$119 per pound vs. \$860–\$7861 per pound for point sources).

<sup>27</sup> 33 U.S.C. §§ 1251–1387 (2000). The goal of the Clean Water Act is found at 33 U.S.C. § 1251(a) (2000).

<sup>28</sup> See, e.g., Clifford Fisher, *The Role of Causation in Science as Law and Proposed Changes in the Current Common Law Toxic Tort System*, 9 BUFF. ENVTL. L.J. 35, 94 (2001) (describing past advocacy groups demands that government protect the public from all environmental toxins, regardless of cost or risk).

<sup>29</sup> See *Kennecott v. U.S. Envtl. Prot. Agency*, 780 F.2d 445, 448 (4th Cir. 1985) (describing Congress’s intention in the Clean Water Act to use the latest technology to push industry toward zero discharge). The possible additional increments are thus rarely finite, even in the short term.

<sup>30</sup> See Andrew P. Morriss, *The Necessity of Economics: The Preferential Option for the Poor, Markets, and Environmental Law*, 5 U. ST. THOMAS L.J. 183, 186–88 (2008) (discussing the role of opportunity costs).



on how much improvement is to be had from spending another dollar, Euro, Yen, rupee, or Yuan across the available alternatives, and we should seek the most environmental benefit for the added dollar spent. This is true whether we assume the current level of expenditures on environmental matters or higher or lower levels of expenditures. To facilitate this comparison, we propose a different way to categorize environmental issues.<sup>31</sup> We will argue that this framework will enable the purchase of greater quantities of environmental goods and services at the cost of the same level of resources than are currently purchased.<sup>32</sup> Moreover, our approach will focus the purchase of environmental goods and services in the areas of greatest need and with greater benefits for the poor, which we view as a more appropriate distributional result than the concentration of benefits on the relatively wealthy.

### *A. A Typology of Environmental Solutions*

The first step in constructing this typology is straightforward: think about environmental quality as a good, purchased by expending resources. These purchases are often made indirectly, as virtually every human activity has an impact on some aspect of the environment, but they are purchases nonetheless.<sup>33</sup> Some goods and services are obvious and generally classified as environmental, such as the pleasure from admiring a beautiful view. Some are less visible, but still important, such as maintaining sea urchin populations.<sup>34</sup> But all such efforts can be considered as the purchase of environmental goods and services.

We are not arguing that the environment must actually be the subject of a market transaction to be of value, but that thinking about changing human behavior is done best by conceptualizing the issues within a market framework because that allows a focus on incentives and on the value obtained from one possible transaction compared to another. Nor are we suggesting that polluters currently own a “right to pollute.” Our analysis is independent of the allocation of rights. Moreover, the conceptualization of the environment as a set of goods and services is consistent not only with “conservative” market and property rights-based approaches but also with the literature on “green GDP” calculations, which attempts to value the goods and services people receive from the environment as

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<sup>31</sup> Note that we are not simply suggesting that policy makers engage in some form of cost-benefit analysis, although we do think that would be a good idea. Our argument goes beyond whether the benefits of a particular policy exceed that policy’s cost and ask whether from among the menu of possible policies we are purchasing the bundle of policies that maximizes environmental protection, given the resource constraints imposed by the combination of the laws of physics and politics.

<sup>32</sup> To those who respond that we are cloaking a desire for less spending in the guise of comparative analysis, we respond that our argument applies regardless of how much is spent.

<sup>33</sup> See Gernot Wagner, *From The Answer Desk: Green GDP*, Environmental Economics, [http://www.env-econ.net/2005/07/from\\_the\\_answer\\_1.html](http://www.env-econ.net/2005/07/from_the_answer_1.html) (last visited Jan. 25, 2009). Even the government of China issues such a measure. See Gov.cn, Chinese Government’s Official Web Portal, *Green GDP Accounting Study Report 2004* Issued, [http://english.gov.cn/node\\_12044/content\\_387775.htm](http://english.gov.cn/node_12044/content_387775.htm) (last visited Jan. 25, 2009).

<sup>34</sup> See Ron R. Levitan, *Community Structure in Times Past: Influence of Human Fishing Pressure on Algal-Urchin Interactions*, 73 *ECOLOGY* 1597, 1597 (1992).

part of national accounts.<sup>35</sup> We are arguing only that by thinking of policy choices in this framework can we ensure that those choices are made in a transparent way that facilitates comparisons.

Purchases of environmental goods and services can occur in several different ways. First, governments or private parties may simply buy the environmental good. For example, both governments and private individuals regularly purchase sensitive lands (or various bundles of property rights in such lands) to preserve those lands' ability to produce environmental goods.<sup>36</sup> Second, governments and private parties may subsidize other people's purchase of environmental goods. For example, governments offer tax deductions for contributions of property rights to land conservation<sup>37</sup> and charities often make matching grants to support donations toward favored activities.<sup>38</sup> Third, governments may require private entities to devote resources to produce environmental goods and services.<sup>39</sup> For example, governments require that vehicle manufacturers ensure that their vehicles meet environmental standards; the cost of doing so is largely borne by the purchasers of the vehicles but the decision on the amount of spending (and, often, on the technology on which it is spent) is made by a government actor, not the consumer or the manufacturer.<sup>40</sup> All of these methods may be reflected in a single good in the marketplace. Thus a "flex-fuel" car—which meets mandatory emissions standards while operating on gasoline, has a tax incentive for consumers, and is bought by a consumer who wants to reduce her environmental impact—produces increased air quality as the result of all three types of purchases. Our point is that the

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<sup>35</sup> See Joy E. Hecht, *Accounting for the Environment: New Directions for the United States?*, 14 NAT. RESOURCES & ENV'T 179, 179 (2000) (defining "green GDP" as the effort to build information systems on environmental issues and linking them to economic data).

<sup>36</sup> See, e.g., Andrew P. Morriss & Roger E. Meiners, *The Destructive Role of Land Use Planning*, 14 TUL. ENVTL. L.J. 95, 128–29 (2000) (discussing private efforts to save Hawk Mountain in Pennsylvania); Lucy Knight, *Profile: Douglas Tompkins*, NEW STATESMAN, Jan. 25, 2007, <http://www.newstatesman.com/environment/2007/01/douglas-tompkins-chile-land> (last visited Jan. 25, 2009) (profiling an American businessman who bought a chunk of Chilean rainforest); RICHARD BREWER, CONSERVANCY: THE LAND TRUST MOVEMENT IN AMERICA I (2003) (describing the role of private land trusts); Andrew P. Morriss, *Private Conservation Literature: A Survey*, 44 NAT. RESOURCES J. 621, 644–46 (2004) [hereinafter Morriss, *Private Conservation Literature*] (book review describing various efforts). See generally SALLY K. FAIRFAX & DARLA GUENZLER, CONSERVATION TRUSTS (2001) (detailing various efforts).

<sup>37</sup> See Roger E. Meiners & Dominic P. Parker, *Legal and Economic Issues in Private Land Conservation*, 44 NAT. RESOURCES J. 353, 358–60 (2004) (analyzing positions on the federal tax code and conservation easements); Morriss, *Private Conservation Literature*, *supra* note 36, at 624–33 (discussing various incentive programs).

<sup>38</sup> See generally FedCenter, Grants: Natural Resources, <http://www.fedcenter.gov/opportunities/grants/#natresources> (last visited Jan. 25, 2009) (outlining federal natural resources grant programs, several of which offer matching grants for restoration projects).

<sup>39</sup> There is an important caveat here. One thing governments may do is provide a forum for enforcement of property rights that hinder pollution, as in the Angler's Conservation Association example cited in note 49 *infra*. That is not a regulatory measure because it is equivalent to preventing the theft by the polluter of property owned by someone else through nonconsensual use of the victim's property.

<sup>40</sup> Standards vary across nations in which vehicles are produced, but since producers wish access to global markets, many adopt higher standards than may be required domestically or, more simply, technological standards continually rise so that no one produces engines using 1960s style emission standards.

environmental good is the same no matter which method is used to purchase it.<sup>41</sup> Table 1 lists estimates of the amounts spent on purchasing pollution abatement as calculated by the Organization for Economic Cooperation and Development (OECD), an organization of developed countries. The Table shows that both sets of purchases are important. For example, public purchases of improvements of water quality through treatment of waste water are a much larger portion of total expenditures than are public purchases of improved air quality (most of which is acquired by requiring other people to spend money via regulations).

There is an important difference across these types of spending, but it does not relate to the environmental good. What is different is that the expenditures made by the first method are "on-budget" for the public decision maker, because the decision-maker is also the spender, while expenditures made by the third are "off-budget" for the public decision maker, who is effectively able to buy environmental goods and services with other people's money. Government expenditures made by the second method may be on- or off-budget, depending on how governments score tax expenditures in their budgetary accounting.<sup>42</sup> Since there is no difference among the three types in terms of their environmental impact, however, expenditures of all three types directed by governments should be treated as if they are "on-budget" for the decision maker and, more importantly, for society. This is so for two reasons.

The first reason is conceptual: if we are to compare costs and benefits of various policies at an aggregate level, which is what rational governments ultimately do whether they engage in formal cost-benefit analysis or not, it should not matter who is paying the cost. Public or private, a dollar spent on environmental quality is a dollar spent on environmental quality. However when governments command private parties to make use of resources rather than purchasing goods in the marketplace with tax revenues, additional distortions in the economy may result.<sup>43</sup> The standard public finance advice is to fund government purchases of goods using the least distorting way to raise revenues to minimize dead weight losses.<sup>44</sup> By advocating putting both direct and indirect expenditures "on budget," we are attempting to implement this advice.

A second reason to treat decisions as "on budget" regardless of who is paying the bill is that polluters have generally been using a resource that, until the

<sup>41</sup> Of course, different institutions may produce different outcomes by buying different bundles of goods. Private conservation organizations often buy fewer of the "sticks in the bundle" of property rights than governments do. This difference reflects differences in incentives. For an overview of the wide range of organizational arrangements that provide environmental protection beyond formal governmental control, see generally ELINOR OSTROM, *GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION* (1990) and TERRY L. ANDERSON & DONALD R. LEAL, *ENVIRO-CAPITALISTS: DOING GOOD WHILE DOING WELL* (1997).

<sup>42</sup> See Editorial, *The Much-Needed Return of Pay-Go*, N.Y. TIMES, Mar. 22, 2007, <http://www.nytimes.com/2007/03/22/opinion/22thu2.html> (last visited Jan. 25, 2009) (describing how the pay-go policy requires Congress to balance any forgone tax revenue by either raising other taxes or cutting spending).

<sup>43</sup> See generally Gordon Tullock, *The Welfare Costs of Tariffs, Monopolies and Theft*, 5 W. ECON. J. 224 (1967) (the classic article on "deadweight losses").

<sup>44</sup> The origins of this are expressed in A.C. PIGOU, *THE ECONOMICS OF WELFARE* 195 (MacMillan & Co. Ltd. 1962) (1920). There might well be reasons to assign the cost to a particular person or firm, to ensure that "the polluter pays," but that is a separate issue from deciding whether to spend the resources at all.

pollution problem appeared, was a common pool resource available to whoever claimed it.<sup>45</sup> This does not give existing users the right to keep using the resource, and shifting to a scheme for regulating access, such as by assigning property rights, is usually an economically efficient thing to do when the resource is overused.<sup>46</sup> However, it means that some people must stop using a resource and incur extra costs while other people will not. Before we collectively impose costs on someone, we should want to be sure that it is worth the cost of restricting use of the common pool resource in question.<sup>47</sup> Putting resource allocation decisions “on budget” is an important tool in this respect, even if we ultimately decide to let the costs remain where they fall. Thus we are not advocating always paying polluters not to pollute, although that can be an effective policy in some instances.<sup>48</sup> We are advocating making policy decisions, in light of information about the costs of compliance, that take cost estimates seriously and treat them as part of the overall budget regardless of who initially pays the bill.

Our argument in this section is straightforward—all environmental protection costs are costs and need to be counted when comparing possible policy responses to environmental problems. It should not matter whether we are counting the costs to a government agency of buying hybrid vehicles rather than nonhybrid vehicles, the cost to consumers of the same purchase, or the cost of mandates on rental car companies to purchase hybrids for their fleets. Further, for purposes of this argument we can be agnostics on the method of calculating costs; what matters is that the costs are calculated consistently. If fuel economy trumps battery disposal issues, the Prius should score above the Hummer. If the reverse is true, then the relative scores are reversed as well. So long as a consistent measure of cost accounting is used across environmental issues, decision making can be improved by considering costs as costs regardless of where they initially fall.

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<sup>45</sup> H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124, 124 (1954) (providing the classic explanation of the economic incentive to over-exploit un-owned resources).

<sup>46</sup> When valued assets are at stake, there will be a struggle to determine who gets legal control. See, e.g., Terry L. Anderson & Peter J. Hill, *The Race for Property Rights*, 33 J.L. & ECON. 177 (1990). The result is often detailed governmental rules that, despite the best of intentions, result in overly-costly controls. “[T]he system has grown to the point where it amounts to nothing less than a massive effort at Soviet-style central planning of the economy to achieve environmental goals.” Richard B. Stewart, *Controlling Environmental Risks through Economic Incentives*, 13 COLUM. J. ENVTL. L. 153, 154 (1988). Nevertheless, despite continued calls for taxes on pollution by many economists, there is good reason to suspect that regulation may be preferred to taxes. See James M. Buchanan & Gordon Tullock, *Polluters’ Profits and Political Response: Direct Controls Versus Taxes*, 65 AM. ECON. REV. 139, 141 (1975).

<sup>47</sup> A study for the Small Business Administration estimated total regulatory compliance cost in the U.S. economy to be \$1.1 trillion in 2004. See W. MARK CRAIN, SMALL BUS. ADMIN., OFFICE OF ADVOCACY, THE IMPACT OF REGULATORY COSTS ON SMALL FIRMS 4 (2005), available at <http://www.sba.gov/advo/research/rs264tot.pdf>. Environmental regulations cost an estimated \$1249 per employee in 2004 dollars; the cost per employee for small employers (fewer than 20 employees) was estimated to be \$3296 per employee. *Id.* at 5. Those sums are larger than the per capita income of people in many nations. See Cent. Intelligence Agency, *The World Factbook, Rank Order-GDP-per capita (PPP)*, <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html> (last visited Jan. 25, 2009).

<sup>48</sup> See, e.g., Morriss et al., *supra* note 26, at 64–65 (discussing programs for purchase of increments in water quality); Jonathan H. Adler, *The Ducks Stop Here? The Environmental Challenge to Federalism*, 9 SUP. CT. ECON. REV. 205, 206, 237 (2001) (discussing Ducks Unlimited’s “prairie pothole” program).

### B. A Typology of Environmental Problems

Environmental problems are often distinguished according to the size of the area affected, yielding local, regional, and global environmental issues. Local problems are generally the easiest problems to solve. A source emits a pollutant that causes harm in the immediate area; for example, when an upstream polluter's emissions into a river harm a downstream user of the same river. When the upstream polluter and downstream victim are in the same jurisdiction, the solution is relatively simple. The downstream victim seeks relief from the upstream polluter in the courts and is awarded damages, injunctive relief, or both.<sup>49</sup> There may be complications that hinder such a simple solution, of course. In some cases, the polluters may have obtained state permission to pollute, thereby blocking nuisance actions.<sup>50</sup> In other cases, the number of sources may be so large as to make a nuisance suit an unlikely remedy due to high transactions costs. For example, it would be impracticable for Los Angeles-area residents suffering health effects from the combined emissions of the region's millions of autos to sue each motorist for his or her contribution to the overall problem.<sup>51</sup> In such cases a political process can serve as a substitute for the legal system and those aggrieved may seek to obtain relief through legislation,<sup>52</sup> although invoking the political process involves problems of its own.<sup>53</sup> The solution is nonetheless conceptually straightforward:

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<sup>49</sup> See Roger Bate, *Saving Our Streams: The Role of the Anglers' Conservation Association in Protecting English and Welsh Rivers*, 14 *FORDHAM ENVTL. L. REV.* 375 (2003) (discussing the role of private organizations in preserving water quality in the United Kingdom); Julian Morris, *Climbing Out of the Hole: Sunsets, Subjective Value, the Environment, and the English Common Law*, 14 *FORDHAM ENVTL. L. REV.* 343 (2003) (discussing the role of nuisance law in private individuals' efforts to protect the environment). Private suits also played an important role in water quality regulation in the United States long before federal involvement in water quality issues. See Peter N. Davis, *Theories of Water Pollution Litigation*, 1971 *WIS. L. REV.* 738 (1971); Samuel C. Weil, *Waters: American Law and French Authority*, 33 *HARV. L. REV.* 133 (1919) (arguing that the riparian doctrine was based on the Napoleonic Code).

<sup>50</sup> Jonathan H. Adler, *Fables of the Cuyahoga: Reconstructing a History of Environmental Protection*, 14 *FORDHAM ENVTL. L. REV.* 89, 113–14 (2002) (explaining failure of nuisance suits seeking injunctions against polluters of Cuyahoga River due to impact of state-issued permits for pollution).

<sup>51</sup> See *Diamond v. Gen. Motors Corp.*, 97 Cal. Rptr. 639, 644–45 (Cal. Ct. App. 1971) (detailing failed nuisance class action on behalf of residents of Los Angeles County against industrial polluters in which no economical and effective group remedy existed); *City of San Jose v. Superior Court*, 525 P.2d 701, 710 (Cal. 1974) (ruling a class action invalid in which purported class sought air pollution relief from airport because facts were too peculiar for each case and too difficult to determine issues common to purported class). This has not stopped some politicians from making an effort to use such suits. See, e.g., Rob Luke, *Car-Makers Get One Down, Two to Go in Triple-Suit Cal. GHG Attack*, LEGALNEWSLINE.COM, Sept. 18, 2007, <http://www.legalnewsline.com/news/contentview.asp?c=201056> (last visited Jan. 24, 2009) (reporting on California Attorney General Jerry Brown's failed public-nuisance lawsuit against the Big Six automakers).

<sup>52</sup> See INDUR M. GOKLANY, *CLEARING THE AIR: THE REAL STORY OF THE WAR ON AIR POLLUTION* 111–23 (1999) (crediting state and local air pollution legislation for improvements in air quality in the United States).

<sup>53</sup> The legislators may, of course, give protection to special interests (rent-seekers). See, e.g., Peter Pashigian, *Environmental Regulation: Whose Self-Interests Are Being Protected?*, 23 *ECON. INQUIRY* 551 (1985). See generally *TOWARD A THEORY OF THE RENT-SEEKING SOCIETY* (James M. Buchanan et al., eds., 1980); Fred S. McChesney, *Rent Extraction and Interest-Group Organization in a Coasean Model of Regulation*, 20 *J. LEGAL STUD.* 73, 79–85 (1991).

identify a problem and its source, then require the source to reduce its emissions until the harm is reduced to acceptable levels.<sup>54</sup>

Environmental problems that cross political boundaries present trickier legal problems. One reason is that when a larger area is involved, causation is often harder and more expensive to prove. Acid rain is an example of the difficulties in resolving such disputes.<sup>55</sup> But many of the greater difficulties are due more to the multiple jurisdictions involved. Persuading Britain to incur costs to reduce emissions to protect Swedish forests is harder than persuading British courts to tell an upstream British source to stop emitting a pollutant into a river that harms a downstream British rights holder, not because the moral or economic problems are harder but because the multijurisdictional nature of the problem makes it more difficult to resolve. Put simply, British voters are generally less interested in incurring costs to benefit Swedes than they are to benefit Britons. Because Swedish forest owners could not effectively sue British, Polish, or German<sup>56</sup> coal plants for acid rain damage, they had to rely on negotiations among the nations involved.<sup>57</sup> This made resolving the external-to-Britain acid rain problem more expensive and more likely to involve interest group bargaining than internal-to-Britain river problems, but it did not change the conceptual nature of the problem or the solution. In short, there are additional practical political problems when pollutants cross legal boundaries but the technical solution remains the same: identify the source, identify the environmental quality goal, and reduce emissions to meet the goal.

Global pollution problems may be the most difficult to tackle politically, but the conceptual solution remains the same. For example, greenhouse gas emissions are the largest current global pollution issue; others include persistent pesticides, deep sea fishing, plastics in the ocean, and acidification of the ocean.<sup>58</sup> The question in such cases is not whether there are harms to specific individuals from emissions, either

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<sup>54</sup> In most cases, we think this is most effectively done through a combination of private property rights and common law legal actions. See Roger Meiners & Bruce Yandle, *Common Law and the Conceit of Modern Environmental Policy*, 7 GEO. MASON L. REV. 923 (1999). The method chosen is not crucial to our argument however.

<sup>55</sup> Robert F. Blomquist, *The Beauty of Complexity*, 39 HASTINGS L.J. 555, 562 (1988) (reviewing WILLIAM H. RODGERS, *ENVIRONMENTAL LAW: AIR AND WATER* (1986)) (observing that acid rain dispute will remain one of most "intractable" air quality issues); Ned Helme & Chris Neme, *Acid Rain: The Problem*, EPA J., Jan.-Feb. 1991, at 18, 19-20 (designing effective strategy to prevent further acid rain was considered one of the most "intractable" environmental policy problems). Acid rain was, to Congress, little more than a political football that could not be dealt with in a straightforward manner. See Richard Meyer & Bruce Yandle, *The Political Economy of Acid Rain*, 7 CATO J. 527, 544 (1987).

<sup>56</sup> These three countries are the three largest individually identified countries that are sources of sulfur deposited in Sweden. See Air Pollution & Climate Secretariat, *supra* note 3.

<sup>57</sup> Regarding the damage, see Press Release, Swedish NGO Secretariat on Acid Rain, Coal-Fired Power Stations Top Damage League (Feb. 2, 2006), available at <http://www.acidrain.org/pages/publications/reports/pressrelease22feb06.pdf>. Regarding the European Convention on Long-range Transboundary Air Pollution, see U.N. Econ. Comm'n for Europe, Convention on Long-range Transboundary Air Pollution, <http://www.unece.org/env/lrtap/> (last visited Jan. 25, 2009).

<sup>58</sup> See WORKING GROUP 1 REPORT, *supra* note 6; George Ekström & Sve-Erik Pettersson, *The Global Pesticides Project: Reducing Risk in Tropical Agriculture*, PESTICIDE NEWS, June 2005, at 17, 17-19; Stephen Leahy, *Drowning in an Ocean of Plastic*, WIRED, June 5, 2004, <http://www.wired.com/science/discoveries/news/2004/06/63699> (last visited Jan. 24, 2009); THE ROYAL SOCIETY, OCEAN ACIDIFICATION DUE TO INCREASING ATMOSPHERIC CARBON DIOXIDE 1 (2005), available at <http://royalsociety.org/displaypagedoc.asp?id=13314>.

local or distant, but whether the total sum of all environmental damage produces a general harm to the world.<sup>59</sup> Special interest problems are endemic in addressing global pollution issues, making them particularly difficult to solve without massive efforts at coordination, again generally requiring invoking supranational political processes to produce agreements among sovereign entities.<sup>60</sup> But aside from these political problems, the structure of the solution remains the same.

There is an additional distinction between local and larger scale environmental problems. Some human health impacts occur primarily at the local level. Elevated arsenic in one North American town's drinking water has relatively little environmental impact on Europeans, for example. In contrast, emissions of greenhouse gases in any location have their impact via global changes in climate caused by total global emissions of greenhouse gases and so have no purely local impact. One might argue that where impacts are almost wholly local (e.g., arsenic levels in drinking water), different jurisdictions might have different preferences about the level of environmental quality to buy, while where impacts are more global, local preferences are irrelevant. There is a vigorous environmental federalism literature that persuasively makes just such an argument.<sup>61</sup> Our framework does not preclude differences in preferences but suggests that those claiming a higher preference for environmental quality must justify why they buy it only where it benefits them if they fail to provide it across borders, particularly when doing so results in overall lower levels of environmental quality. People in one jurisdiction certainly should be allowed to buy more environmental quality than people in another if they wish to do so, but such purchases must be based on the preferences of the purchasers, not a general appeal to being green. Moreover, as we will argue below, such purchases are vulnerable to moral criticism in some cases as reflecting a preference for small improvements in the lives of the privileged at the expense of a large improvement in the lives of the poor.

Rather than sorting environmental problems into these three categories and then attempting to construct a variety of institutions to address the problems, it is more productive to focus on two things that all categories of problems have in common. First, regardless of whether a problem affects a local area within a single jurisdiction, a region cutting across several jurisdictions, or the entire globe, the evaluation of the costs of the environmental impact should be independent of human-created

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<sup>59</sup> Caution is always in order in presuming that the current view is correct. For example, the near-global ban on DDT prompted by *Silent Spring* has caused millions of deaths for little environmental benefit. Andrew P. Morriss & Roger E. Meiners, *Property Rights, Pesticides, & Public Health: Explaining the Paradox of Modern Pesticide Policy*, 14 *FORDHAM ENVTL. L. REV.* 1, 2, 23–27 (2002) (discussing the consequences of DDT's ban).

<sup>60</sup> Highly motivated interest groups, including nations, tend to dominate political action. On the other side are disorganized, rationally ignorant citizens who may bear costs but are largely clueless about them or unable to act. See generally MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS* (Harvard University Press 1974) (1965).

<sup>61</sup> See Jonathan H. Adler, *When is Two a Crowd? The Impact of Federal Action on State Environmental Regulation*, 31 *HARV. ENVTL. L. REV.* 67, 67–69 (2007); Henry N. Butler & Jonathan R. Macey, *Externalities and the Matching Principle: The Case for Reallocating Environmental Regulatory Authority*, 14 *YALE L. & POL'Y REV.* 23, 25 (1996). See generally Jonathan H. Adler, *Judicial Federalism and the Future of Federal Environmental Regulation*, 90 *IOWA L. REV.* 377 (2005); Jonathan H. Adler, *Jurisdictional Mismatch in Environmental Federalism*, 14 *N.Y.U. ENVTL. L.J.* 130 (2005) [hereinafter Adler, *Judicial Federalism*].

boundaries. Thus, pollution of the Rio Grande, shared by the United States and Mexico, should be evaluated in the same way as pollution of the Mississippi River, which lies within the United States alone, or pollution of the Rio Yaqui, which lies within Mexico alone.<sup>62</sup> Second, the calculation of benefits should not distinguish among costs imposed on people (e.g., health effects) based on the jurisdiction in which they live. Thus, regardless of whether we are discussing pollution of the Rio Yaqui, the Rio Grande, or the Mississippi River, the benefit per person of improving water quality should be considered to be the same for otherwise identical individuals living in the Mexico and the United States.<sup>63</sup> This stems from the equal moral worth of all humans and seems to be something sufficiently obvious that it is not necessary to argue the point in any detail.<sup>64</sup> Of course, this does not mean that there will always need to be equal levels of pollution in the Mississippi, the Rio Grande, and the Rio Yaqui. We posit only that the default position should be that if an expenditure of \$X brings an improvement of Y units of water quality in the Rio Grande and Z units in the Mississippi, and  $Y > Z$ , that the expenditure of the next \$X ought to go to the Rio Grande rather than the Mississippi. Those who wish to spend it on the Mississippi bear the burden of rebutting this presumption by showing that the valuations are incorrect or rebuttable for some other reason. We do not accept an argument that rejects the equal moral worth of individuals on both sides of the U.S.-Mexican border and so which does not provide a justification for buying a smaller increment in environmental quality on one side of that border rather than a larger one on the other side.

Moreover, even many "local" environmental problems are really global problems in some dimensions. Preserving endangered species habitat in Brazil benefits Americans, and vice versa, because the benefits of species preservation (existence value, potential medicines, preservation of robust ecosystems, etc.) are generally ones that are not limited to the immediate neighbors of the habitat.<sup>65</sup> Even local water quality issues often have global impacts, as many pollutants eventually find their way into the oceans and into marine life consumed by humans far from the source.<sup>66</sup>

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<sup>62</sup> Of course, all these rivers ultimately drain into oceans and so there is a global aspect to some river water quality issues as well as local and regional ones.

<sup>63</sup> Our formulation allows for varying the calculations based on differences such as income-adjusted demand for environmental goods and services.

<sup>64</sup> Of course, richer people lose more money when they miss a day of work due to illness than do poor people, but the declining marginal value of money means that what they lose may not be as valuable as the smaller in magnitude losses incurred by the poorer people. The correct solution to these sorts of problems strikes us as a simple assumption that everyone should be treated the same, putting the burden of justifying differential treatment on those proposing it.

<sup>65</sup> Gretchen C. Daily et al., *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems*, ISSUES IN ECOLOGY, Spring 1997, at 1, 2, available at [http://www.esa.org/science\\_resources/issues/FileEnglish/issue2.pdf](http://www.esa.org/science_resources/issues/FileEnglish/issue2.pdf) (listing ways ecosystem services support life, including air purification, biodiversity maintenance, climate stabilization, and aesthetic beauty).

<sup>66</sup> See Judith Kimerling, *Disregarding Environmental Law: Petroleum Development in Protected Natural Areas and Indigenous Homelands in the Ecuadorian Amazon*, 14 HASTINGS INT'L & COMP. L. REV. 849, 874 (1991) ("Bioaccumulation of petroleum in the food chain can cause serious human health problems . . . a variety of organics and heavy metals are known to bioaccumulate in fish that live in polluted waters, making them dangerous for human consumption."); NAT'L ENVTL. JUSTICE ADVISORY COUNCIL, U.S. ENVTL. PROT. AGENCY, FISH CONSUMPTION AND ENVIRONMENTAL JUSTICE 11 (2002), available at [http://www.epa.gov/oecaerth/resources/publications/ej/nejac/fish-consump-report\\_1102.pdf](http://www.epa.gov/oecaerth/resources/publications/ej/nejac/fish-consump-report_1102.pdf) (describing how contaminants travel great distances in air and water, accumulate in fish tissue and are consumed by humans).



Our analysis does not address *how* a problem is addressed or whether mandatory or voluntary incentive measures are preferable. We think how any given environmental problem is solved is a question best determined at the level of social organization that most closely matches the boundaries of the problem (e.g., solving watershed problems on a watershed basis) so as to take advantage of local knowledge, and that *mandatory* measures should be implemented at the lowest level of government possible (e.g., a preference for local governments over regional ones, regional ones over national ones, and national ones over international bodies), to ensure increased participation by those most affected by the problem and to allow regulatory competition and experimentation.<sup>67</sup> The key conclusion we draw from the two points made in this section is that there should be no presumption that expenditures to buy improvements in environmental quality by any particular jurisdiction should be made only for improvements *within* the jurisdiction where the resources are collected. Just as charities that raise money in the United States may spend their resources to address problems outside the United States, so governments acting as coordination devices can collect resources in one jurisdiction and expend them in another.

There is a danger that we may appear to be proving too much here. If we are considering the benefits to those on both sides of the border with respect to improving water quality even where there are not spill-over effects from Mexico to the United States, why does not the same argument hold with respect to food purchases in the United States, where the benefit of the extra calories in a Starbucks Frappuccino™ would be much greater if consumed by a hungry person in Mexico rather than an obese person in New York City? Similar arguments might be made about almost any good.<sup>68</sup> We distinguish environmental goods and services from other goods and services in two ways. First, while it is true that calories consumed in New York cannot be consumed in Oaxaca, the caloric intakes of consumers in the two locations are not interconnected in the same way that the environment in the two locations is. Both consumers may be part of a global economy but the purchase by an individual of a good in one location has only a *de minimus* effect on the availability and price of goods elsewhere, while government policies are so large that they produce major impacts. For example, U.S. government policies favoring corn-based ethanol have produced a rise in food prices in Mexico that harms the poor there in the name of improving environmental quality in the United States.<sup>69</sup> Second, individual decisions and collective decisions should be evaluated according to different moral yard sticks.

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<sup>67</sup> See Adler, *Judicial Federalism*, *supra* note 61 at 377.

<sup>68</sup> Such an argument was made in a recent *Harvard Law Review* student Note that drew widespread attention as an example of ideology masquerading as legal scholarship. See Note, *Never Again Should a People Starve in a World of Plenty*, 121 HARV. L. REV. 1886, 1893 (2008). On the reaction to the Note, see David Lat, *Working in Biglaw = Killing Babies?*, ABOVE THE LAW: A LEGAL TABLOID, May 21, 2008, [http://abovethelaw.com/2008/05/hlr\\_in\\_toilet\\_flush\\_flush.php](http://abovethelaw.com/2008/05/hlr_in_toilet_flush_flush.php) (last visited Jan. 24, 2009).

<sup>69</sup> See Elisabeth Malkin, *Thousands in Mexico City Protest Rising Food Prices*, N.Y. TIMES, Feb. 1, 2007, [http://www.nytimes.com/2007/02/01/world/americas/01mexico.html?\\_r=1&scp=2&sq=ethanol+%2B+food+prices+%2B+mexico+%2B+poor&st=nyt&oref=slogin](http://www.nytimes.com/2007/02/01/world/americas/01mexico.html?_r=1&scp=2&sq=ethanol+%2B+food+prices+%2B+mexico+%2B+poor&st=nyt&oref=slogin) (last visited Jan. 25, 2009) (citing analysts' agreement that U.S. ethanol production has helped raise food prices in Mexico); Aditya Chakraborty, *Secret Report: Biofuel Caused Food Crisis: Internal World Bank Study Delivers Blow to Plant Energy Drive*, THE GUARDIAN, July 4, 2008, <http://www.guardian.co.uk/environment/2008/jul/03/biofuels.renewableenergy> (last visited Jan. 25, 2009) (referencing confidential report claiming biofuels have raised global food prices by 75%).

Each person must make his or her own choices about how to live a moral life, and experience has shown that leaving fundamental questions of morality to individuals and to competing visions of the moral life rather than imposing one view through a government is a superior policy.<sup>70</sup>

We now turn to the second part of our argument, examining the costs and benefits of environmental protection.

### C. *The Costs of Environmental Protection*

Environmental damage occurs when human activity alters nature in a way that changes what is generally called the “natural” environment.<sup>71</sup> In virtually all cases the damage is an unsought by-product of human action—if the job could be accomplished without causing the damage, the no damage alternative usually would be acceptable and often preferable. For example, when coal is burned, there are emissions of particulates and various by-products of combustion, such as sulfur dioxide and carbon dioxide.<sup>72</sup> The purpose of burning coal is to obtain heat for cooking, warmth, or power generation, not to emit particulates, sulfur dioxide, or carbon dioxide. If it did not cost anything to do so, those burning coal would presumably be happy to reduce such emissions (if asked politely). Unfortunately it almost always costs something to reduce emissions, and it often costs quite a lot.<sup>73</sup> These costs are why the pollutants are emitted in the first place—disposal into the environment is treated by polluters as a costless means of disposing of unwanted waste products.<sup>74</sup> The problem then is figuring out how to make sure that the source

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<sup>70</sup> See GARY S. BECKER & GUY NASHAT BECKER, *THE ECONOMICS OF LIFE: FROM BASEBALL TO AFFIRMATIVE ACTION TO IMMIGRATION, HOW REAL-WORLD ISSUES AFFECT OUR EVERYDAY LIFE* 15 (1997) (“Competition is good for religion, as it is for ordinary commodities, because religious groups are forced to learn how better to satisfy members’ needs than they do when they have a monopoly position.”); Laurence R. Iannaccone, *The Consequences of Religious Market Structure*, 3 *RATIONALITY & SOC’Y* 156, 160 (1991) (stating that officially established religions are analogous to a situation where there is “a heavily subsidized dominant firm, run or regulated by the state” together with “[a] large number of smaller, independent, and competing firms” which exist around the dominant firm’s edges); Andrew P. Morriss & Benjamin Cramer, *Disestablishing Environmentalism*, 39 *ENVTL. L.* (forthcoming June 2009).

<sup>71</sup> We put “natural” in quotes because we think humans are a part of the environment and that there is nothing “unnatural” about their activities or anything particularly special about the prehuman environment. Nonetheless, for purposes of our argument we assume that human action is the defining characteristic of what most people define as “environmental problems.”

<sup>72</sup> Union of Concerned Scientists, *How Coal Works*, [http://www.ucsusa.org/clean\\_energy/coalswind/brief\\_coal.html](http://www.ucsusa.org/clean_energy/coalswind/brief_coal.html) (last visited Jan. 25, 2009).

<sup>73</sup> See FREDRIC BECK ET AL., *RENEWABLE ENERGY FOR CALIFORNIA: BENEFITS, STATUS & POTENTIAL—RESEARCH REPORT NO. 15*, at 12 (2002), available at [http://www.repp.org/repp\\_pubs/pdf/repp\\_calrenew\\_2002.pdf](http://www.repp.org/repp_pubs/pdf/repp_calrenew_2002.pdf) (detailing significant scrubber costs for Washington state coal plants causing electricity costs to rise 100%); Keith Bradsher, *A Leading Asian Utility to Cut Carbon Emissions*, *N.Y. TIMES*, Dec. 7, 2007, <http://www.nytimes.com/2007/12/07/business/worldbusiness/07power.html?scp=10&sq=reducing%20coal%20emissions%20+%20expensive&st=cse> (last visited Jan. 25, 2009) (“Reaching [emission] goals could be difficult, as many clean coal technologies either produce only modest reductions in carbon dioxide emissions, are very expensive or are simply not yet technologically feasible . . . the technology to do so is still under development and could prove costly even if perfected.”).

<sup>74</sup> This problem is most pronounced on the global level due to the lack of legal constraints. At the local level, legal constraints tend to be strongest. If your neighbor is burning stinky coal and it damages

of the emissions is paying for the costs it imposes in doing so.<sup>75</sup> Of course, today's waste is sometimes tomorrow's product and so these problems can resolve themselves.<sup>76</sup> In at least some cases, however, they will not.

In general, the cost of preventing environmental harm has a rising marginal cost curve, as do most activities.<sup>77</sup> In other words, if we begin with a source emitting 100 tons, it will generally cost more to remove the second ton than it will cost to remove the first, more to remove the third than the second, and so on.<sup>78</sup> (The same is true of protecting the  $n^{\text{th}}$  and  $(n+1)^{\text{th}}$  unit of land from development.) In general it is also true that the marginal cost increases more between the cost of reduction of the  $n^{\text{th}}$  and  $(n+1)^{\text{th}}$  unit, where  $n > 1$ , than between the first and second units of reduction. (In calculus terms, both the first and second derivatives of the cost function are positive.)<sup>79</sup> The marginal cost curve for almost every environmental protection measure looks something like Figure 1. The slope of the curve may be steeper or flatter; there may be plateaus scattered throughout, and so forth, but the general shape is approximated here.

The reason for this shape is straightforward: if rational people are involved in the decision making, stopping the first unit of environmental harm is going to be accomplished by removing the cheapest unit of environmentally-damaging activity. For example, suppose we are concerned about the emissions of sulfur dioxide from a power plant burning high sulfur coal.<sup>80</sup> The plant can switch to lower sulfur coal and get an immediate reduction in emissions of the pollutant without any additional changes. If taking into account the differences in coal cost and transportation; the price difference between the low sulfur coal and high sulfur coal is relatively small, then the cost of this reduction is also small. If the next increment in reduction requires the addition of

your property, you likely have an action for nuisance. The United States Supreme Court noted that this is true even for regional pollution more than a century ago. *Georgia v. Tenn. Copper Co.*, 206 U.S. 230, 238–39 (1907). When property rights are not specified, then the problems of infringement by pollution is much greater.

<sup>75</sup> Perfection, meaning zero pollution, is not possible. Some emissions of most substances do not cause measurable harm so are not of concern. Realistically we deal, based on the best scientific evidence, in incremental or marginal harms or costs compared to marginal benefits of reductions. "We have maintained our goal to eliminate the discharge of pollutants by 1985" said Senator Muskie in 1978 when discussing the Clean Water Act. Sen. Edmund S. Muskie, *The Meaning of the 1977 Clean Water Act*, EPA J., July–Aug. 1978, at 4. He was either clueless that zero pollution is impossible if humans live or just being a good politician.

<sup>76</sup> See Pierre Desrochers, *How Did the Invisible Hand Handle Industrial Waste? By-Product Development Before the Modern Environmental Era*, 8 ENTERPRISE & SOC'Y 348, 362 (2007); Pierre Desrochers, *Industrial Ecology and the Rediscovery of Inter-Firm Recycling Linkages: Historical Evidence and Policy Implications*, 11 INDUS. & CORP. CHANGE 1031, 1035 (2002).

<sup>77</sup> See, e.g., BARRY C. FIELD, NATURAL RESOURCE ECONOMICS: AN INTRODUCTION 139 (2001); STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION 10–19 (1993) (discussing the general failure of most policies to link costs and benefits).

<sup>78</sup> It is possible that it may cost the same to achieve certain levels of reductions at certain other points on the curve, but for simplicity's sake we are assuming a normal marginal cost curve. People rationally go for the biggest bang for the buck, so the pollutants cheapest to remove will be the first target.

<sup>79</sup> See generally EDWARD M. GRAMLICH, A GUIDE TO BENEFIT-COST ANALYSIS 48–76 (2nd ed. 1998) (discussing the basic principles of cost-benefit valuation).

<sup>80</sup> One must remember that the stated objective of laws, including environmental laws, can be quite different from their *sub rosa* intent, which can be perverse. See, e.g., BRUCE A. ACKERMAN & WILLIAM T. HASSLER, CLEAN COAL/DIRTY AIR: OR HOW THE CLEAN AIR ACT BECAME A MULTIBILLION-DOLLAR BAIL-OUT FOR HIGH-SULFUR COAL PRODUCERS AND WHAT SHOULD BE DONE ABOUT IT 64–65 (1981).

expensive smokestack scrubbers to the plant, the cost of this next reduction will be much greater than the reduction accomplished by switching to low sulfur coal.<sup>81</sup>

The importance of the shape of the marginal cost curve is that it means that buying  $n^{\text{th}}$  unit of reductions is generally cheaper than buying the  $(n+x)^{\text{th}}$  unit of reductions, where  $x>0$ . As a result, it implies that any given expenditure can generally buy more total units of reduction by buying  $n$  units of reduction at two separate locations than by buying  $2n$  units of reduction at a single location, if both locations have similar cost curves. Of course, buying  $n$  units at each two separate locations sometimes means that different people experience different amounts of environmental benefits than if  $2n$  units were bought at one location and none at the other. We therefore turn to the benefits of environmental goods and services.

#### *D. The Benefits of Environmental Protection*

The benefits of protecting the environment generally follow a declining marginal benefit curve, as is almost always the case with any good or service.<sup>82</sup> That is, the benefit of reducing pollution from  $n$  units to  $(n-1)$  units is generally greater than the benefits of reducing pollution from  $(n-x)$  units to  $(n-x-1)$  units, where  $x>0$ . (In calculus terms, the first and second derivatives of the benefit function are negative.) As a result, the marginal benefit curve for pollution control usually looks something like Figure 2. Again, there may be important caveats about the shape of this curve in any particular case. For example, there may be sharp discontinuities to the marginal benefits curve if threshold effects exist with respect to exposure to a pollutant.<sup>83</sup> Nonetheless, the overall shape of the curve is a sufficiently general phenomenon that we can rely on it here, and the existence of peculiar bends or kinks in the curve at various points do not affect the general analysis, although they may affect particular calculations.

The consequence of this is that reducing pollution where there is a lot of it generally yields “more bang for the buck” than removing the last increment from an emissions stream that is already pretty clean. For example, a comprehensive study of Superfund sites, allegedly the most hazardous dump sites in the nation, based on a survey of 130 sites, estimated that the mean cost of remediation per Superfund site, to avert one case of cancer, was \$11.7 billion.<sup>84</sup> While some sites

<sup>81</sup> This relationship is an important part of the reason for economists’ general recommendation to reduce pollution through effluent taxes rather than technology mandates; it leaves the choice of the technology to the operator of the polluting plant, who benefits by reducing the cost of compliance and creates competition to devise new, more efficient technology.

<sup>82</sup> See generally WALTER J. WESSELS, *ECONOMICS* 9–11 (2nd ed. 1993) (discussing the general principles of marginal analysis).

<sup>83</sup> Meaning merely that at particular points, once current technology has been brought to bear on helping resolve a problem, there may be a rush to adopt the technology once it is demonstrated to be successful and the cost of implementing it is reduced.

<sup>84</sup> W. Kip Viscusi & James T. Hamilton, *Are Risk Regulators Rational? Evidence from Hazardous Waste Cleanup Decisions*, 89 AM. ECON. REV. 1010, 1021 (1999). That estimate is in 1993 dollars, which would translate to a cost of about \$17.3 billion per case of cancer averted in 2008 dollars. See BUREAU OF LABOR STATISTICS, U.S. DEP’T OF LABOR, *CPI DETAILED REPORT* tbl.24 (Malik Crawford ed., 2008), available at <http://www.bls.gov/cpi/cpid0806.pdf>.

were cost effective in preventing harm, most provided almost no measurable benefit.<sup>85</sup>

The distribution of the benefits may be different, however, depending on both the mechanism by which the harm is caused and where the reductions occur. If the pollution emitted primarily causes local problems, spending  $\$n$  on reduction at both location A and location B has a different appearance to individuals living at those two locations than does spending  $\$2n$  on reduction at A and  $\$0$  on reduction at B. People at B are better off under the former policy than they are under the latter, and people at A are worse off under the former than they are under the latter.<sup>86</sup> If the problem is long distance air pollution, where location A is far enough upwind of B for the ill-effects of the air pollution emitted at A to appear at B but not A, and B is upwind enough of "location" C for the problems connected to B's emissions to appear at C but not B, spending  $\$2n$  in reductions at A yields benefits for B, while spending  $\$n$  on reductions at A and B, yields benefits for B and C, albeit less for B than under the other policy. Of course, if the problem is a global pollutant, it does not matter where the reductions come from, although even in global pollution cases the harms may not be evenly distributed. If benefits are positively linked to the size of the emissions reduction, declining marginal benefits means that spending  $\$n$  at both A and B yields more total reduction than spending  $\$2n$  at A and  $\$0$  at B; thus, the overall increase in welfare is greater under the second policy.

#### *E. Considering Both Marginal Costs and Marginal Benefits*

When we combine the considerations of marginal costs and marginal benefits, we arrive at an opportunity to show two curves intersecting—the Holy Grail of the economic explanation of many things and certainly of the costs and benefits of environmental protection measures. As everyone who has taken virtually any economics class knows, the intersection of the curves denotes the point where the benefits of spending more are outweighed by the costs of doing so and the savings from spending less are smaller than the benefits of spending more. This is not armchair theorizing. Under Executive Order (E.O.) 12,866 issued in 1993 by President Bill Clinton, the United States Environmental Protection Agency (EPA), like other agencies, conducts costs and benefits analyses of various major regulations.<sup>87</sup> The Office of Management and Budget explained in 1996, when discussing the implementation of E.O. 12,866, how marginal cost would be considered:

All costs calculated should be incremental, that is, they should represent changes in costs that would occur if the regulatory option is chosen compared to costs in the base case (ordinarily no regulation or the existing regulation) or under a less stringent alternative. Future costs that would be incurred even if the regulation is not promulgated, as well as costs that have already been incurred (sunk costs), are not part of incremental costs. If marginal cost is not constant for any component of costs,

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<sup>85</sup> See Viscusi & Hamilton, *supra* note 84, at 1022–23.

<sup>86</sup> Always assuming that the costs are justified for  $n$  units of reduction.

<sup>87</sup> Exec. Order No. 12,866, 3 C.F.R. 638 (1993), *reprinted as amended in* 5 U.S.C. § 601 (2008).

incremental costs should be calculated as the area under the marginal cost curve over the relevant range.<sup>88</sup>

Similarly, on the benefits side, the guidelines explain how marginal benefits should be calculated: "An attempt should be made to quantify all potential real incremental benefits to society in monetary terms to the maximum extent possible."<sup>89</sup> Hence, when the National Ambient Air Quality Standards were revised for ground-level ozone in 2008, a cost-benefit analysis was performed.<sup>90</sup> The 2008 standard of 0.075 parts per million (ppm) (a reduction from the 0.084 ppm standard established in 1997), was evaluated relative to an alternative tougher standard of 0.070 ppm that was also considered.<sup>91</sup> In Table 2 we summarize the major costs and benefits of that standard relative to the more stringent alternative.<sup>92</sup> Using EPA's figures, the marginal cost of a reduction in the ozone standard from 0.075 ppm to 0.070 ppm would be between \$4.5 billion under the "low" scenario and \$13.2 billion under the "high" scenario, while the marginal benefits would be between \$1.06 billion and \$11 billion, respectively.<sup>93</sup> The increment in additional pollution control from 0.075 ppm to 0.070 ppm would thus appear to have a marginal cost that exceeds its marginal benefit by a substantial amount. EPA concluded that the additional benefit was not worth the additional cost and selected the 0.075 ppm standard.<sup>94</sup>

One may quibble with various aspects of how EPA conducted this particular cost-benefit analysis.<sup>95</sup> But the exercise provides an example of an analysis that involves detailed considerations of marginal costs and marginal benefits. Of course, EPA had it easy in this 550 page regulatory analysis—it was merely considering one of the criteria pollutants in isolation, and did not make judgments about shifting resources from one area to another under the Clean Air Act, let alone to or from air pollution issues to water pollution issues or to some other area of the budget entirely or even to reducing government spending.

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<sup>88</sup> OFFICE OF MGMT. & BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, ECONOMIC ANALYSIS OF FEDERAL REGULATIONS UNDER EXECUTIVE ORDER 12866 (1996), <http://clinton4.nara.gov/OMB/inforeg/riaguide.html> (last visited Jan. 25, 2009).

<sup>89</sup> *Id.*

<sup>90</sup> EPA, EPA-452/R-08-003, FINAL OZONE NAAQS REGULATORY IMPACT ANALYSIS (2008), available at [http://www.epa.gov/ttnecas1/regdata/RIAs/452\\_R\\_08\\_003.pdf](http://www.epa.gov/ttnecas1/regdata/RIAs/452_R_08_003.pdf).

<sup>91</sup> *See id.* at ES-1.

<sup>92</sup> For a summary of the ozone rules proposed in June 2007 and approved in March 2008, see MOBILE SOURCES TECHNICAL REV. SUBCOMM., CLEAN AIR ACT ADVISORY COMM.: OZONE NAAQS REGULATORY IMPACT ANALYSIS 10-11 (2007), available at [http://www.epa.gov/air/caaac/mstrs/sept2007/evans\\_adler.pdf](http://www.epa.gov/air/caaac/mstrs/sept2007/evans_adler.pdf).

<sup>93</sup> *Id.* at 7-8.

<sup>94</sup> National Ambient Air Quality Standards for Ozone, 73 Fed. Reg. 16,436 (Mar. 17, 2008) (to be codified at 40 C.F.R. pts 50, 58); EPA, Ozone Air Quality Standards, <http://www.epa.gov/air/ozonepollution/standards.html> (last visited Jan. 25, 2009).

<sup>95</sup> Some political conservatives complained the new standard was not worth the cost. *See, e.g.*, Nicolas Loris & Ben Lieberman, *EPA Should Not Increase the Ozone Regulation Burden*, HERITAGE FOUNDATION, Feb. 26, 2008, <http://www.heritage.org/Research/EnergyandEnvironment/wm1827.cfm> (last visited Jan. 25, 2009). Others thought it did not go far enough. *See, e.g.*, Utah Moms for Clean Air, *New Federal Ozone Standard Falls Short*, <http://www.utahmomsforcleanair.org/2008/03/15/new-federal-ozone-standard-falls-short/> (last visited Jan. 25, 2009). In fact, Earthjustice filed a petition for judicial review of the rule on behalf of several citizens groups. *Petition for Review*, *Am. Lung Assoc. v. EPA*, No. 08-1203 (D.C. Cir. May 27, 2008).

We are going to assume away the substantive problem of comparing gains in water quality with the benefits of economic growth from cutting capital gains taxes or improved air quality with improved water quality, or any of the many other tradeoffs implicit in every government budget. However the government makes such decisions, our argument is simply that its decisions are likely to be improved by being made with greater knowledge of the costs and benefits, and the marginal costs and marginal benefits in particular, of the policies in question. We leave it to politicians to compare air quality improvements with funding boondoggles like “the bridge to nowhere”<sup>96</sup> or worthwhile programs. That is what members of Congress get elected and paid to do.<sup>97</sup> What needs to be done is to compare the marginal benefits and costs of making improvements in air quality in one program in one location with improvements in air quality in other programs and in other locations.

#### F. What About Borders?

We’ve argued that marginal costs and marginal benefits matter because they enable us to make better decisions, with better being defined as “more environmental quality for the same money,” “the same environmental quality for less money,” or both. A hypothetical example illustrates how this would work in practice.

Imagine a world with three nations. The map in Figure 4 illustrates this fictional world, noting the capital cities of each.<sup>98</sup> As you might expect from its name, the people of Ecotopia are environmentally conscious, take pride in their country’s willingness to impose stringent environmentally protective legislation, and devote considerable resources to protecting and improving the environment. As would be expected from its name, the people of Industrialia value economic growth over environmental protection. Their lands, air, and water suffer as a result, but their economy is booming and they are wealthy. The final country, Economia, applies economic logic to all policy decisions, and steers something of a middle course. We assume that through the combination of the Tiebout effect<sup>99</sup> and liberal

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<sup>96</sup> See Ronald D. Utt, *The Bridge to Nowhere: A National Embarrassment*, HERITAGE FOUNDATION, Oct. 20, 2005, <http://www.heritage.org/Research/Budget/wm889.cfm> (last visited Jan. 25, 2009). That earmark was particularly large, but not uncommon as the federal budget is packed with such items of minimal benefits. See, e.g., OFFICE OF MGMT. & BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, LIST OF 2008 APPROPRIATIONS EARMARKS BY 110TH CONGRESS SUBCOMMITTEE (2008), [http://earmarks.omb.gov/2008\\_appropriations\\_earmarks\\_110th\\_congress.html](http://earmarks.omb.gov/2008_appropriations_earmarks_110th_congress.html) (last visited Jan. 25, 2009) (“In fiscal year 2008, there were 11,524 earmarks totaling \$16,501,833,000 for appropriations accounts.”).

<sup>97</sup> Convincing politicians to make budget judgments in a principled way is a problem well beyond the scope of this Article.

<sup>98</sup> Yes, we’re being cute. Ecotopia’s capital is named for Rachel Carson, Economia’s for Adam Smith, and Industrialia’s for T.S. Eliot in honor of *The Wasteland*, for it surely is one given its citizens’ preferences.

<sup>99</sup> See generally Charles M. Tiebout, *A Pure Theory of Local Expenditures*, 64 J. POL. ECON. 416 (1956). Tiebout is credited with the idea that people vote with their feet. High taxes (or a particular mix of policies) by one government causes some people to migrate to other jurisdictions with lower taxes (or a different policy mix). This fiscal mobility imposes disciplines on governments and allows for competition across jurisdictions. It is presumed to be strongest in metro areas with multiple jurisdictions, while decreasing in strength at the state and national levels respectively. There is a small industry based on this notion; years ago, a paper counted 200 empirical studies published that examined the Tiebout effect. See Keith Dowding et al., *Tiebout: A Survey of the Empirical Literature*, 31 URB. STUD. 767, 767–68, 787 (1994).

immigration policies in all three countries, people have sorted over time so that the voters in each of the three nations get roughly their preferences in environmental and economic policies from their governments.

As a result, the marginal costs and benefits of an additional unit of pollution control vary widely across the three nations. In Table 3 we have assigned arbitrary numbers that illustrate the situation. Since Ecotopia is quite clean, it must spend a lot to get an additional improvement—it is high on the marginal cost curve, so the marginal benefit of the last dollar spent is low because the last few units of pollution are costly to eliminate. Since Industrialia is so filthy, it is easy to get a big bang for the first dollar spent there on pollution control. The people in Economia are “just right” in economic terms, as privately funded but universal economics education means that they are specially trained to understand how to balance marginal costs and marginal benefits and set their policies accordingly.

As indicated earlier, some environmental issues cause primarily local damage. Each nation deals with these differently and does so to the satisfaction of its voters. Ecotopia has stringent laws restricting activities that cause localized pollution effects.<sup>100</sup> Economia uses the law of nuisance to enforce rights against damaging invasions and also allows parties to bargain in favor of more pollution, with some government intervention where transactions costs preclude bargaining. The government uses cost-benefit analysis when regulatory controls are needed. Industrialia overrides the law of nuisance with a preference for industrial activity.<sup>101</sup> Everyone is happy enough with the varied states we observe.

Distance pollution poses a greater problem. Suppose that in the winter the winds blow west to east and in the summer they blow east to west. Each nation's emissions affect only the neighboring nation. In the winter, Industrialia benefits from Ecotopia's environmental consciousness. This is fine with Ecotopia's voters, who value environmental protection above all else. Industrialia does not mind if Ecotopia pays for improvements in its environment, and so does not object to Ecotopia's measures. Economia is none too happy with Industrialia, however, as Industrialia is exporting pollution to Economia.

The situation is different in the summer. Economia is happier, for the wind no longer brings Industrialia's pollution. It sends some pollution to Industrialia and has no incentive to stop. Ecotopia at this time of year suffers from the pollution from their neighbor Industrialia but can do nothing about it directly. Thus at different times of the year, both Economia and Ecotopia are unhappy about the

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<sup>100</sup> Ecotopia has a lot in common with California and its strict environmental standards aimed at reducing local pollution. See, e.g., Mary Lu Abbott, *California Toughens its Law on Ships' Waste Dumping*, L.A. TIMES, Mar. 20, 2005, at L-5 (reporting on new California law that gives state nation's strictest pollution discharge standard for cruise ships sailing along its coast); Carol Pogash, *Faced With New Air Standards, California's Earthbound Farmers Are Wary*, N.Y. TIMES, July 1, 2004, at A14 (describing California's attempts to improve air quality with some of most stringent agricultural pollution standards in the nation).

<sup>101</sup> Let the Cuyahoga River be an industrial sewer. See generally Jonathan H. Adler, *Fables of the Cuyahoga: Reconstructing a History of Environmental Protection*, 14 FORDHAM ENVTL. L. REV. 89, 145 (2002) (describing how, based upon the evidence presented on the 1969 Cuyahoga river fire, “it is not clear that the 1969 fire can be labeled a product of the ‘common law era’ . . . [or] laid at the feet of local indifference . . . [because] [m]any factors conspired to contribute to the Cuyahoga's sorry condition”).



pollution imposed by their neighbor, but unable to address the problems as the sources lie outside their laws' reach.

The third problem is the problem of global pollution. All three countries' emissions affect the whole world. Again, there is no solution possible at the national level. Industrialia does not seem to mind the long term effects of the emissions, seeing the costs as simply the price of progress. Economia is not willing to spend money on reducing emissions on its own (for it would share the benefits with Industrialia and Ecotopia and, being sensible and economically literate, Economia's voters refuse to allow others to free ride on them), but it would be willing to cut emissions to some extent if the other two nations agreed to do so in an equitable manner. Ecotopia's voters support domestic self-sacrifice for the greater good, as they derive satisfaction from the effort itself even if they are not able to get emissions down "enough" on their own.<sup>102</sup>

In Table 4 we summarize the costs and benefits of dealing with pollution at different jurisdictional levels. Local pollution has been dealt with in a manner satisfactory to the residents of the assorted nations. Distance and global pollution have not been dealt with, which creates opportunities for "gains from trade" of a kind normally not considered—paying for reductions in pollution in other jurisdictions. While we can see the possibilities, the trade across political divides can be easier theorized than done.

Ignoring all issues except the environment, one solution to the distance and global problems would be to combine the three nations into a single jurisdiction, at least for environmental regulation purposes.<sup>103</sup> If they all had roughly equal voting age populations to start, the Economia voters would be the swing bloc on environmental legislation.<sup>104</sup> The result would be a coalition of Economia and Ecotopia voters to handle global pollution at the Economia preferred levels and a federal structure to allow local problems to be handled locally, as we see in Table 4. This results from the appeals of federalism's efficiencies to the Economia voters, the ability to pollute locally to Industrialia's, and the ability to have stringent local standards to Ecotopia's voters.

If we assume Economia's preferences for economic analysis make it likely to accept regional negotiations as the preferred means of settling distance pollution, Economia and Industrialia could negotiate a compact to reduce the emissions in Industrialia in the winter in exchange for a payment from Economia; the latter thus would buy the reductions to the efficient level where marginal benefit equals marginal cost.<sup>105</sup> Similarly, in the summer Ecotopia would cut a similar deal with Industrialia. Because Industrialia is not willing to pay for pollution reductions, no

<sup>102</sup> Ecotopians may be thought of as religious in their zeal. See, e.g., Robert H. Nelson, *Environmental Religion: A Theological Critique*, 55 CASE W. RES. L. REV. 51 (2004); Robert H. Nelson, *Environmental Calvinism: The Judeo-Christian Roots of Environmental Theology*, in *TAKING THE ENVIRONMENT SERIOUSLY* ch. 10 (Roger E. Meiners & Bruce Yandle eds., 1993).

<sup>103</sup> Not being fools, the Industrialia voters would likely reject a proposal to unite, as they would lose out on most of the votes. Collective solutions are thus unlikely.

<sup>104</sup> We are ignoring political issues in the design of federal institutions. Economia and Ecotopia could gang up on Industrialia and force it to pay for reducing distance pollution.

<sup>105</sup> States were involved in compacts before the dominance of federal environmental controls. See, e.g., Bruce Yandle, *Grasping for the Heavens: 3-D Property Rights and the Global Commons*, 10 DUKE ENVTL. L. & POL'Y F. 13, 34–36 (1999).

similar deal is reached with *Economia* to cut those states' summer emissions, so *Economia* will not control this class of pollution. *Ecotopia's* voters stick with their principles and cut emissions despite *Industrialia's* unwillingness to pay.

Political agglomeration into a federal structure "solved" (by either the luck of the voting distribution or the impact of the Tiebout effect combined with liberal immigration policies) the global pollution problem, if we accept as "solved" the level of reduction to the point where further reductions are not cost-justified and fewer reductions would impose more costs than they save. Many environmentalists, of course, would not accept this as a solution. Regardless of whether this level of reduction is "enough," things are likely improved in terms of the total emissions prevented, since resources have shifted from buying expensive, small improvements in *Ecotopia* to buying cheap, large improvements in *Industrialia* and, to a lesser extent, in *Economia* through the solution to the free rider problem. There are also improvements in dealing with distance pollution. Environmental quality is improved in *Ecotopia* in the summer and *Economia* in the winter, unchanged in *Industrialia* year round, and unchanged in *Economia* in the summer and *Ecotopia* in the winter. Problems remain from an environmental perspective since *Industrialia* is still polluted in the summer from *Economia*, but there are Pareto-improvements in environmental quality.<sup>106</sup> Local pollution continues to be handled on a local basis and so there is no change in that.

A switch to a unitary state with national standards and uniform taxation would make the *Economia* voters the marginal voters, and so the solution would not be a Pareto-improvement, although it might meet the looser Kaldor-Hicks criteria.<sup>107</sup> As Table 6 illustrates, *Ecotopia* voters have lost some degree of environmental protection with respect to local pollution; *Industrialia* voters have an unwanted increase in environmental protection across the board and are paying for more environmental clean up than before (since *Ecotopia* and *Economia* no longer need to bribe them); and *Economia* voters experience an increase in costs to help pay for the clean up of the distance pollution that affects *Industrialia*.

The point of this exercise has not been to show that we can make up numbers to show a particular outcome and so justify our proposals.<sup>108</sup> The point is that what drives the results in both the three-nation and unified solutions is that voters generally care about the costs and benefits within their own jurisdictions. Voters in *Economia* will not pay to clean up pollution they export to *Industrialia*, even though they will pay for equivalent increases in quality within *Economia* or to bribe

<sup>106</sup> JAMES M. HENDERSON & RICHARD E. QUANDT, *MICROECONOMIC THEORY: A MATHEMATICAL APPROACH* 255 (2d ed. 1971) ("An allocation is *Pareto-optimal* if production and distribution cannot be reorganized to increase the utility of one or more individuals without decreasing the utility of others. Conversely, an allocation is *Pareto-nonoptimal* if someone's utility can be increased without harming anyone else.").

<sup>107</sup> A standard interpretation of the "Kaldor criterion" is: "Allocation A is socially preferable to B if those who gain from A could compensate the losers (i.e., bribe them to accept A) and still be in a better position than at B." *Id.* at 279. The "Hicks criterion" is essentially the same: "Allocation A is socially preferable to B if those who would lose from A could not profitably bribe the gainers into not making the change from B to A." *Id.*

<sup>108</sup> See C. Steven Bradford, *As I Lay Writing: How to Write Law Review Articles for Fun and Profit*, 44 J. LEGAL EDUC. 13, 22-23 (1994) (providing generic law and economics analysis which justifies "whatever type of regulation you want to propose").

Industrialia to take steps that improve things for them. The amazingly environmentally conscious voters in Ecotopia are willing to pay for cleaning up for their neighbors, but this is probably even more unrealistic an assumption than our assumption that Industrialia's voters care only about their economy and not at all about their environment.<sup>109</sup> As a result, if Industrialia were slightly larger than the other two and conquered Ecotopia or Economia, those jurisdictions would soon look like the pre-war Industrialia even if the newly conquered territory had full democratic voting rights.<sup>110</sup>

Political borders determine the outcomes of environmental decisions in our example in two ways that reflect how they operate in the real world. First, the borders determine the policies that are adopted because of the preferences of the people within the borders of each nation. In short, by deciding who gets to vote, policy outcomes are affected.<sup>111</sup> Second, the political borders define the region of concern for the policy. Economia's voters are quite willing to spend to the Pareto optimal point on local pollution in an independent Economia and to the Pareto optimal point on global pollution in a unified state (either federal or unitary), but they are not willing to spend on distance pollution in either circumstance because the beneficiaries are not voters in Economia.<sup>112</sup> We will not delve into any highly theoretical definitions of the role of the "other" in politics; instead we simply note that few politicians in any nation have made increasing foreign aid to other nations a key part of their political platforms<sup>113</sup> and even "generous" nations tend to spend relatively little on other nations compared to domestic spending.<sup>114</sup>

<sup>109</sup> On the general relationship between national wealth and state of the environment, see BRUCE YANDLE ET AL., ENVIRONMENTAL KUZNETS CURVES: A REVIEW OF FINDINGS, METHODS, AND POLICY IMPLICATIONS (2004), available at [http://www.perc.org/pdf/rs02\\_1a.pdf](http://www.perc.org/pdf/rs02_1a.pdf).

<sup>110</sup> If the conquered territory were able to be a separate state within Industrialia, of course, it could preserve some of the pre-existing environmental policies, but Industrialia is not a federal nation.

<sup>111</sup> See ANTHONY DOWNS, AN ECONOMIC THEORY OF DEMOCRACY 116–17 (1957) (presenting the classic statement on the median voter theory, the idea that politicians benefit in elections by embracing the views of the median voter).

<sup>112</sup> In our example, the beneficiaries are in Industrialia and so don't care about this.

<sup>113</sup> A 2005 Harris poll of public attitudes toward various public programs ranked foreign aid last. Only 8% claimed to strongly support it, and 32% provided modest support; 60% supported it very little or not at all. See Harris Interactive, National Parks, Crime-Fighting, Medicare and Social Security Top the List of Government Services Which Have Strongest Public Support, [http://www.harrisinteractive.com/harris\\_poll/index.asp?PID=620](http://www.harrisinteractive.com/harris_poll/index.asp?PID=620) (last visited Jan. 25, 2009).

<sup>114</sup> See generally STEVEN RADELET, CTR. FOR GLOBAL DEV., A PRIMER ON FOREIGN AID (2006), available at [http://aideffectiveness.developmentgateway.org/uploads/media/aideffectiveness/file\\_WP92.pdf](http://aideffectiveness.developmentgateway.org/uploads/media/aideffectiveness/file_WP92.pdf) (recognizing Norway, Denmark, Luxembourg, the Netherlands, and Sweden as the world's most generous donors in 2004, with their foreign aid measuring between 0.79%–0.92% of their respective gross domestic product (GDP)). We do not mean to imply that more such spending would be a good thing simply because there is more spending. There is considerable evidence that most governmental foreign aid simply props up corrupt regimes and retards economic progress. For an overview, see WILLIAM EASTERLY, THE WHITE MAN'S BURDEN: WHY THE WEST'S EFFORTS TO AID THE REST HAVE DONE SO MUCH ILL AND SO LITTLE GOOD 135–36 (2006). Numbers on foreign aid do not include private giving. Such contributions in 2006 were estimated to be \$34.8 billion from persons and private entities in the United States; next was the United Kingdom at \$1.61 billion (although incomplete numbers from Germany and Canada indicate those countries could, proportionally, surpass the United Kingdom a bit). THE CENTER FOR GLOBAL PROSPERITY, INDEX OF GLOBAL PHILANTHROPY 2008, at 48 (Darrell Delamaide ed., 2008), available at <https://www.hudson.org/files/documents/2008%20Index%20-%20Low%20Res.pdf>. Giving from Norway, which ranks high in governmental giving, was

So what? The idea that borders matter is not new. What is new is the insight our analysis yields that identifies borders as the reason that environmental protection priorities are skewed to leave high-marginal-benefit, low-marginal-cost gains on the table while devoting resources to low-marginal-benefit, high-marginal-cost gains. That is unfortunate. There are inefficiencies both in the form of paying more for an environmental gain than there is value received and in the unrealized gains from exchanges that did not occur with other countries. Not only is this an inefficient outcome but it is an inequitable one as well, leaving the burden of environmental damage disproportionately on the world's poor. Worse, there are straightforward ways to achieve more environmental protection for the same resource cost by reallocating resources across problems.

Many environmental problems do not fit neatly into the tripartite classification we set out. Stopping some pollutants from entering the environment improves more than the local environment—reducing toxic effluent into a river improves the local environment, the distant downstream environment, and the global environment of the oceans. In a quite different vein, it can be argued that it is immoral (as discussed below) to implicitly or explicitly discount the human benefits of improving environmental quality in a particular area when selecting among policy options simply because the people happen to reside elsewhere. At this point, all we ask of our readers is a recognition that borders matter for how we count the benefits and costs of environmental protection but do not matter for evaluation of the environmental harm.

### III. MARGINAL BENEFITS AND MARGINAL COSTS IN PRACTICE

What do the marginal costs and benefits of environmental policies look like in the real world? Economic theory is useful because it helps us understand changes by the process of exchange that can improve the situation of all parties involved. In this Part we apply the basic concepts of marginal costs and marginal benefits to the real world.

#### *A. Marginal Costs and Benefits in Developed Countries*

Developed countries (primarily the United States, much of Europe, and Japan) have enacted a wide range of environmental legislation and regulations in the last several decades. As a result, they are quite high on the marginal cost curve in most areas, with the last dollars spent buying only fairly small increases in environmental quality. For example, the Office of Management and Budget

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\$0.25 billion, or 0.07% of U.S. giving. *Id.* Adjusted for GDP, that would be a private giving rate from Norway that is about 40% of the private giving of the U.S. rate. Private giving from France, adjusted for GDP, is about 7% of the U.S. rate. *See id.* One might also consider the consequences of relatively lax immigration laws that allow more people, usually from lower-income countries, to move to wealthier countries and have the chance to send remittances back home. For 2006, that sum was estimated to be \$71.5 billion from the United States; no other country was one-tenth that sum, so as a share of GDP, the United States had the highest level of remittances. *Id.* at 64. Private charity and remittances generally go directly to people, not to government leaders who often have discretion to use the funds as they see fit.

estimates, using EPA figures, that the now vacated<sup>115</sup> 2006 Clean Air Mercury Rule for Electric Utility Steam Generating Units would have resulted in benefits of between \$0.2 and \$2 million by 2020 at a cost of \$896 million.<sup>116</sup> The Department of Transportation–Coast Guard requirements for double hulled vessels to reduce oil spills are estimated to cost \$583 million to produce benefits of \$17 million, assuming \$2000 in costs per barrel of oil spilled.<sup>117</sup> Similarly, vessel response plans, implemented by the Coast Guard in case of oil spills, are estimated to have a cost of \$295 million to generate estimated benefits of \$9 million.<sup>118</sup> Some of EPA's land disposal restrictions were estimated to have benefits of \$26 million at a cost of between \$240 and \$272 million, assuming \$5 million per death by cancer.<sup>119</sup> EPA's reformulated gasoline rule had a midpoint cost estimate of \$760 million and benefits estimate of just \$535 million.<sup>120</sup>

Although no one appears to collect or calculate marginal costs and marginal benefits in a systematic way,<sup>121</sup> EPA's cost and benefit estimates suggest that there are likely to be large differences in the marginal benefits of various measures addressing particular pollutants. For example, in its retrospective cost-benefit analysis of the Clean Air Act's impact between 1970 and 1990, EPA concluded that 221 thousand of the 234 thousand ton reduction in lead emissions were due to the removal of lead from gasoline;<sup>122</sup> highway VOC controls accounted for more than 15 million of the 17 million ton improvement in VOCs;<sup>123</sup> 84 million of the 89 million ton reduction in CO emissions were due to highway vehicle controls;<sup>124</sup> and 5 million of the 16 million ton reduction in sulfur dioxide emissions came from

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<sup>115</sup> *New Jersey v. EPA*, 517 F.3d 574, 583–84 (D.C. Cir. 2008) (vacating the Clean Air Mercury Rule and remanding the new source performance standards to EPA for reconsideration).

<sup>116</sup> That is at a discount rate of 7%; the benefits are slightly higher if a 3% discount rate is used. OFFICE OF MANAGEMENT AND BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, 2006 REPORT TO CONGRESS ON THE COSTS AND BENEFITS OF FEDERAL REGULATIONS AND UNFUNDED MANDATES ON STATE, LOCAL, AND TRIBAL ENTITIES 16, 62 (2006), available at [http://www.whitehouse.gov/omb/inforeg/2006\\_cb/2006\\_cb\\_final\\_report.pdf](http://www.whitehouse.gov/omb/inforeg/2006_cb/2006_cb_final_report.pdf) [hereinafter 2006 REPORT]. It should be noted that there is controversy as to whether agencies generally under-estimate costs and over-estimate benefits to build the case for their actions or over-estimate costs and under-estimate benefits to reduce the impact of potential regulations. See, e.g., Frank Ackerman, *The Unbearable Lightness of Regulatory Costs*, 4 *FORDHAM URB. L.J.* 1071, 1082–84 (2006) (summarizing studies analyzing regulatory cost benefit analyses). We will take agency reported numbers as given.

<sup>117</sup> 2006 REPORT, *supra* note 116, at 68. That regulation was imposed during fiscal year (FY) 1994–1995. Double Hull Standards for Vessels Carrying Oil in Bulk, 60 *Fed. Reg.* 13,318 (Mar. 10, 1995).

<sup>118</sup> 2006 REPORT, *supra* note 116, at 70. That regulation was imposed during FY 1992–1993. Vessel Response Plans, 58 *Fed. Reg.* 7376 (Feb. 5, 1993).

<sup>119</sup> 2006 REPORT, *supra* note 116, at 69. That regulation was imposed during FY 1993–1994. *Id.* at 68. Of course, there are other regulations that are dubious on a cost-benefit basis which are not in the traditional environmental area, such as the Occupational Safety and Health Administration's (OSHA's) Occupational Exposure to Asbestos regulations, which are estimated to cost \$448 million to generate benefits of \$92 million. *Id.* at 69. That regulation was imposed during FY 1993–1994. *Id.* at 68.

<sup>120</sup> *Id.* at 69. That regulation was imposed during FY 1993–1994. *Id.* at 68.

<sup>121</sup> See EPA, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT, 1970 TO 1990 ES-10 (1997), available at <http://www.epa.gov/air/sect812/copy.html> (“[H]istorical expenditure data . . . are not structured in ways which allow attribution of control costs to specific programs or standards . . . [M]ost control programs yielded a variety of benefits . . .”).

<sup>122</sup> *Id.* at 17.

<sup>123</sup> *Id.* at 15.

<sup>124</sup> *Id.* at 15–17.

controls on electric utilities.<sup>125</sup> Thus, between 62% and 94% of the benefits of the Clean Air Act regulation of these substances appear to have come from a relatively small set of regulations. EPA concluded that “a large proportion of the monetized benefits of the historical Clean Air Act derive from reducing two pollutants: lead and particulate matter.”<sup>126</sup> The Agency, however, was quick to qualify this conclusion by noting there were substantial nonmonetized benefits of regulations and controls on other pollutants that occurred as an incident of controlling the target pollutant.<sup>127</sup> EPA’s numbers suggest that a marginal cost/marginal benefit comparison is likely to yield relevant information for situating particular measures on the relevant marginal cost and marginal benefit curves.

The experience in the European Union (EU) is much the same. Tradeoffs are recognized and indicate that, for example, air emission standards often have little to do with where the greatest benefit can be generated. One EU-commissioned study showed that controlling a ton of particulate material emission had a health benefit about twenty-five times as great as controlling a ton of VOC emissions.<sup>128</sup> Another example is the 2008 vote by the Environment Committee of the European Parliament to cut the percent of biofuels required for transportation fuel from the existing ten percent goal for 2020 to four percent.<sup>129</sup> The Committee expressed concern that using crops for fuel was helping drive up food prices.<sup>130</sup> The Committee’s position was rejected by the European Commission,<sup>131</sup> but the essential tradeoffs are clear.

The point is that rich economies appear to be spending considerable resources to produce relatively small environmental benefits with some frequency. How do these expenditures compare to those made in developing countries?

### *B. Marginal Costs and Benefits in Developing Countries*

While the United States is so rich that a couple hundred million dollars here and there is often treated like a rounding error in the federal budget,<sup>132</sup> it is a significant sum in much of the world. Unlike the developed countries, many developing countries in Latin America, Asia, and Africa, and some of the post-Soviet countries of Eastern Europe and Asia, are low on the marginal cost curve and high on the marginal benefit curve with respect to environmental protection,

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<sup>125</sup> *Id.* at 15.

<sup>126</sup> *Id.* at ES-9.

<sup>127</sup> *See id.* at ES-11 (providing examples of benefits resulting from control of a target pollutant that went beyond those associated with merely reducing the target pollutant).

<sup>128</sup> *See* MIKE HOLLAND ET AL., DAMAGES PER TONNE EMISSION OF PM<sub>2.5</sub>, NH<sub>3</sub>, SO<sub>2</sub>, NO<sub>x</sub> AND VOCs FROM EACH EU25 MEMBER STATE (EXCLUDING CYPRUS) AND SURROUNDING SEAS, at ii (2005), available at [http://www.cafe-cba.org/assets/marginal\\_damage\\_03-05.pdf](http://www.cafe-cba.org/assets/marginal_damage_03-05.pdf) (estimating damages from various air pollutants based on where the pollutants were emitted and the degree of exposure to people and ecosystems).

<sup>129</sup> James Kanter, *Europeans Reconsider Biofuel Goal*, N.Y. TIMES, July 8, 2008, at C1.

<sup>130</sup> *Id.*

<sup>131</sup> *Id.* at C5.

<sup>132</sup> *See* Chris Isidore, *Markets and the Deficit: No Fear*, CNNMONEY.COM, Dec. 12, 2005, [http://money.cnn.com/2005/12/12/news/economy/budget\\_deficit/index.htm](http://money.cnn.com/2005/12/12/news/economy/budget_deficit/index.htm) (last visited Jan. 25, 2009) (quoting a political economist as stating that a federal budget cut of \$56 billion over five years is “almost a rounding error”).

suggesting that increases in spending on environmental quality in those countries would yield comparatively large benefits. Reliable cross-country numbers are hard to come by, but Table 1 lists the total pollution abatement spending as a percentage of gross domestic product (GDP) and per capita as reported by the OECD, as well as breakdowns by environmental domain. Even taking into account the inevitable inaccuracies introduced into such cross-country comparisons by differences in definition, data collection methods, year of data collection, and other factors, the large differences in the results suggest that even among developed economies environmental spending varies widely and that the differences between developed and developing economies are substantial.

Note that if we are comparing costs and benefits in one country to those in another, it might be better to invest in environmental protection in another country, even when costs do not exceed benefits in a rich country. That is, the gap between costs and benefits may be so large (particularly in very poor countries) that the net benefits of spending an additional dollar there may outweigh net benefits of the last dollar spent in the United States or in Europe even where there is a net benefit to the last dollar spent in the latter. For example, the EPA air quality regulations for municipal waste combustors was estimated to have a cost of \$349 million and midrange benefits of about the same, so the program has been a wash.<sup>133</sup> Consideration must be given to the benefits that could be had for a similar cost on a program in a high-polluting country, particularly one that has distance or global consequences. For example, a sewage treatment plant for Dar-es-Salaam, Tanzania, was estimated to have a net present value (benefits over costs) of \$565 million at a cost estimated to be between \$147 and \$377 million.<sup>134</sup> Besides local pollution benefits, reducing sewage flow to the sea has beneficial impact on marine life and the coastline. Spending the \$349 million on sewage treatment in Tanzania instead of air pollution from municipal waste in the United States would thus increase net benefits, improve the environment, and benefit the poor.

This effect can be seen even without resort to particularly sophisticated economic analyses or cost-benefit studies. Many extremely poor countries have so few large scale air polluters that air quality problems tend to be most significant at the household level, with the most air pollution problems caused by people breathing smoke while cooking or heating with wood or dung.<sup>135</sup> Such indoor air pollution has

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<sup>133</sup> See OFFICE OF MGMT. AND BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, 2007 REPORT TO CONGRESS ON THE BENEFITS AND COSTS OF FEDERAL REGULATIONS AND UNFUNDED MANDATES ON STATE, LOCAL, AND TRIBAL ENTITIES 62 tbl.B-1 (2007), available at [http://www.whitehouse.gov/omb/infomag/2007\\_cb/2007\\_cb\\_final\\_report.pdf](http://www.whitehouse.gov/omb/infomag/2007_cb/2007_cb_final_report.pdf) (estimating the annual cost of municipal waste combustor rules at \$349 million, and the annual benefits of municipal waste combustor rules between \$71 and \$736 million).

<sup>134</sup> INST. OF MARINE SCIS., UNIV. OF DAR ES SALAAM, COST-BENEFIT ANALYSIS CASE STUDIES IN EASTERN AFRICA FOR THE GPA STRATEGIC ACTION PLAN ON SEWAGE 7-8, 52 (2002), available at [http://www.gpa.unep.org/documents/cost-benefit\\_analysis\\_east\\_africa\\_english.pdf](http://www.gpa.unep.org/documents/cost-benefit_analysis_east_africa_english.pdf). Note that the cost estimate is admittedly "crude." *Id.* at 52.

<sup>135</sup> Anthony Leiman et al., *Reducing the Healthcare Costs of Urban Air Pollution: The South African Experience*, 84 J. ENVTL. MGMT. 27, 36 (2007) (noting that industrial intervention flunks a cost-benefit test; interventions should begin at the household level).

serious health consequences<sup>136</sup> and, of course, adds to global emission levels from relatively inefficient combustion for heating purposes.<sup>137</sup> Burning solid fuels is estimated to cause 1.6 million deaths annually from acute respiratory infection; about a third of that is in sub-Saharan Africa and another third in South Asia.<sup>138</sup> In addition, solving indoor air pollution can reduce greenhouse gas emissions.<sup>139</sup>

Significant improvements are to be had by improved ventilation with chimneys and more efficient fuel sources such as LPG or kerosene. Switching from wood and dung to those fuels dropped particulate matter from 1500–2000 micrograms per cubic meter air to 76–101 micrograms.<sup>140</sup> One estimate of the cost of a “healthy year gained” from improved stoves is as low as \$13 in South Asia and \$20 in sub-Saharan Africa.<sup>141</sup> By using kerosene, the cost in those locales is \$36 and \$60 per year.<sup>142</sup> In rough terms, for as little as \$1000 a healthy life of seventy years can be purchased for a person. This contrasts to a standard value of \$5 million per cancer death prevented in benefit estimates for environmental measures adopted in the United States,<sup>143</sup> a 5000 to 1 ratio of value. Sophisticated mathematics is not necessary to demonstrate that in such circumstances shifting some resources from environmental protection in the United States to environmental projects in South Asia or sub-Saharan Africa would dramatically increase overall human welfare.

Another example that does not rely on complex calculations is prevention of desertification, a major problem in many parts of the world. A primary culprit is harvesting of wood resources for cooking.<sup>144</sup> The loss of groundcover then

<sup>136</sup> See DISEASE CONTROL PRIORITIES PROJECT, HOW TO REDUCE INDOOR AIR POLLUTION THROUGH COST-EFFECTIVE SOLUTIONS 1 (2007), available at <http://www.dcp2.org/file/123/DCPP-IndoorAirPollution.pdf>.

<sup>137</sup> See JON CREYTS, ET AL., MCKINSEY & CO., REDUCING U.S. GREENHOUSE GAS EMISSIONS: HOW MUCH AT WHAT COST?, xiv, 38 (2007), available at [http://www.mckinsey.com/clientservice/ccsi/pdf/US\\_ghg\\_final\\_report.pdf](http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf). The United States is one of the highest greenhouse gas (GHG) emitters based on per capita income (Australia and Canada are higher), but like other developed nations, GHG emissions per \$1000 of GDP produced is much lower than in less-wealthy nations. For 2005, it was estimated that GHG emissions per \$1000 of GDP in the United States were 0.6 tons CO<sub>2</sub>, while they were 3.1 in China, 6.3 in Ukraine, and 11.0 in Indonesia. *Id.* at 5–6.

<sup>138</sup> DISEASE CONTROL PRIORITIES PROJECT, *supra* note 136.

<sup>139</sup> GEO YEAR BOOK: AN OVERVIEW OF OUR CHANGING ENVIRONMENT 52 (Paul Harrison ed., 2006), available at [http://www.unep.org/geo/yearbook/yb2006/PDF/Complete\\_pdf\\_GYB\\_2006.pdf](http://www.unep.org/geo/yearbook/yb2006/PDF/Complete_pdf_GYB_2006.pdf) (“Depending on assumptions and global warming potentials of the different pollutants involved, improving biomass stoves can achieve a double benefit in the form of lower GHG emissions and reduced ill-health. Even shifting to clean-burning fossil fuels could be considered a GHG-reduction measure in places where wood is not harvested renewably, because it reduces emissions of methane and black carbon, as well as of CO<sub>2</sub>.”).

<sup>140</sup> Nigel Bruce et al., *Indoor Air Pollution*, in DISEASE CONTROL PRIORITIES IN DEVELOPING COUNTRIES 793, 803 (Dean T. Jamison et al. eds., 2006). The lower level of exposure would be about triple the EPA particulate standard, but would obviously be a massive improvement.

<sup>141</sup> *Id.* at 806.

<sup>142</sup> *Id.*

<sup>143</sup> 2006 REPORT, *supra* note 116, at 69 tbl.C-2. Five million dollars per life is the number used by OMB in its calculations. *See id.*

<sup>144</sup> See UNITED NATIONS ECON. COMM’N FOR AFRICA, AFRICA REVIEW REPORT ON DROUGHT AND DESERTIFICATION 4 (2008), available at [http://www.uneca.org/eca\\_resources/Publications/books/drought/](http://www.uneca.org/eca_resources/Publications/books/drought/). Not only are there negative environmental consequences, but there are significant social and economic effects. For example, in Ethiopia, wood gathering consumes hours a day, usually for women and girls,



contributes to global distribution of particulate matter. This problem can be addressed by building biogas plants, a program that is particularly advanced in Nepal, providing a proven track record for the technology. The plants are low-tech affairs that use collected human and animal waste to generate gas, which can be burned instead of wood and cost approximately \$280 per unit.<sup>145</sup> Burning biogas instead of wood for cooking reduces respiratory problems in the households that make the switch; the gas is a more efficient heat source; less wood cutting means less deforestation, allowing for more carbon sinks; less deforestation means less soil loss due to erosion from rain runoff; less hunting for wood means women and girls have more time for other activities, including education; the residual from the biogas plant is used as fertilizer, raising agricultural productivity and reducing the need to purchase chemical fertilizers.<sup>146</sup> We could not find a cost-benefit analysis for biogas in Nepal, perhaps because the program so obviously is worthwhile that no one sees the need to conduct a formal analysis, but given the low cost per unit and the huge wood and time saving alone there is no question about either the economic viability or the environmental benefits.

The costs are probably similar for such projects in Africa. Single-family biogas digesters in Africa cost about \$50 to purchase or construct.<sup>147</sup> A large-scale project in Nigeria is estimated to cost \$300,000 to provide gas for 5400 families, which then need a liquefied natural gas (LNG) stove for cooking.<sup>148</sup> (Biogas is estimated to cost about one-quarter the price of LNG.)<sup>149</sup> Because the majority of sub-Saharan people burn wood or dung for cooking, biogas projects offer an alternative to capital-intensive methods such as electrification or solar panels.<sup>150</sup> The quality of the lives of biogas users is improved and there are widespread environmental benefits at the local, regional, and global levels.

Putting aside the local benefits of improved health and economic opportunity, the reduction in desertification and the more efficient use of fuel has global consequences at a relatively low price from the perspective of wealthy nations now

thereby reducing alternative employment or educational possibilities. See Scott Baldauf, *Saving Ethiopia's Forest, and its Cutters*, CHRISTIAN SCI. MONITOR, Jan. 24, 2007, <http://www.csmonitor.com/2007/0124/p06s01-woaf.html> (last visited Jan. 25, 2009). Girls report frequent beatings and rape as they go into forests looking for wood. *Id.* Native girls carrying a bundle of sticks on their head may make for good tourist photos, but it is a sign of low productivity with significant environmental consequences since millions of people are doing the same thing. *Id.*

<sup>145</sup> Trishna Gurung, *Biogas—Saving Nature Naturally in Nepal*, WWF NEWS CENTRE, Mar. 6, 2007, [http://www.panda.org/news\\_facts/newsroom/index.cfm?uNewsID=95320](http://www.panda.org/news_facts/newsroom/index.cfm?uNewsID=95320) (last visited Jan. 25, 2009) (describing the health and environmental benefits of biogas use in Nepal).

<sup>146</sup> See generally Biogas Sector Partnership Nepal, <http://www.bspnepal.org.np/> (last visited Jan. 25, 2009) (describing success stories after biogas implementation, the associated tradeoffs, and a description of the program).

<sup>147</sup> Valerie J. Brown, *Biogas: A Bright Idea for Africa*, 114 ENVTL. HEALTH PERSP. A 300, A 303 (2006). The \$50 cost cited may be true, but a project in Tanzania reports a cost of about \$100. ESTHER EBRAHIMIAN & STEPHEN GITONGA, COMMUNITY ACTION TO ADDRESS CLIMATE CHANGE: CASE STUDIES LINKING SUSTAINABLE ENERGY USE WITH IMPROVED LIVELIHOODS 21 (2003), available at <http://www.undp.org/energy/docs2/SGPCaseStud.pdf>. In Tanzania, each biogas unit is estimated to reduce deforestation by 37 hectares per year (about 70 acres) and the animal dung, rather than emit greenhouse gases during degrading, is made useful. *Id.*

<sup>148</sup> Brown, *supra* note 147, at A 301–02.

<sup>149</sup> *Id.* at A 301.

<sup>150</sup> *Id.* at A 303.

on the costly margins of pollution reduction. We are not the first to recognize this, of course. As a World Bank study of the impacts of biofuels noted, “the environmental literature is dominated by a discussion of net carbon offset and net energy gain, while indicators relating to impact on human health, soil quality, biodiversity, water depletion, etc., have received much less attention.”<sup>151</sup> Self-interest would predict this; the concern of rich nations about environmental action in Africa is largely: “What impact does it have on us?” On the other hand, Africans are strongly interested in their health and economic status. There are gains from trade to be made here of a nontraditional form.

### C. Marginal Analysis

When wide disparities exist in the marginal costs and marginal benefits of environmental policies in different areas of the world, there are resources “left on the table” that could buy either more environmental quality at the same price, or the same environmental quality at a lower cost, saving resources for other priorities. In economic terms, there is the possibility of a Kaldor-Hicks improvement in welfare. In English, that means that it would be possible to improve aggregate social welfare by making changes in policy and that these gains are large enough to allow compensation of those made worse off by the changes from the gains.<sup>152</sup> The “trick” in a Kaldor-Hicks optimality analysis is a bit of slight of hand—unlike in the case of Pareto optimality, the losers need not actually be compensated for their losses so long as it is theoretically possible that they could be compensated from the gains.<sup>153</sup> It is our contention that opportunities exist to shift resources from developed country investments in environmental protection to developing country investments in environmental protection, where the shift would generate sufficient gains in the developing country that could compensate the developed country for the reduction in environmental quality that would occur there if the investments were shifted.

Applying marginal analysis to environmental quality issues is not as simple in practice as it is in theory, however, because of the distributional issue. If we reduce Americans’ expenditures on environmental quality in the United States, and shift those resources to buying increased environmental quality in sub-Saharan Africa, and the problems we are addressing are not solely global pollution, people in Africa are going to be receiving a transfer payment (in the form of improved standards of living that happen to improve environmental quality) from Americans. If this is

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<sup>151</sup> DEEPAK RAJAGOPAL & DAVID ZILBERMAN, THE WORLD BANK, REVIEW OF ENVIRONMENTAL, ECONOMIC AND POLICY ASPECTS OF BIOFUELS, at abstract (2007), available at <http://ssrn.com/abstract=1012473> (discussing details of lower greenhouse gas emissions as a consequence of biofuel projects).

<sup>152</sup> See HENDERSON & QUANDT, *supra* note 106, at 279.

<sup>153</sup> This slight of hand makes Kaldor-Hicks a slippery concept to apply and it is frequently invoked to justify policies where the benefit and cost claims have an element of fantasy to them. See Herbert Hovenkamp, *Positivism in Law & Economics*, 78 CAL. L. REV. 815, 847 (1990) (“Kaldor-Hicks assumes that the marginal utility of income is constant, and that a dollar creates the same amount of welfare in one person as in another. These assumptions are without any empirical foundation.”); Reza Dibadj, *Weasel Numbers*, 27 CARDOZO L. REV. 1325, 1327 (2006) (criticizing Kaldor-Hicks standard as “worsen[ing] the incoherence” of Pareto-based analysis amid general attack on law and economics analysis). We have a slightly different purpose in mind for our use of the Kaldor-Hicks criteria, however, that we think addresses the potential for slight of hand. We will address this below.

done with public funds, the Congress and President who approved the shift will have to respond to questions about why American tax dollars are being spent in Africa rather than in the United States. As the environmental debate is currently structured, with each measure independently classified as “green” or “not green,” there is little hope that such trades could occur.<sup>154</sup> However if the debate specifically addressed marginal costs and marginal benefits, significant gains from trade might be possible.

The answer to why marginal analysis across borders is not the norm is precisely this point: such expenditures would not be politically sustainable in the country making the transfer payments, and might even be unpopular in the recipient country, depending on how payments were made.<sup>155</sup> We think this is a good explanation of why the policies are as observed, but it is not a good reason for academic analyses of environmental policies to apply a “Fortress America” approach to environmental policy any more than a closed-nation view of trade is sensible. The gains available in terms of the total amount of environmental quality that can be purchased for any given amount of resources is large enough to make the case that taking global marginal costs and benefits into account ought to be considered a necessary component of environmental policy analysis.

The distributional issue ought not to block this for two reasons. First, the resource shifts will almost entirely be from wealthy countries to poorer countries. The high-marginal-cost, low-marginal-benefit regulations and statutes exist mostly in wealthy nations in North America, Europe, and Asia. The low-marginal-cost, high-marginal-benefit opportunities are in much of the rest of the world. Erring on the side of resource transfers to poorer countries, particularly where those resource transfers actually do some good (as we will argue below) seems like an appropriate rule of thumb. Second, because the wealthy nations tend to have strong traditions of markets, the rule of law, and protection of property rights,<sup>156</sup> they are also most likely to be able to find lower marginal cost methods of maintaining their current levels of environmental quality by making greater use of markets. Moving to an accounting for marginal costs and marginal benefits would thus put pressure on these countries to be more careful purchasers of environmental goods.

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<sup>154</sup> See, e.g., Greenpeace, Kleercut: Wiping Away Ancient Forests, <http://www.greenpeace.org/usa/campaigns/forests/kleercut> (last visited Jan. 25, 2009). Note the charismatic mega-fauna and butterflies. While that may seem silly, domestic issues are more attractive to most voters than biogas generators hooked up to latrines in Nepal.

<sup>155</sup> A couple hundred million dollars or Euros could buy or lease a lot of forest land in poor nations to protect it from harvesting as well as to protect species, but that often smacks of imperialism and can destroy economic opportunities for people on the ground. Doug Tompkins made a lot of money with the clothing company Esprit; when he sold it, he used his fortune to amass about 2.2 million acres in Chile and Argentina. See Knight, *supra* note 36. While his motives and actions appear purely environmental, he faced populist hostility and governmental opposition. See *id.* A rich foreigner moving in and taking over a lot of land always spurs suspicion.

<sup>156</sup> These are among the important reasons why these countries are rich. See, e.g., HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL: WHY CAPITALISM TRIUMPHS IN THE WEST AND FAILS EVERYWHERE ELSE* 211 (2000); PAUL COLLIER, *THE BOTTOM BILLION: WHY THE POOREST COUNTRIES ARE FAILING AND WHAT CAN BE DONE ABOUT IT* 85 (2007).

## IV. A MARGINAL-ANALYSIS-BASED ENVIRONMENTAL POLICY

What would an environmental policy based on considering marginal costs and marginal benefits look like? There are three things that would have to be considered: what yardstick to use to measure environmental quality purchases, how to decide which purchases count in any particular comparison, and how to avoid having the policy turn into a means by which poorer countries are turned into “eco-Disneylands” by rich countries under the guise of improving environmental quality but with the agenda of preventing the poorer countries from developing as competitors of the rich countries.

A. *The Right Yardstick*

We began by categorizing environmental problems into local, distance, and global pollution. Global pollutions are the “easiest” for which to devise a yardstick: the issue is the total emissions of some substance. A reduction in Germany is equivalent to a reduction in Chad in terms of the impact on the global environment. In these cases we want either to minimize the emissions generally (arguing that the same marginal cost of reduction everywhere is the goal), or we want to reach some predetermined target level of emissions that has been selected for either scientific or political reasons (as with the Kyoto Protocol).<sup>157</sup>

Distance pollution problems are more difficult. Acid rain was a problem between eastern Canada and New England (the recipients) and the American Midwestern states (the sources).<sup>158</sup> Similarly, Scandinavian countries were recipients of acid rain from sources across eastern and southern Europe.<sup>159</sup> How can we compare the marginal costs of reducing emissions in the American Midwest and in Poland, when the beneficiaries of the reductions are quite different? It would be little consolation to the Swedes to be told “Sorry, it turns out to be cheaper to protect Canada and New England, so Polish utilities are putting their money into cleaning up power plants in Ohio.”

The problem is readily solved by being clearer about what the analysis would bring to the discussion. Let us suppose that Polish coal-fired power plants are sufficiently different from American coal-fired power plants such that there are dramatically different marginal cost curves to acid-rain-precursor emissions reductions in the two countries and that the American plants can be made cleaner at a lower marginal cost everywhere along the cost curve. A policy analysis sensitive

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<sup>157</sup> The Kyoto Protocol is an agreement tied to the United Nations Framework Convention on Climate Change which is “binding” on 37 nations as to greenhouse gas emission levels. See Kyoto Protocol, *supra* note 11; Kyoto Protocol - United Nations Framework Convention on Climate Change (UNFCCC), [http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php) (last visited Jan. 25, 2009) [hereinafter Kyoto Protocol Homepage]. Prior to the adoption of the Kyoto Protocol, the UNFCCC only encouraged industrialized nations to reduce emissions. *Id.*

<sup>158</sup> See Meyer & Yandle, *supra* note 55, at 527. To say the least, Congress was not pleased with the results of the National Acid Precipitation Assessment Program (NAPAP) as it undercut assertions by political leaders. See David W. Riggs, *Acid Rain and the Clean Air Act: Lessons in Damage Control*, in *TAKING THE ENVIRONMENT SERIOUSLY* 141, 142, 154 (Roger E. Meiners & Bruce Yandle eds., 1993). When science does not square with politics, scientists can be unfunded.

<sup>159</sup> See Air Pollution & Climate Secretariat, *supra* note 3.

to marginal costs and marginal benefits would not necessarily mean that there would be no reductions in emissions from Polish plants. Within the region affected by a distance externality, it would be important to compare marginal costs. Across regions, such a difference should prompt two actions. First, the question of why the difference existed would be an important one for analysis because it could point to directions for investment in improved technology. Perhaps Polish coal produced more acid rain precursors per BTU generated or American plants had superior designs. Discovering such differences could then spur investment by governments or private entities into ways to shift the Polish marginal cost curve downward.

Second, to the extent reducing acid rain as a general matter was seen as something worthy of funding, irrespective of whether it was reduced in Sweden or eastern Canada and New England, the lower marginal cost curve in the United States would direct funders to the most effective place to spend their money. As they put money into further reductions in the United States, however, they would move along the marginal cost curve until it no longer made sense to continue such investment. At some point, therefore, the United States's comparative advantage in reducing coal-fired power plant emissions would be gone and investment might shift to reducing emissions in Poland to the benefit of Sweden.<sup>160</sup>

Similarly, with respect to local pollution, a key benefit of applying a marginal analysis would be to facilitate comparisons on expenditures in addressing similar problems and helping to direct resources to the most effective spot. By providing a benchmark, a marginal analysis would give local groups and governments an incentive to compete to provide lower-marginal-cost, higher-marginal-benefit opportunities for donors, including larger governmental units. Such comparisons would also reveal when a jurisdiction had adopted a high cost strategy over a low cost one, driving improvements in the cost of protecting the environment.

It is important to recognize that there might be significant differences in the demand curve for environmental improvements and that this could affect the analysis. As in our rather extreme example of Ecotopia and Industrialia, societies can differ in how much environmental quality their members want. As a general matter, voters in richer countries want greener lifestyles, in large measure because they can afford them, but also because being wealthier changes preferences. That is, greater wealth generally shifts the demand curve in a nation for environmental goods up and to the right (hence "richer is greener"). A large empirical literature has confirmed what is generally referred to as Environmental Kuznets Curves (EKC); as incomes begin to rise from bare subsistence levels, the environment generally worsens, but at some point of higher per capita wealth, the demand for environmental quality increases and many measures of the environment improve.<sup>161</sup>

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<sup>160</sup> It might seem far-fetched to consider charitable contributions to reduction of acid rain-related emissions in either the United States or Britain, but many of the benefits of reducing acid rain were ones that appealed to many people who did not live in the affected areas, since they involved preserving attractive forests.

<sup>161</sup> Jean Argas & Duane Chapman, *A Dynamic Approach to the Environmental Kuznets Curve Hypothesis*, 28 *ECOLOGICAL ECON.* 267 (1999) ("The Environmental Kuznets Curve (EKC) hypothesis states that pollution levels increase as a country develops, but begin to decrease as rising incomes pass beyond a turning point."). The origin of the literature in this area (which played on earlier work by Nobel-laureate Simon Kuznets indicating that as incomes in a nation rise, income inequality increases, but eventually begins to become more equal) is attributed to Gene M. Grossman & Alan B. Krueger,

Because of such changes in preferences, marginal benefits might be higher, and so justify higher marginal cost expenditures on pollution reduction or conservation, in a rich country than in a poor country. The Aldo Leopold Foundation's Legacy Center in Wisconsin received Platinum LEED (Leadership in Energy and Environmental Design) Certification for its many advanced environmental efficiencies.<sup>162</sup> Such experimentation, let alone the existence of such a foundation, is most likely to occur in wealthy nations. People who live on the brink of starvation cannot contemplate such wonders as they burn sticks or coal in huts for heat or cooking.<sup>163</sup> Much of the environmental political debate takes place without explicitly acknowledging this somewhat uncomfortable fact. Getting it explicitly stated and discussed would improve the transparency of the debate.

A marginal analysis would also provide benefits when considering where to spend resources. Governments (and private donors) must consider what they are buying when they allocate resources amongst solving local, distance, and global pollution. Knowing the marginal costs and marginal benefits of each does not answer the question of whether to allocate resources to a local, distance, or global problem but it makes the tradeoffs more explicit and so improves the transparency of the debate. This brings us to the question of just who counts in making the decisions about environmental spending priorities.

### *B. Who Counts and Who Does Not*

"Environmental justice" emerged as an important theme in the environmental law and policy literature in the United States in the 1980s.<sup>164</sup> A consistent theme of the environmental justice critique of environmental law in the United States was that it allowed or encouraged the shifting of environmentally destructive activities to areas where poorer people lived.<sup>165</sup> Part of the critique was based on a misunderstanding of the economics of land use.<sup>166</sup> Unattractive land uses locate on low value land because it would be wasteful to build them on land that had a higher alternative use.<sup>167</sup> Poor people also tend to cluster on low value land because they

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*Economic Growth and the Environment*, 110 Q. J. ECON. 353 (1995). For a survey of the literature, which shows the relationship between income and environmental quality to hold across a wide range of environmental measures, see YANDLE ET AL., *supra* note 109.

<sup>162</sup> For a description, see Welcome to the Aldo Leopold Legacy Center, <http://www.aldoleopold.org/legacycenter/> (last visited Jan. 25, 2009).

<sup>163</sup> This is not to be remotely critical of the investment of resources at the Aldo Leopold Legacy Center; no doubt much can be learned from the experiences there with new technologies, but it is the kind of expenditure, occurring in an already relatively clean environment, that might be contrasted to the improvements that could be had in locations not blessed with such wealth.

<sup>164</sup> See Gauna, *supra* note 16, at 9 (explaining that environmental justice has only been conspicuous on the national agenda since 1982).

<sup>165</sup> Rachel D. Godsil & James S. Freeman, *Jobs, Trees, and Autonomy: The Convergence of the Environmental Justice Movement and Community Economic Development*, 5 MD. J. CONTEMP. LEGAL ISSUES 25, 34 (1994) (discussing "environmental justice's" struggle to address the disparate impact of pollution on poor communities).

<sup>166</sup> H. Spencer Banzhaf & Randall P. Walsh, *Do People Vote with Their Feet? An Empirical Test of Tiebout's Mechanism*, 98 AM. ECON. REV. 843, 862 (2008).

<sup>167</sup> See Jeremy L. Minnis, *The Distribution and Enforcement of Air Polluting Facilities in New Jersey*, 57 PROF. GEOGRAPHER 411, 412 (2005). For an overview of the issues regarding the impact of "dirty"

cannot afford higher valued land.<sup>168</sup> As a result, the poor often end up as neighbors to unpleasant-to-be-near locations such as Superfund sites.<sup>169</sup> In short, it is unlikely that a new oil refinery will be built in Manhattan,<sup>170</sup> where the price of real estate is high and the attendant reduction in property values would be great. The much smaller drop (or even improvement) in property values that a refinery as a neighbor would bring to the nearly empty stretch of Yuma County, Arizona, where Arizona Clean Fuels is attempting to build, makes it more likely that a refinery will be built there.<sup>171</sup> That is unlikely to change.

The environmental justice literature provides an important insight for the marginal analysis offered here: there should be a presumption that people count the same in summing up the benefits of government expenditures regardless of who the people are.<sup>172</sup> Identifying the marginal costs and benefits of various environmental policies is one way to create pressure to do so.<sup>173</sup> Most of the environmental justice literature has focused on two issues. First, there have been critiques of the location of polluting facilities in poorer areas within rich countries.<sup>174</sup> Second, there have also been extensive critiques of the export of polluting activities (whether waste disposal or the production of goods) to poor countries.<sup>175</sup> There has not, however,

industrial areas and the poor, see NAT'L ENVTL. JUSTICE ADVISORY COMM., UNINTENDED IMPACTS OF REDEVELOPMENT AND REVITALIZATION EFFORTS IN FIVE ENVIRONMENTAL JUSTICE COMMUNITIES, FINAL REPORT (2006), available at <http://www.epa.gov/compliance/resources/publications/ej/nejac/redev-revital-recomm-9-27-06.pdf>.

<sup>168</sup> See Vicki Been, *Locally Undesirable Land Uses in Minority Neighborhoods: Disproportionate Siting or Market Dynamics?* 103 YALE L.J. 1383, 1385 (1994).

<sup>169</sup> See Katherine A. Kiel & Michael Williams, *The Impact of Superfund Sites on Local Property Values: Are All Sites the Same?*, 61 J. URB. ECON. 170, 170–71 (2007) (citing EPA studies confirming that Superfund sites lower local house prices).

<sup>170</sup> Instead it will be built, apparently, in low-density South Dakota. In June 2008, voters in Union County, South Dakota, approved a zoning change to allow construction of the first oil refinery in the United States since 1978. See Dirk Lammers, *S.D. County Approves Rezoning for New Oil Refinery*, BOSTON.COM, June 4, 2008, [http://www.boston.com/news/nation/articles/2008/06/04/sd\\_county\\_approves\\_rezoning\\_for\\_new\\_oil\\_refinery/](http://www.boston.com/news/nation/articles/2008/06/04/sd_county_approves_rezoning_for_new_oil_refinery/) (last visited Jan. 25, 2009).

<sup>171</sup> See Andrew P. Morriss & Nathaniel Stewart, *Market Fragmenting Regulation: Why Gasoline Costs So Much (and Why It's Going to Cost More)*, 72 BROOK. L. REV. 939, 1037–39 (2007) (describing efforts to build refinery in Yuma, Arizona).

<sup>172</sup> It may be that there are specific instances where deviations from this principle are justified, but it is a strong presumption.

<sup>173</sup> For a particularly unfortunate example of a failure to adequately explain one such instance, see Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations, 68 Fed. Reg. 5492, 5521 (Feb. 3, 2003) (suggesting to the EPA that the value of saving a statistical life (VSL) be replaced or augmented by the monetary value of a statistical life year (VSLY)); EPA, FINAL REGULATORY SUPPORT DOCUMENT: CONTROL OF EMISSIONS FROM UNREGULATED NONROAD ENGINES 10-28 to 10-29 (2002), available at <http://www.epa.gov/otaq/regs/nonroad/2002/r02022.pdf> (calculating the value of the life of an elderly individual at 38% less than someone under 70); see also Seth Borenstein, *An American Life Worth Less Today*, ABC NEWS, July 11, 2008, <http://abcnews.go.com/Technology/wireStory?id=5353888> (last visited Jan. 25, 2009) (terming the EPA report's calculations "politically explosive").

<sup>174</sup> See Sheila Foster, *Race(ial) Matters: The Quest for Environmental Justice*, 20 ECOLOGY L.Q. 721, 721–22 (1993) (noting a "consensus that low-income and minority communities bear a disproportionate share of environmental exposure and health risks").

<sup>175</sup> See Peter D.P. Vint, *The International Export of Hazardous Waste: European Economic Community, United States, and International Law*, 129 MIL. L. REV. 107, 110 (1990) (discussing both secret and negotiated dumping of hazardous waste by developed nations in the third world); Philip Weinberg, *Environmental Protection in the Next Decades: Moving from Clean Up to Prevention*, 27

been much criticism of the practice of buying relatively costly marginal improvements in rich countries while neglecting relatively cheap marginal improvements in poor countries.<sup>176</sup> This is an important omission in the debate and one that marginal analysis helps to identify.

With respect to global pollution issues, there can be little debate that an effective environmental policy ought to be based on buying the greatest possible reduction in pollution for any given level of expenditure. If it is cheaper to purchase reductions in China than in Germany, in Mexico than the United States, and in Tanzania than in Canada, then reductions ought to be purchased in China, Mexico, and Tanzania rather than in Germany, the United States, and Canada.

Regional and local pollution issues present a slightly more difficult analysis because changing how resources are allocated will produce distributional effects. If the marginal cost of reducing sulfur dioxide emissions is lower in China, Mexico, and Tanzania, buying the reductions there instead of in Germany, the United States, and Canada will mean that the benefits of the next dollar of spending accrue to different people than if the money was spent in the three wealthy countries. Moreover, if the money being spent is coming from the three wealthy countries' taxpayers, there may be opposition to a program of spending abroad that would not exist with respect to a program of domestic spending. In short, the budget constraint may be looser with respect to domestic environmental spending with modest benefits than it is with respect to environmental spending that primarily benefits foreigners, even if the net benefit is much larger in the latter case.

Nonetheless we think it is time that developed world environmental policymakers directly confront the consequences of pursuing a high-marginal-cost, low-marginal-benefit environmental policy in the developed world and ignoring the chance for low-marginal-cost, high-marginal-benefit policies in the less developed world. Why is it morally acceptable to spend \$210 million reducing the "regulatory ceiling" for arsenic levels in U.S. drinking water supplies from fifty parts per billion (ppb) to ten ppb at a cost per life saved (using EPA's own numbers) of \$6.1 million<sup>177</sup> when that same money could fund over 160,000 wells in India?<sup>178</sup> We cannot conceive of a rational, nonracist motive for treating the lives of people in developing countries as less worthy than the lives of people in the developed world. Indeed, given the huge differences in marginal costs and marginal benefits for environmental policies in the developed and developing worlds, shifting resources

LOY. L.A. L. REV. 1145, 1149 (1994) (referring to the exportation of waste and polluting industries to developing nations as "environmental colonization").

<sup>176</sup> *But see, e.g.,* Don Surber, *Saving Our Coasts by Ravaging Nigeria*, CHARLESTON DAILY MAIL, June 26, 2008, <http://www.dailymail.com/Opinion/DonSurber/200806260164> (last visited Jan. 25, 2009).

<sup>177</sup> OFFICE OF GROUND WATER & DRINKING WATER, EPA, EPA 815-R-00-026, ARSENIC IN DRINKING WATER RULE ECONOMIC ANALYSIS 1-4, 5-23 (2001), available at [http://yosemite1.epa.gov/ee/epa/riafile.nsf/vw/AN/W200012A.pdf/\\$File/W200012A.pdf](http://yosemite1.epa.gov/ee/epa/riafile.nsf/vw/AN/W200012A.pdf/$File/W200012A.pdf) [hereinafter ARSENIC RULE ECONOMIC ANALYSIS]; JASON K. BURNETT & ROBERT W. HAHN, AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES, EPA'S ARSENIC RULE: THE BENEFITS OF THE STANDARD DO NOT JUSTIFY THE COSTS 14 tbl. 1 (2001), available at <http://aei-brookings.org/admin/authorpdfs/redirect-safely.php?fname=.../pdffiles/phppu.pdf>.

<sup>178</sup> Well cost of \$1300 assumed based on Ashok Gadgil, *Drinking Water in Developing Countries*, 23 ANN. REV. ENERGY ENV'T 253, 270 (1998), available at <http://ewb-uiuc.org/system/files/Drinking%20Water%20in%20Developing%20Countries.pdf>.



to the developing world would be necessary even if policy makers in industrialized countries substantially discounted the lives of those in the developing world.

### C. Avoiding Turning the Developing World into Eco-Disneyland

One danger of shifting environmental quality resources into higher marginal benefit, lower marginal cost purchases across nations is that rich nations may use these purchases to hinder the rise of economic competitors among less well-off nations. Such complaints have been regularly heard about a variety of environmental policies, from dolphin-safe tuna and turtle-safe shrimp fishing rules<sup>179</sup> to greenhouse gas emissions reductions.<sup>180</sup> Given the creativity and ingenuity of individuals and governments in devising measures to benefit special interests, we take this problem seriously.

Consider the on-going debate about the all-but-dead Kyoto treaty. Some wealthy nations, such as the United States, have made some progress in reducing greenhouse gases.<sup>181</sup> But progress is difficult and extremely costly, as these nations generally use cutting-edge technology. Even if the Kyoto goals could be met by countries that ratified the treaty, these goals will not be enough to reduce global

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<sup>179</sup> See World Trade Organization, *The Environment: A Specific Concern*, [http://www.wto.org/English/thewto\\_e/whatis\\_e/tif\\_e/bey2\\_e.htm](http://www.wto.org/English/thewto_e/whatis_e/tif_e/bey2_e.htm) (last visited Jan. 25, 2009) (explaining how U.S. regulations could not be imposed upon Mexico for dolphin protections during tuna fishing because it could “lead to a flood of protectionist abuses” and how a U.S. ban on imported shrimp and shrimp products from India, Malaysia, Pakistan, and Thailand under the Endangered Species Act of 1973 constituted arbitrary and unjustifiable discrimination under Article XX of the General Agreement on Tariffs and Trade of 1994 (GATT) where the United States gave financial assistance and longer transition periods for Caribbean nations to utilize technology demanded of them by the United States for the same protection of sea turtles).

<sup>180</sup> See James Reynolds, *Capping Emission?*, BBC NEWS, July 9, 2008, [http://www.bbc.co.uk/blogs/thereporters/jamesreynolds/2008/07/capping\\_emissions.html](http://www.bbc.co.uk/blogs/thereporters/jamesreynolds/2008/07/capping_emissions.html) (last visited Jan. 25, 2009) (referring to China’s National Climate Change Program which argues that since developed countries had an industrial revolution, the developing world, including China, should get one too).

<sup>181</sup> U.S. greenhouse gas emissions declined by 1.5% in 2006. ENERGY INFO. ADMIN., U.S. DEP’T OF ENERGY, *EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2006 1* (2007), available at <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrrpt/057306.pdf>. This was due in large part to a reduction in carbon dioxide reductions due to favorable weather conditions, higher energy costs, an increased use of natural gas, and a greater reliance on non-fossil energy sources. *Id.* Given that the economy grew by about three percent that year, *id.* at 2, the reduction in greenhouse gas emission per dollar of GDP is even more pronounced. The European Union, the major Kyoto supporter, has talked a good game, but delivered little, always seeing improvements in the future. See, e.g., Press Release, European Environment Agency, *Reducing the Environmental Impact of Our Activities* (Jan. 25, 2009), <http://www.eea.europa.eu/highlights/reducing-the-environmental-impact-of-our-activities> (last visited Jan. 25, 2009) (attempting to solicit consideration about how to increase energy efficiency in the workplace while announcing the agency passed an external audit certifying compliance with the Eco-Management Audit Scheme); see also David Charter, *EU’s Carbon Trading Fails to Cut Emissions*, THE TIMES, Apr. 3, 2007, <http://www.timesonline.co.uk/tol/news/world/europe/article1605038.ece> (last visited Jan. 25, 2009) (stating that “[t]he amount of greenhouse gas pumped into European skies rose by up to 30 million tonnes last year despite the EU’s pledge to lead the world in tackling climate change”); John Vidal, *Europe Fails to Cut Greenhouse Gas Emissions: Figures Show Kyoto Commitment Unlikely to Be Met*, GUARDIAN.CO.UK, June 18, 2005, <http://www.guardian.co.uk/uk/2005/jun/18/environment.society> (last visited Jan. 25, 2009) (citing an increase of 1.1% in greenhouse gas emissions from 2003–2004 for the 15 countries who were EU members).

greenhouse gas emissions given the rise in emissions from China, India, and other developing nations. The greenhouse gas issue rests with such nations. The prospects are not rosy. A careful analysis of emission data from China shows emissions rising fast and expected to rise significantly more.<sup>182</sup> While the growing demand for electricity in China is well understood, the jump in emissions is worse than expected because “many of the poorer interior provinces replicated inefficient 1950s Soviet technology.”<sup>183</sup>

Lecturing the Chinese about the evils of air pollution will not provide new information to them. They breathe polluted air and can see the costs. Like governments in many poor countries, the Chinese government (and likely many of the Chinese people) will trade pollution today for higher income tomorrow, planning to deal with the pollution problems later. This creates room for gains from trade. Reducing emissions in the United States or the European Union is costly; the bang for the buck is likely to be much larger by paying for Chinese electric generators to scrap old plants and install the level of technology enjoyed in wealthy nations. The Chinese objection to the cost of such measures can be resolved by giving the Chinese electricity generators the equipment in exchange for the benefit of lower levels of emissions.<sup>184</sup> Similarly, wealthy nations can volunteer to pay for the extinguishing of long-burning coal mine fires. Putting out such fires is difficult, but some claim that they may contribute as much as one percent of all greenhouse gas emissions.<sup>185</sup> If such estimates were shown to be valid, it could be less costly to extinguish useless fires rather than expend similar resources on other emission control devices. There are countless other possibilities.

There is an important consequence to shifting some of the purchase of environmental goods and services by developed countries to developing countries: it will increase the reliance on voluntary transactions. Because American regulators cannot directly regulate pollution sources or land developers in Mexico, Chad, Indonesia, or Brazil, any purchases of environmental quality there by Americans must rely on positive incentives to people in those countries to change their behavior. As noted earlier, the experience with such programs suggests that relatively large benefits can be bought for relatively small sums in many instances.

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<sup>182</sup> One study estimates that China’s carbon dioxide emissions will grow at an average annual rate of 11%, thereby increasing emissions by 600 million metric tons from 2000 to 2010. That contrasts to the Kyoto goal (which is unlikely to be met) of reducing emissions by 116 million metric tons of emissions. See Maximilian Auffhammer & Richard Carson, *Forecasting the Path of China’s CO2 Emissions Using Province-Level Information*, 55 J. ENVTL. ECON. & MGMT. 229, 244–45 (2008).

<sup>183</sup> Press Release, UC Berkeley, New Analysis Finds Alarming Increase in Expected Growth of China CO2 Emissions (Mar. 10, 2008), available at [http://www.berkeley.edu/news/media/releases/2008/03/10\\_chinaco2.shtml](http://www.berkeley.edu/news/media/releases/2008/03/10_chinaco2.shtml).

<sup>184</sup> Of course such gifts would be tied to guarantees about the junking of the old facilities and other steps to ensure the old technology is not shipped to Vietnam or some other locale further down the feeding chain.

<sup>185</sup> Surprisingly little information can be found on this, but then who has an incentive to gather such information? We cannot vouch for the accuracy of this, but it does stand to reason that if there are numerous uncontrolled mine fires, CO<sub>2</sub> and other emissions are generated for no beneficial purpose such as producing electricity. See Kevin Krajick, *Fire in the Hole*, SMITHSONIAN, May 2005, at 52. There are some such fires in the United States, but they are a larger problem in China, where little is done about most of them. *Id.* at 55.

There are a host of benefits to such a change. First, it will spur creative contracting that will yield benefits for domestic purchases of environmental quality as well. Second, it will help develop a market for environmental goods and services that nongovernmental organizations and individuals can participate in directly, increasing the amount of environmental quality produced. Third, it will provide incentives to develop effective means of monitoring the production of environmental quality. Finally, it will directly benefit relatively poor people.

#### *D. A Policy Framework*

We are not so foolish as to construct an elaborate scheme for amending virtually every major environmental statute in the world, let alone the United States, to implement a grand scheme of marginal analysis. We propose something more modest: three steps to capture the benefits of thinking on the margin.<sup>186</sup>

##### *Step 1: Make marginal cost and marginal benefit estimates transparent and routine.*

Governments regularly calculate the benefits and costs of regulatory measures.<sup>187</sup> They are less likely to do so explicitly when spending their own money on environmental goods and services (e.g., buying park land), because those expenditures are often done through appropriations riders and other nontransparent methods.<sup>188</sup> National governments, international organizations, and private donors could make a contribution by insisting that estimates of the marginal costs and marginal benefits of environmental expenditures be made public. This could be done by adding to the laundry list of regulatory analyses required before a new regulation is issued by EPA, mandating that an agency like the Congressional Budget Office make an analysis of legislation, or other methods.<sup>189</sup> Transparency is good and

<sup>186</sup> Government agents *talk* a lot about doing a better job, and no doubt they are sincere, but there is little evidence that the host of initiatives ever changes much substantively. Administrations have many such projects to assure voters that waste in government is under attack. See, e.g., Office of Management and Budget (OMB), ExpectMore.gov, <http://www.whitehouse.gov/omb/expectmore/> (last visited Jan. 25, 2009). Cost-benefit analysis has the virtue of putting numbers down that can be verified or subject to criticism on a basis that is more concrete than happy talk about “doing more” and “working harder.” Numbers can be fudged, but that is subject to review.

<sup>187</sup> The Office of Information and Regulatory Affairs (OIRA) in the OMB has long done much of the cost-benefit work. See Memorandum from John D. Graham, Administrator, OMB, to President’s Management Council (Sept. 20, 2001), available at [http://www.whitehouse.gov/omb/inforeg\\_oira\\_review\\_process/](http://www.whitehouse.gov/omb/inforeg_oira_review_process/). The General Accounting Office has similarly done many studies, which can trigger scraps with other agencies. Members of Congress and administrations lean on agencies to produce studies consistent with politically preferred results, but such instances have the benefit of being subject to review by other agencies or outsiders. See, e.g., Nat’l Center for Env’tl Econ., EPA, Gen. Accounting Office Review, <http://yosemite1.epa.gov/ee/epalib/riaepa.nsf/7f727a0dc1d97c3a852567840015b9a3/b0b647ced4a5b42485256757006ea0f0!OpenDocument> (last visited Jan. 25, 2009). Outside groups may object to cost-benefit analysis as they can be inconsistent with special interests. See, e.g., Public Citizen, Graham’s Nomination to Head OMB-OIRA Threatens Health, Safety and Environmental Safeguards, <http://www.citizen.org/congress/regulations/graham/oiraoverview.html> (last visited Jan. 25, 2009).

<sup>188</sup> See *Why Should an Outhouse Cost Taxpayers \$1 Million?*, USA TODAY, Dec. 16, 1997, at 14A. Congressional earmarks for boondoggles in national parks are something to behold, given the shabby condition of the parks.

<sup>189</sup> E.g., CONG. BUDGET OFFICE, POLICY OPTIONS FOR REDUCING CO<sub>2</sub> EMISSIONS, at iii (2008), available at <http://www.cbo.gov/ftpdocs/89xx/doc8934/02-12-Carbon.pdf>.

relatively cheap. It would improve environmental policy making and necessitates only hiring some economists and policy analysts. As an added benefit, this could be done by executive order in the United States, requiring only a stroke of the pen.

*Step 2: Explicitly recognize tradeoffs among purchases of environmental goods.*

Once the reporting of marginal cost and benefit estimates are consistently available, independent analysts—from public policy pressure groups to universities to the assortment of NGOs interested in environmental, development, and other issues—could use them to criticize resource allocations among environmental goods. It will almost certainly be true that interest groups will be among those offering critiques—auto manufacturers are likely to conduct studies that show that the marginal cost of additional domestic mobile source controls is higher than that of additional stationary source controls, while power generators are likely to discover precisely the opposite. The market place of ideas is the proper venue for such discussions, and shining more light on them by establishing benchmarks will lead to a convergence on more generally accepted numbers.<sup>190</sup>

When higher quality, and more, data are available, it will be possible to have a better informed debate about environmental policy along the following lines. Suppose EPA is considering a rule like the change in the Safe Drinking Water Act<sup>191</sup> standard for arsenic imposed as part of the Clinton Administration's midnight regulations in 2001.<sup>192</sup> This was a high-marginal-cost, low-marginal-benefit regulation relative to improving drinking water availability in countries lacking basic sanitation.<sup>193</sup> Instead of the rather emotional debate over arsenic

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<sup>190</sup> There are a host of issues in cost-benefit analysis that deserve public airing. For example, Professor Sunstein has noted that standard government procedure is to treat the value of lives saved as the same. Cass R. Sunstein, *Lives, Life-Years, and Willingness to Pay*, 104 COLUM. L. REV. 205, 205 (2004). But it makes little sense to assert that saving the life of a child is equal in economic value to saving the life of an elderly person. *Id.* at 206.

<sup>191</sup> 42 U.S.C. §§ 300f–300j-26 (2000).

<sup>192</sup> The Arsenic in Drinking Water Rule was one of a number of regulations pushed out the door in the final hours of the Clinton administration to evade the normal review process. National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring, 66 Fed. Reg. 6976 (Jan. 22, 2001) (to be codified at 40 C.F.R. pts. 9, 141, 142). The midnight regulation process was not peculiar to that Administration and is part of a practice of catering to special interests and bureaucratic preferences. See generally Andrew P. Morriss et al., *Between a Hard Rock and a Hard Place: Politics, Midnight Regulations and Mining*, 55 ADMIN. L. REV. 551, 553 (2003) (discussing the politicization of environmental regulation). The arsenic regulation provoked a considerable scholarly controversy. Compare Cass R. Sunstein, *The Arithmetic of Arsenic*, 90 GEO. L.J. 2255, 2257 (2002) (arguing that cost-benefit analysis, even though inexact, is still the preferred method for making agency decisions), and Thomas O. McGarity, *Professor Sunstein's Fuzzy Math*, 90 GEO. L.J. 2341, 2342 (2002) (contending that cost-benefit analysis should be used conjunctively with other scientific approaches), with Lisa Heinzerling, *Markets for Arsenic*, 90 GEO. L.J. 2311, 2313 (2002) (rejecting cost-benefit analysis on the grounds that it focuses only on commercial factors and ignores more important considerations like the collective good), and Shi-Ling Hsu, *Fairness Versus Efficiency In Environmental Law*, 31 ECOLOGY L.Q. 303 (2004) (proposing that environmental regulation shift from an economic-based approach to an efficiency-based approach).

<sup>193</sup> EPA's estimate showed the costs to outweigh the benefits. ARSENIC RULE ECONOMIC ANALYSIS, *supra* note 177, at 1-4. This estimate was critiqued by an AEI-Brookings Joint Center for Regulatory Studies analysis. See BURNETT & HAHN, *supra* note 177, at 14 tbl.1. This showed costs to exceed the benefits by \$190 million; meaning an estimated \$65 million per statistical life saved. *Id.*

levels that followed the George W. Bush Administration's reconsideration of the arsenic standard change,<sup>194</sup> it would have been more useful to discuss whether additional resources in arsenic level reductions were the best use way to improve drinking water quality in particular, water quality more generally, or environmental quality overall.<sup>195</sup> Further, a debate over whether the much larger benefits of improving drinking water access in, say, sub-Saharan Africa would have been far more relevant.<sup>196</sup> Of course, it might be that Americans would decide that they do not care enough about drinking water access in such locales to warrant shifting the resources, but having the debate in explicit terms about the costs and benefits at stake would be more honest than the current practice of pretending the tradeoff does not exist.<sup>197</sup>

*Step 3: Presume that resources should be applied to the highest marginal benefit, lowest marginal cost uses within environmental expenditures.*

If all environmental expenditures were "on budget" (even given the uncertainties about many cost estimates), Congress would set an annual budget for environmental quality purchases, perhaps with separate categories for direct expenditures and indirect expenditures through regulations.<sup>198</sup> This would create an incentive for shifting expenditures to where they bought the greatest valued increase

<sup>194</sup> *E.g.*, Press Release, Natural Resources Defense Council, NRDC Denounces Bush Administration Suspension of Arsenic-in-Drinking-Water Protections (May 22, 2001), available at <http://www.nrdc.org/media/pressReleases/010522a.asp>. Interestingly, a 2008 Gallup poll found that "polluted drinking water" in America was at the top of environmental concerns of Americans; that is consistent with every poll dating back to 1989. See Jeffrey M. Jones, *Polluted Drinking Water Was No. 1 Concern Before AP Report*, GALLUP, Mar. 12, 2008, <http://www.gallup.com/poll/104932/Polluted-Drinking-Water-No-Concern-Before-Report.aspx> (last visited Jan. 25, 2009).

<sup>195</sup> Since the arsenic problem was localized, a national rule may not be the most efficient way to handle the issue. Wallace E. Oates, *The Arsenic Rule: A Case for Decentralized Standard Setting?*, 147 RESOURCES 16, 17 (2002).

<sup>196</sup> The World Health Organization estimates that 1.5 million children die annually due to contaminated water. See World Health Organization, *Lack of Water and Inadequate Sanitation, Children's Environmental Health*, <http://www.who.int/ceh/risks/cehwater/en/> (last visited Jan. 25, 2009). If these lives were valued at \$5 million each, the cost would be \$7.5 trillion annually.

<sup>197</sup> "One cannot put a price tag on human life," said the Comptroller of Texas, John Sharp, when speaking in favor of a \$3 billion bond issue in Texas to help support cancer research. Karen Brooks, *Armstrong Leads Bus Tour for Nov. 6 Cancer Funds Vote*, DALLAS MORNING NEWS, Oct. 16, 2007, <http://www.dallasnews.com/sharedcontent/dws/news/texasouthwest/stories/101607dntexcancer.367c273.html> (last visited Jan. 25, 2009). Politically, people are expected to say such things, but it reflects the standard emotional nature of the debate and ignores the fact that political leaders, such as the Comptroller of Texas, do put price tags on human lives by pushing state resources into cancer research instead of highway safety or expanded infant care in Texas, let alone the rest of the world.

<sup>198</sup> Yes, we know the devil is in the details and Congress is adept at evading constraints on its spending generally. The Social Security program is supposed to be protected from revenue encroachment by having it in its own funding category, but for decades Congress has "borrowed" (spent) the net revenue generated by Social Security taxes on general budget items, so the "trust fund" consists of IOUs from Congress that are really part of the national debt. See DON FULLERTON & BRENT D. MAST, *INCOME REDISTRIBUTION FROM SOCIAL SECURITY 3* (2005). Integrity in federal spending is beyond the ken of this paper.

in environmental quality. This is not going to happen easily, of course, as members of Congress, of both parties, are jealous of their ability to control appropriations.<sup>199</sup>

However, it would not be unreasonable that there be a presumption that needs to be shifted by the proponents of high marginal cost changes. For example, why it is better to devote, annually, the \$210 million necessary to comply with the more stringent arsenic standards for drinking water in the United States which yields benefits of \$23 million,<sup>200</sup> than to provide safe drinking water and sanitation to an additional half-million people each year in developing countries for the same cost?<sup>201</sup> The World Health Organization (WHO) estimates a benefit of water and sanitation facilities of \$5–\$28 for every \$1 spent in developing regions.<sup>202</sup> (It must be noted that the WHO benefit analysis is much more conservative than how benefits are measured in the United States, where the value of every life is commonly presumed to be at least \$5 million.<sup>203</sup> The majority of other countries are much more modest, only measuring direct lost wages from illness and death.<sup>204</sup> If U.S. benefit presumptions were applied to such projects, the benefit measures would be much higher.) Such discussions, if required, would identify areas of the law where statutory mandates consistently caused regulators to do expensive but not particularly beneficial things, flagging the areas that needed reform.

<sup>199</sup> As Congress adjourned in August 2008, party leaders squabbled about who was responsible for assorted budgetary impasses and if a special session should be called to “solve” energy problems. See Jackie Kucinich & Jared Allen, *White House Says No to Special Session of Congress*, THE HILL, Aug. 4, 2008, <http://thehill.com/leading-the-news/white-house-says-no-to-special-session-of-congress-2008-08-04.html> (last visited Jan. 25, 2009).

<sup>200</sup> BURNETT & HAHN, *supra* note 177, at 14 tbl.1.

<sup>201</sup> This is a very rough calculation, but presume \$200 million per year allocated to providing capital equipment needed for households to have potable water and sanitation (part of improving water quality involves proper waste disposal). For household connections (cheaper options, such as standpost wells, are available) in Africa and Asia the cost of water is \$148–\$164 per capita and \$193–\$248 per capita for sanitation (septic tanks are cheaper); so presume \$400 per capita total to provide and maintain such facilities. GUY HUTTON & JAMIE BARTRAM, WORLD HEALTH ORG., REGIONAL AND GLOBAL COSTS OF ATTAINING THE WATER SUPPLY AND SANITATION TARGET (TARGET 10) OF THE MILLENNIUM DEVELOPMENT GOALS 6 (2008), available at [http://www.who.int/water\\_sanitation\\_health/economic/mdg\\_global\\_costing.pdf](http://www.who.int/water_sanitation_health/economic/mdg_global_costing.pdf). The \$200 million budget would cover 500,000 people, assuming the beneficiaries pay nothing, which is not a reasonable assumption, so in practice significantly more could be covered. Annual maintenance costs for water and sanitation are estimated to be \$19–\$22 annually. See *id.* Hence, over 10 years, infrastructure for water and sanitation could be provided to 5 million persons. For water alone, it would be more than double that number, but doing both at once has significant advantages.

<sup>202</sup> GUY HUTTON & LAURENCE HALLER, WHO, EVALUATION OF THE COSTS AND BENEFITS OF WATER AND SANITATION IMPROVEMENTS AT THE GLOBAL LEVEL 3, 35 (2004), available at [http://www.who.int/water\\_sanitation\\_health/wsh0404.pdf](http://www.who.int/water_sanitation_health/wsh0404.pdf).

<sup>203</sup> Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations, 68 Fed. Reg. 5492, 5499–501 (Feb. 3, 2003).

<sup>204</sup> HUTTON & HALLER, *supra* note 202, at 29–33. Unlike U.S. cost-benefit analysis, which get embroiled in arguments about “existence value,” “hedonic values,” and presume generous market values for all our lives, the WHO only estimated lost work days, lost income from illness or death, time gained from not having to walk to wells, improvements in education from fewer sick days, etc.—very utilitarian measures. On the fancy measures in vogue in the United States, see generally Donald J. Boudreaux et al., *Talk Is Cheap: The Existence Value Fallacy*, 29 ENVTL. L. 765 (1999) (discussing “existence value” in the United States).

Of course, some practical problems will arise in any effort to implement an environmental expenditure policy based on marginal costs and benefits. For example, oil refineries are major sources of concern with respect to many air pollutants. Pollution control at Mexican oil refineries appears to be less advanced than it is at U.S. refineries.<sup>205</sup> Our analysis suggests that it is likely that the United States ought to subsidize improvements in air quality at Mexican refineries rather than trying to squeeze out additional improvements at U.S. refineries. Instead of trying to browbeat poorer nations into treaties by which they promise to “come up to” rich country environmental standards, it may simply be cheaper to assist in paying for new technology to be installed.

The first practical problem is that this turns an off-budget regulatory expenditure (i.e., the government makes a private entity spend money rather than collecting taxes and spending the money itself) into an on-budget expenditure.<sup>206</sup> The second practical problem is that the Mexicans may have little incentive to run the equipment effectively, although this could be surmounted by clever contracting and monitoring. The third practical problem is that refineries in Mexico are owned by the Mexican government as the Mexican Constitution forbids foreign investment in the oil sector—so the issue is a particularly politically sensitive one.<sup>207</sup> This would limit the clever contracting we just resorted to as a solution to the second problem. More broadly, there are major questions about the effectiveness of many of the purchased environmental mitigation measures, such as carbon offsets.<sup>208</sup> This is true for Mexico, the United States, and any other country. The focus on national tradeoffs alone means policy is too restrictive and fails to generate environmental benefits that are as large as those that could be achieved by changing the borders. Despite these problems we think that the size of the gains in environmental quality possible would produce a gain in net benefits.

## V. CONCLUSION

Marginal costs and marginal benefits of improving environmental quality vary across the world and across types of actions to aid the environment. Thinking about margins can offer “free” improvements by identifying opportunities to shift

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<sup>205</sup> See, e.g., Mark A. Uhlig, *Mexico Closes Giant Oil Refinery to Ease Pollution in the Capital*, N.Y. TIMES, Mar. 19, 1991, at A1, A6 (describing closure of a refinery accounting for seven percent of national capacity because of pollution it caused).

<sup>206</sup> We leave aside the problem of the perception of the American public that “foreign aid” is generally unimportant. See *supra* note 113.

<sup>207</sup> Constitución Política de los Estados Unidos Mexicanos [Constitution], as amended, art. 27, Diario Oficial de la Federación [D.O.], 5 de Febrero de 1917 (Mex.); see also Tim Weiner, *As National Oil Giant Struggles, Mexico Agonizes Over Opening It to Foreign Ventures*, N.Y. TIMES, Feb. 17, 2002, at 6 (describing presidential promises to allow foreign participation in oil industry and opposition from labor unions and other nationalist forces).

<sup>208</sup> See generally Robert L. Glicksman, *Balancing Mandate and Discretion in the Institutional Design of Federal Climate Change Policy*, 102 NW. U. L. REV. 196, 207 (2008) (discussing the possibility that some pending carbon offset proposals are based upon suspect science and unfit for climate change regulation); Kenneth R. Richards & Stephanie Hayes Richards, *An Analysis of the Leading Climate Change Bills in the U.S. Senate*, 38 ENVTL. L. REP. NEWS & ANALYSIS, ENVTL. LAW INST. 10,388, 10,397 (2008) (describing a history of “manipulation and obfuscation” with carbon offsets trading systems that reduce beneficial effects).

resources to improve the total sum of environmental quality purchased for any given expenditure.

The provision of environmental quality, both directly by government and by government mandates, is rife with partisan political interests driven by special interests that can profit from particular actions,<sup>209</sup> as well as by political pandering to the rational ignorance we all have about environmental matters. Rather than tell people the amount of mercury in the atmosphere is so trivial as to be largely irrelevant, especially given other environmental issues that could have been addressed, even the supposedly anti-environmental George W. Bush Administration gave in on the issue and adopted a more stringent (and costly) rule for mercury.<sup>210</sup> Citizens cannot be knowledgeable about the multitude of tradeoffs that exist and must rely on representatives to make choices about the best use of limited resources. Incorporating other jurisdictions into the calculation can allow the purchase of greater levels of environmental protection. Even if one does not care about poor people suffering from polluted water and smoke-filled huts, there is reason to be concerned about pollution that has global consequences.

Taking the interconnectedness of ecosystems and equal moral worth of individuals seriously requires that we rethink how we approach environmental problems. It is not economically efficient, environmentally sound, or morally acceptable to evaluate the benefits and costs of environmental measures solely at the national level. Rational policy making requires consideration of the relative benefits and costs of expenditures across borders as well as within them. The principles proposed in this Article are a first step to making such consideration possible. Political leaders have strong incentives only to focus on domestic problems. Paying foreigners to reduce pollution is expected to be a politically unpopular position. However, working to help resolve environmental problems in other nations can help increase environmental security for wealthy nations.

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<sup>209</sup> While there seems to be a rather vague popular belief that environmental statutes were passed to put nasty polluters in their place, the evidence does not seem to square with that. The biggest polluters appeared to dominate planning for passage of the Clean Air and Clean Water Acts. See Meiners & Yandle, *supra* note 54, at 957 (noting half the witnesses at congressional hearings for the Clean Air Act were from industry); Andrew P. Morriss, *The Politics of the Clean Air Act*, in POLITICAL ENVIRONMENTALISM 263–315 (Terry L. Anderson ed., 2000). In the case of the Clean Air Act, that was borne out in practice. See ACKERMAN & HASSLER, *supra* note 80, at 71 (describing EPA's reliance on industry for information). In the case of the Clean Water Act, see generally Anand Bhansali et al., *Sewage Treatment as an Industry Subsidy*, 68 ECON. GEOG. 174 (1992) (noting how public funds used for water treatment plants lower the transaction costs to the entities that discharge into those treatment plants).

<sup>210</sup> See Standard of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 70 Fed. Reg. 28,606 (May 18, 2005) (to be codified at 40 C.F.R. pts. 60, 72, 75).



Table 1: Pollution Control Expenditures

Country	% GDP		Per Capita Expenditures					
	Total expenditures All	Public	Wastewater		Air		Waste	
			Public	Business	Public	Business	Public	Business
Australia	1.2	0.3	34.0	14.7	2.0	10.5	23.8	20.0
Belgium	1.1	0.5	45.5	50.1	1.0	26.8	69.9	55.7
Canada	1.2	0.6	74.2	n/a	n/a	n/a	50.5	n/a
France	1.3	0.6	n/a	22.1	0.9	17.6	59.7	16.1
Germany	1.6	1.3	177.6	47.5	0.3	40.5	163.4	38.0
Japan	1.4	0.6	60.8	n/a	53.0	n/a	9.8	n/a
Netherlands	2.1	1.1	133.8	19.6	30.0	69.2	56.3	8.4
New Zealand	0.9	0.7	102.4	n/a	n/a	n/a	37.1	n/a
Norway	1.2	0.6	83.4	n/a	5.0	n/a	17.2	n/a
Sweden	1.1	0.2	67.7	29.6	n/a	31.4	43.9	29.7
Switzerland	1.1	0.7	134.8	55.0	5.8	36.0	82.8	75.8
United Kingdom	0.6	0.6	6.7	13.0	4.6	12.2	89.0	14.9
United States	1.6	0.7	105.0	23.4	8.9	31.3	58.9	8.7
Czech Republic	0.6	0.3	n/a	n/a	n/a	n/a	n/a	n/a
Hungary	1.5	0.6	76.1	12.2	0.5	17.5	3.9	8.7
Mexico	0.7	0.5	1.6	n/a	0.3	n/a	2.9	n/a
Poland	1.5	0.8	68.7	23.9	1.9	25.4	17.3	16.8
Slovak Republic	0.8	0.1	5.7	17.0	5.3	36.8	2.9	14.3
Turkey	1.1	0.9	12.9	1.8	0.0	7.8	23.4	3.3

Source: OECD, WORKING GROUP ON ENVTL INFO. AND OUTLOOKS, POLLUTION AND ABATEMENT AND CONTROL EXPENDITURE IN OECD COUNTRIES 32 tbl. 1, 39 tbl.4a, 39 tbl.4b, 40 tbl.4c (2007), available at <http://www.oecd.org/dataoecd/37/45/38230860.pdf>. Data from most recent year available to study authors; dollar amounts in constant purchasing power parity values.

**Table 2: EPA Cost Benefit Analysis of Ozone Standard Alternatives**

Annual Estimates	0.075 ppm Standard	0.070 ppm Standard
Adverse health effects prevented under new standard	470 cases chronic bronchitis 1,400 nonfatal heart attacks 5,600 hospital & ER visits 17,500 cases of upper and lower respiratory symptoms 9,400 cases aggravated asthma 675,000 days of missed work or school 2 million days of restricted activities due to symptoms	780 cases chronic bronchitis 2,300 nonfatal heart attacks 7,600 hospital & ER visits 30,000 cases of upper and lower respiratory symptoms 16,000 cases aggravated asthma 890,000 days of missed work or school 2.7 million days of restricted activities due to symptoms
Estimated costs of implementing the standard	Low \$5.5 billion High \$8.8 billion	Low \$10 billion High \$22 billion
Estimated value of standard benefits	Low \$1.5 to \$15 billion High \$7.3 to \$22 billion	Low \$2.56 to \$24 billion High \$9.7 to \$33 billion

Source: CLEAN AIR ACT ADVISORY COMM.: MOBILE SOURCES TECHNICAL REV. SUBCOMM., OZONE NAAQS REGULATORY IMPACT ANALYSIS 7-8 (2007), available at [http://www.epa.gov/air/caaac/mstrs/sept2007/evans\\_adler.pdf](http://www.epa.gov/air/caaac/mstrs/sept2007/evans_adler.pdf).

**Table 3: Marginal Costs and Marginal Benefits**

Jurisdiction	Marginal Cost of Pollution Control at Current Levels	Marginal Benefit of Pollution Control at Current Levels
Ecotopia	10	1
Industrialia	0	20
Economia	5	5

**Table 4: Three Nation Marginal Costs and Marginal Benefits**

Jurisdiction	Marginal Cost of Pollution Control for			Marginal Benefit of Pollution Control for		
	Local Pollution	Distance Pollution	Global Pollution	Local Pollution	Distance Pollution	Global Pollution
Ecotopia	10	10	10	1	1	1
Industrialia	0	0	0	20	20	20
Economia	5	0	0	5	20	20

**Table 5: Federal Nation Marginal Costs and Marginal Benefits**

Jurisdiction	Marginal Cost of Pollution Control for			Marginal Benefit of Pollution Control for		
	Local Pollution	Distance Pollution	Global Pollution	Local Pollution	Distance Pollution	Global Pollution
Ecotopia	10	10	5	1	1	5
Industrialia	0	5	5	20	5	5
Economia	5	0	5	5	20	5

**Table 6: Unitary Nation Marginal Costs and Marginal Benefits**

	Marginal Cost of Pollution Control for			Marginal Benefit of Pollution Control for		
	Local Pollution	Distance Pollution	Global Pollution	Local Pollution	Distance Pollution	Global Pollution
Ecotopia	5	5	5	5	5	5
Industrialia	5	5	5	5	5	5
Economia	5	5	5	5	5	5

**Figure 1: Marginal Cost of Pollution Reduction**

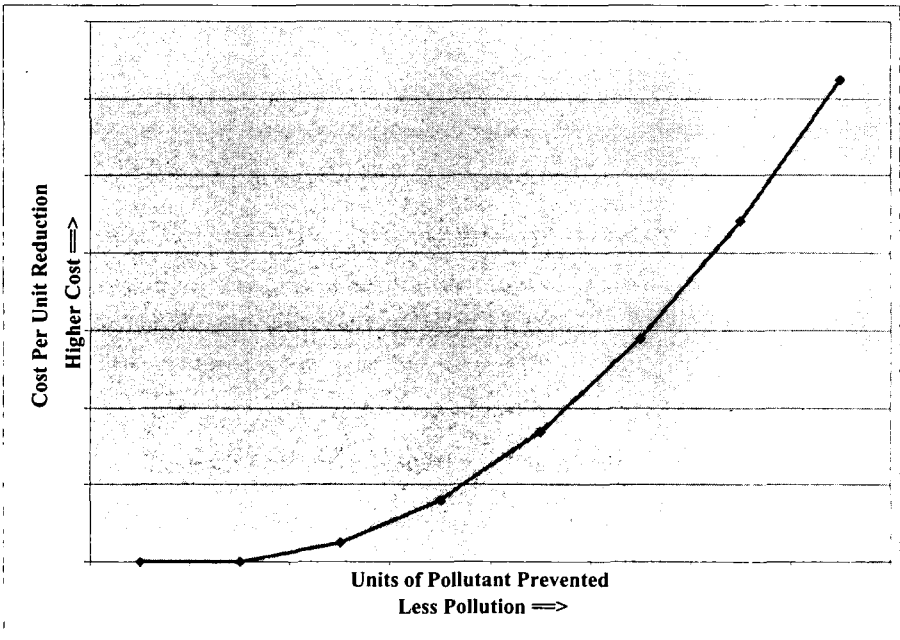


Figure 2: Marginal Benefits

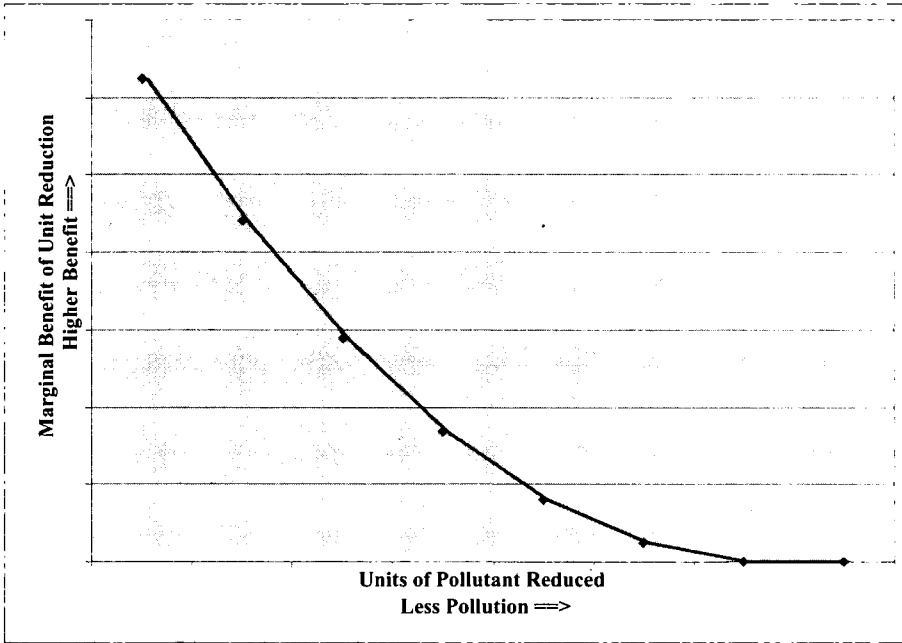
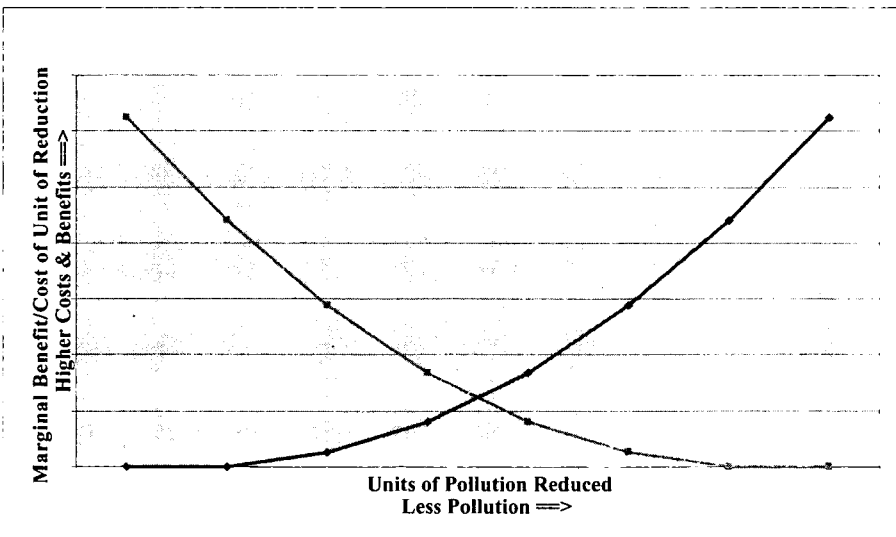


Figure 3: Marginal Benefits and Marginal Costs



**Figure 4: Borders**

