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Borders & The Environment

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Borders & The Environment

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Abstract

Despite regular acknowledgement of the interconnectedness of global ecosystems, government policies at the national level focuses 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 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 both less total environmental quality and treats residents of rich and poor countries different 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 from wherever most efficiently achievable

BORDERS & THE ENVIRONMENT

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ABSTRACT

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Introduction

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

¹ 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 ENV'T'L. 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.").

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

³ Acidification – The Swedish NGO Secretariat on Acid Rain, http://www.acidrain.org/pages/acidEutrophications/sub3_1.asp (last visited June 21, 2008) (acidifying pollutants resulting from airborne deposition of sulphur, nitrogen oxides and ammonia are able to carry long distances; 14% of oxidized nitrogen deposited in Sweden from the UK).

⁴ Sandra Dibble, *Development Boom on Gold Coast Forces Scrutiny of Sewage Plight*, THE SAN DIEGO UNION TRIBUNE, October 21, 2007, available at http://www.signonsandiego.com/uniontrib/20071021/news_1n21sewage.html (discharging sediment from state-run sewage plant threatens new and developing communities upstream).

⁵ 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). See also *Bringing Coastal Dead Zones Back to Life – ActionBioscience.org* (American Institute of Biological Sciences), <http://www.actionbioscience.org/environment/howarth.html#primer> (last visited June 30, 2008) (explaining rivers can carry pollutants great distances and result in coastal "dead zones").

⁶ Fourth Assessment Report - Intergovernmental Panel on Climate Change (IPCC), <http://www.ipcc.ch/ipccreports/ar4-wg1.htm> (last visited June 21, 2008) ("Working Group I Report 'The Physical Science Basis'").

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.⁷ This argument is often heard in the context of trade negotiations, with the developed country environmental pressure groups (often successfully) demanding that trade treaties aimed at reducing barriers to trade include environmental protection standards.⁸ The environmental “side agreement” to the North American Free Trade Agreement (NAFTA) is an example of this reaction.⁹

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.¹⁰ The Kyoto Protocol, for

⁷ Paul Cough, *Trade-Environment Tensions: Options Exist for Reconciling Trade and Environment*, 19. ENV'T'L. PROTECTION AGENCY J. 28-32 (1993), available at <http://www.ciesin.org/docs/008-065/008-065.html> (expanding world trade creates problems with varying environmental standards, some suggest imposing duties on countries with relaxed standards to compensate).

⁸ Stephen P. Mumme, *NAFTA and Environment*, FOREIGN POL'Y IN FOCUS, vol. 4 No. 26, October 1999, available at <http://www.fpif.org/briefs/vol4/v4n26nafta.html> (analyzing the challenges free trade poses to North American environment and proposes a strengthening of NAFTA's environmental protection measures).

⁹ North American Agreement on Environmental Cooperation, U.S.-Can.-Mex., Sept. 14, 1993, 32 I.L.M. 1480 (1993); 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).

¹⁰ 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) (“...another 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) (“the 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. ENV'T'L. 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

example, attempts to set levels of carbon dioxide emissions by signatories.¹¹ Similarly, the World Trade Organization (WTO) has been moving gradually to include environmental standards as a regular part of trade agreements.¹² Such agreements also tend to emphasize the need for less-developed countries to impose more stringent environmental standards domestically.¹³

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.¹⁴ 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.¹⁵

bottom' is to eliminate or reduce those differences through international agreements.”). For a general refutation of that view, see ROBERT K. FLECK AND F. ANDREW HANSEN, DO PROFITS PROMOTE POLLUTION? THE MYTH OF THE ENVIRONMENTAL RACE TO THE BOTTOM, PERC Policy Series 41 (2007), available at <http://www.perc.org/articles/article898.php>

¹¹ Kyoto Protocol - United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int/kyoto_protocol/items/2830.php (last visited June 26, 2008) (detailing the goals, mechanisms, and future of the Kyoto Protocol and global emission reduction).

¹² Trade and Environment – World Trade Organization (WTO), http://www.wto.org/english/tratop_e/envir_e/envir_e.htm (last visited June 26, 2008) (“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.”).

¹³ Joseph F. DiMento & Pamela M. Doughman, *Soft Teeth in the Back of the Mouth: The NAFTA Environmental Side Agreement Implemented*, 10 GEO. INT'L ENV'T'L. L. REV. 651, 654 (1998) (using trade agreements as affirmative vehicles to promote environmental policy); Daniel T. Griswold, *Trade, Labor, and the Environment: How Blue and Green Sanctions Threaten Higher Standards*, TRADE POL'Y ANALYSIS, No. 15, 2 (Aug. 2, 2001), available at <http://www.freetrade.org/pubs/pas/tpa-015b.pdf> (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. ENV'T'L. L. & POL'Y 187, 190 (2001/2002) (enforcing environmental standards through trade restrictions as a policy instrument).

¹⁴ *India focuses on solar energy in new climate plan*, THE TIMES OF INDIA, June 30, 2008, available at http://timesofindia.indiatimes.com/Earth/India_focuses_on_renewables_in_new_plan/articleshow/3180537.cms (reporting Indian Prime Minister wants energy efficient economic development, but the country must expend more energy to lift populace from poverty); see also Kristen Sheeran, *Beyond Kyoto: North-South Implications of Emissions Trading and Taxes*, 5 SEATTLE J. FOR SOC. JUST. 697, 703-704 (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).

¹⁵ Malini Mehra, Op-Ed., *Time to Stop the Climate Blame Game*, BBC NEWS, Dec. 3, 2007, available at <http://news.bbc.co.uk/1/hi/sci/tech/7125047.stm> (citing Indian and Chinese policy: non-historical emitters with large poor populations should not be expected to reduce emissions).

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.¹⁶ This literature argues that it is unjust for poorer people to bear more of the risk of environmental harms than richer people do.¹⁷ The solutions proposed are generally similar to those proposed by those concerned with the transnational impact of polluting activities – either action by international institutions or restrictions on trade.¹⁸

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 super-majority and unanimity voting rules.¹⁹ International

¹⁶ 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.”).

¹⁷ See Rachel D. Godsil, *Remedying 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 (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.”); see also Roberto Suro, *Pollution-Weary Minorities Try Civil Rights Tack*, *N.Y. TIMES*, Jan. 11, 1993, available at <http://query.nytimes.com/gst/fullpage.html?res=9F0CE2DF143DF932A25752C0A965958260&sc=&spon=&pagewanted=all> (discriminating land use, environmental-clean up policies spur environmental justice movement).

¹⁸ See Robert F. Blomquist, *Globoecoprmatism: 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. ENV’T L. L.J.* 71, 108 (2005) (United Nations Human Rights Committee is primary international institution issuing decisions on environment-related harm to humans).

¹⁹ See Natalie Avery, *How TNCs Influence Global Food Standards*, *THIRD WORLD NETWORK FEATURES*, Oct. 24, 1995, available at <http://www.hartford-hwp.com/archives/28/076.html> (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 planet but to burden economic rivals); *id.* at 771-772 (explaining how global environmental regulations often spurred by benefiting industries and their lobbyists); Ofer Eldar, *Vote-Trading in International Institutions*, 19 *EUR. J. INT’L L.* 3 (2008) (describing vote trading in international organizations); Roland Vaubel, *A Public Choice View of International Organizations*, in *THE POLITICAL ECONOMY OF INTERNATIONAL ORGANIZATIONS: A PUBLIC CHOICE APPROACH* 27, 27-40 (Roland Vaubel & Thomas D. Willett eds., 1991) (raising problems of rent-seeking and ineffective oversight); Paul B. Stephan, *Accountability and International Lawmaking: Rules, Rents and Legitimacy*, 17 *NW. J. INT’L L. & BUS.* 681, 698-99 (1996-1997) (international law has a relative lack of accountability and is vulnerable to interest group politics).

agreements on environmental issues are costly to negotiate and vulnerable to special interests as well.²⁰ Restrictions on free trade are costly because they reduce overall wealth;²¹ worse, such restrictions often hurt poorer nations the most.²²

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 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 I 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 II 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 III develops a policy framework to implement the analysis.

I. 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-

²⁰ Gary E. Marchant & Douglas J. Sylvester, *Transnational Models for Regulation on 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 771-772.

²¹ James M. Sheehan, *Free Trade is Green Trade*, in *ECOLOGY, LIBERTY & PROPERTY* 149 (Jonathan H. Adler ed., 2000) available at <http://cei.org/gencon/019,03111.cfm> (“Free trade is essential for both wealth creation and environmental protection.”).

²² See DOUGLAS A. IRWIN, *FREE TRADE UNDER FIRE* 160-166 (2nd ed. 2005) (describing advantages of free trade for developing countries).

environment”) and being, well, “not green.”²³ 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.²⁴ 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, 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.²⁵ 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.

²³ Walmart: “We Are Not Green,” posting of Keith Johnson to The Wall Street Journal Online (WSJ.com), <http://blogs.wsj.com/environmentalcapital/2008/03/13/walmart-we-are-not-green/> (Mar. 13, 2008, 13:29 EST) (last visited June 26, 2008) (Wal-Mart CEO says that 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, *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.”).

²⁴ 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* 16 U.S.C. § 1538(a)(1)(B) (2000) (taking, i.e. killing, of endangered species prohibited); 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 ENV’T L. L. 769, 787 (2000) (discussing incentive problems in Endangered Species Act).

²⁵ The tradeoffs are complex. Chris Demorro, Op-Ed., *Prius Outdoes Hummer in Environmental Damage*, THE RECORDER ONLINE, Mar. 7 2007, http://clubs.ccsu.edu/Recorder/editorial/print_item.asp?NewsID=188; Bengt Halvorson, *Prius Versus HUMMER: Exploding the Myth*, THE CAR CONNECTION.COM, http://www.thecarconnection.com/article/1010861_prius-versus-hummer-exploding-the-myth (last visited July 1, 2008).

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.²⁶ Even if the goal is eventual elimination of all discharges, as the Clean Water Act suggests,²⁷ 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.²⁸ 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.²⁹ Resources are limited and not all of them can be spent on the environment.³⁰ Our point is simple and does not depend on whether we spend Al Gore’s preferred level or Monty Burns’: 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 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.³¹ We will argue that this framework will enable the

²⁶ See Andrew P. Morriss, Bruce Yandle, & Roger E. Meiners, *The Failure of EPA’s Water Quality Reforms: From Environment-Enhancing Competition to Uniformity and Polluter Profits*, 20 UCLA J. ENV’T L. & POL’Y 25, 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-\$7,861 pound for point sources).

²⁷ 33 U.S.C. § 1251 (2000).

²⁸ 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. ENV’T L. L.J. 35, 94 (2001) (describing past advocacy groups demanding that the government protect public from all environmental toxins, regardless of cost or risk).

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

³⁰ See Andrew P. Morriss, *The Necessity of Economics: The Preferential Option for the Poor, Markets, and Environmental Law*, 5 UNIV. ST. THOMAS L. J. 183, 186-188 (2008) (discussing role of opportunity costs).

³¹ 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

purchase of greater quantities of environmental goods and services at the cost of the same level of resources than are currently purchased.³² 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.³³ 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. 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 part of national accounts.³⁴ We are arguing only that by thinking of policy choices in this framework we can 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

protection, given the resource constraints imposed by the combination of the laws of physics and politics.

³² 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.

³³ See From The Answer Desk: Green GDP – Environmental Economics, http://www.env-econ.net/2005/07/from_the_answer_1.html (July 30, 2005, 13:10 EST) (last visited July 1, 2008). Even the government of China issues such a measure. See Green GDP Accounting Study Report 2004 Issued – Chinese Government’s Official Web Portal, http://english.gov.cn/2006-09/11/content_384596.htm (last visited July 1, 2008).

³⁴ Joy E. Hecht, *Accounting for the Environment: New Directions for the United States?*, 14 WTR 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).

produce environmental goods.³⁵ 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 conservation³⁶ and charities often make matching grants to support donations toward favored activities.³⁷ Third, governments may require private entities to devote resources to produce environmental goods and services.³⁸ 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.³⁹ 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 environmental good is the same no matter which method is used to purchase it.⁴⁰ Table 1 lists estimates of the

³⁵ See, e.g., Andrew P. Morriss & Roger E. Meiners, *The Destructive Role of Land Use Planning*, 14 TULANE ENVTL L. J. 95, 128-129 (2000) (discussing private efforts to save Hawk Mountain in Pennsylvania); Lucy Knight, *Profile: Douglas Tompkins*, NEW STATESMAN (25 Jan. 2007), available at <http://www.newstatesman.com/200701250006> (profiling an American businessman who bought chunk of Chilean rainforest); RICHARD BREWER, CONSERVANCY: THE LAND TRUST MOVEMENT IN AMERICA (2003) (describing role of private land trusts); Andrew P. Morriss, *Private Conservation Literature: A Survey*, 44 NAT. RES. J. 621, 644-646 (2004) (describing various efforts) SALLY K. FAIRFAX & DARLA GUENZLER, CONSERVATION TRUSTS (2001) (same).

³⁶ Roger E. Meiners & Dominic P. Parker, *Legal and Economic Issues in Private Land Conservation*, 44 NAT. RES. J. 353, 359 (2004) (analyzing federal tax code and conservation easements); Morriss, *Private Conservation Literature*, *supra* note 35, at 624-633 (discussing various incentive programs).

³⁷ See generally Grants – FedCenter, <http://www.fedcenter.gov/opportunities/grants/#greeningactivities> (last visited July 1, 2008) (outlining federal natural resources programs, several of which offer matching grants for restoration projects).

³⁸ There's an important caveat here. One thing governments may do is to provide a forum for enforcement of property rights that hinder pollution, as in the Angler's Conservation Association example described in note 48 *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.

³⁹ 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.

⁴⁰ 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 ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1991); see also TERRY L. ANDERSON & DONALD R. LEAL, ENVIRO-CAPITALISTS: DOING GOOD WHILE DOING WELL (1997).

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 how governments score tax expenditures in their budgetary accounting.⁴¹ 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.⁴² 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.⁴³ 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 pollution problem appeared, was a common pool resource available to whoever claimed it.⁴⁴ This does not

⁴¹ See Editorial, *The Much-Needed Return of Pay-Go*, NY Times, Mar. 22, 2007, available at http://www.nytimes.com/2007/03/22/opinion/22thu2.html?_r=1&scp=1&sq=pay%2Fgo&st=nyt&oref=slogin (describing how Pay/Go policy requires Congress to balance any forgone tax revenue by either raising other taxes or cutting spending).

⁴² The classic article on “deadweight losses” is: Gordon Tullock, *The Welfare Costs of Tariffs, Monopolies and Theft*, 5 WESTERN ECON. J. [ECON. INQUIRY] 224 (1967).

⁴³ The origins of this are expressed in A.C. PIGOU, *THE ECONOMICS OF WELFARE* 195 (1920). There might well be reasons to assign the cost to a particular person or firm, to ensure that “the polluter pays,” but that’s a separate issue from deciding whether to spend the resources at all.

⁴⁴ The classic explanation of the economic incentive to over-exploit unowned resources is: H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954).

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.⁴⁵ However, it means that some people are going to have stop using a resource and incur extra costs while other people are 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.⁴⁶ 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.⁴⁷ We are advocating making policy decisions in light of information about the costs of compliance that takes cost estimates seriously and treats 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 non-hybrid ones, 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 they be 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,

⁴⁵ When valued assets are at stake, there will be a struggle to determine who gets legal control. *See, e.g.,* Terry L. Anderson & P.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. ENVT’L. 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 Buchanan & Gordon Tullock, *Polluters’ ‘Profit’ and Political Response: Direct Control Versus Taxes*, 65 AM. ECON. REV. 139 (1975).

⁴⁶ A study for the SBA 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 12 (2005), available at http://199.171.55.4/idc/groups/public/documents/sba_homepage/rs264tot.pdf. Environmental regulations cost an estimated \$1,249 per employee in 2004 dollars; the cost per employee for small employers (fewer than 20 employees) was estimated to be \$3,296 per employee. *Id.* at 13. Those sums are larger than the per capita income of people in many nations. *See* Rank Order-GDP-per capita (PPP), The World Factbook – Central Intelligence Agency, <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html> (last visited August 3, 2008).

⁴⁷ *See, e.g.,* Morriss, Yandle & Meiners, *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 S. CT. ECON. REV. 205, 237 (2001) (discussing Ducks Unlimited’s “prairie pothole” program).

decision making can be improved by considering costs as costs regardless of where they initially fall.

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 and/or injunctive relief.⁴⁸ 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.⁴⁹ 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.⁵⁰ 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,⁵¹ although invoking the political process involves

⁴⁸ Roger Bate, *Saving Our Streams: The Role of the Angler's Conservation Association in Protecting English and Welsh Rivers*, 14 FORDHAM ENV'T L. J. 375 (2003) (discussing role of private organization in preserving water quality in UK); Julian Morris, *Climbing Out of the Hole: Subjective Value, the Environment, and the English Common Law*, 14 FORDHAM ENV'T L. J. 343 (2003) (same). Private suits also played an important role in water quality regulation in the United States long before federal involvement in water quality issues. See Arthur Maas & Hiller B. Zobel, *Anglo-American Water Law: Who Appropriated the Riparian Doctrine?*, 10 PUB. POL. 109 (1960) and Samuel C. Wiel, *Waters: American Law and French Authority*, 33 HARV. L. REV. 133 (1919) (arguing that the riparian doctrine was based on the Napoleonic Code).

⁴⁹ Jonathan H. Adler, *Fables of the Cuyahoga: Reconstructing a History of Environmental Protection*, 14 FORDHAM ENV'T L. J. 89, 113-114 (2002) (explaining failure of nuisance suits seeking injunctions against polluters of Cuyahoga River due to impact of state-issued permits for pollution).

⁵⁰ See *Diamond v. Gen. Motors Corp.*, 97 Cal.Rptr. 639, 645 (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); See also *City of San Jose v. Superior Court*, 12 Cal.3d 447, 459 (Cal. 1974) (ruling a class action invalid in which purported class sought air pollution relief from airport, court ruled facts 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 July 2, 2008) (reporting on California Attorney General Jerry Brown's failed public-nuisance lawsuit against the Big Six automakers).

⁵¹ See INDUR M. GOKLANY, *CLEARING THE AIR: THE REAL STORY OF THE WAR ON AIR POLLUTION* 111-123 (1999) (crediting state and local air pollution legislation for improvements in air quality in U.S.).

problems of its own.⁵² The solution is nonetheless conceptually straightforward: identify a problem and its source, then require the source to reduce its emissions until the harm is reduced to acceptable levels.⁵³

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.⁵⁴ 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 multi-jurisdictional 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 German⁵⁵ coal plants for acid rain damage, they had to rely on negotiations among the nations involved.⁵⁶ 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.

⁵² 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 also generally* TOWARD A THEORY OF RENT-SEEKING (James M. Buchanan et al., eds., 1980) and Fred S. McChensey, *Rent Extraction and Interest Group Organization in a Coasean Model of Regulation*, 20 *J. LEGAL STUD.* 73 (1991).

⁵³ 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.

⁵⁴ Robert F. Blomquist, *The Beauty of Complexity*, 39 *HASTINGS L.J.* 555, 562 (1988) (observing that acid rain dispute will remain one of most “intractable” air quality issues); Ned Helme & Chris Neme, *Acid Rain: The Problem*, 17 *ENV’T L. PROTECTION AGENCY J.* 18, 19-20 (Jan. - Feb., 1991) (designing effective strategy to prevent further acid rain 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 (1987).

⁵⁵ These three countries are the three largest individually identified countries that are sources of sulphur deposited in Sweden. *See* Acidification, *supra* note 3.

⁵⁶ 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* European Monitoring and Evaluation Program (EMEP) Homepage, <http://www.emep-emissions.at/emission-data-webdab/> (last visited Aug. 9, 2008).

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.⁵⁷ The question in such cases is not whether there are harms to specific individuals from emissions, either local or distant, but whether the total sum of all environmental damage produces a general harm to the world.⁵⁸ 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 supra-national political processes to produce agreements among sovereign entities.⁵⁹ 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.⁶⁰ 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

⁵⁷ See note 6 *supra*. See also, G. Ekstrom, S.E. Pettersson, *The Global Pesticides Project: Reducing Risk in Tropical Agriculture*, PESTICIDE NEWS (No. 68) 17 (2005); Stephen Leahy, *Drowning in an Ocean of Plastic*, WIRED, June 5, 2004, available at <http://www.wired.com/science/discoveries/news/2004/06/63699>; THE ROYAL SOCIETY, OCEAN ACIDIFICATION DUE TO INCREASING ATMOSPHERIC CARBON DIOXIDE (2005), available at <http://royalsociety.org/displaypagedoc.asp?id=13314>.

⁵⁸ 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 ENV'T L. J. 1 (2002) (discussing the consequences of DDT's ban).

⁵⁹ 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* (1965).

⁶⁰ See Jonathan H. Adler, *When is Two a Crowd? The Impact of Federal Action on State Environmental Regulation*, 31 HARV. ENV'T L. REV. 67 (2007); 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. ENV'T L. J. 130 (2005); Adler, *Ducks*, *supra* note 47; Henry N. Butler & Jonathan R. Macey, *Externalities and the Matching Principle: The Case for Reallocating Environmental Regulatory Authority*, 23 YALE L. & POL'Y REV./YALE J. ON REG. SYMP.: CONSTRUCTING A NEW FEDERALISM 25 (1996).

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 attempt 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 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.⁶¹ 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.⁶² 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.⁶³ 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 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,

⁶¹ 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.

⁶² Our formulation allows for varying the calculations based on differences such as income-adjusted demand for environmental goods and services.

⁶³ 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.

and vice versa, because the benefits of species preservation (existence value, potential medicines, preservation of robust eco-systems, etc.) are generally ones that are not limited to the immediate neighbors of the habitat.⁶⁴ 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.⁶⁵

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.⁶⁶ 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

⁶⁴ Gretchen C. Daily et al., *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems*, 2 ISSUES IN ECOLOGY 1, 2 (Spring 1997), available at http://www.esa.org/science_resources/issues/FileEnglish/issue2.pdf (listing ways ecosystem services support life, includes air purification, biodiversity maintenance, climate stabilization, and aesthetic beauty).

⁶⁵ 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."); see also NAT'L ENV'TL. JUST. ADVISORY COUNCIL (NEJAC), FISH CONSUMPTION AND ENVIRONMENTAL JUSTICE: REPORT DEVELOPED FROM THE NEJAC MEETING OF DECEMBER 3-6, 2001 11 (2002), available at 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).

⁶⁶ See materials cited in note 60, *supra*.

New York City? Similar arguments might be made about almost any good.⁶⁷ 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.⁶⁸ Second, individual decisions and collective decisions should be evaluated according to different moral yard sticks. 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.⁶⁹

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.⁷⁰ In virtually all cases the

⁶⁷ 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 (2008). On the reaction to the note, see Working in Biglaw = Killing Babies - Above the Law, http://abovethelaw.com/2008/05/hlr_in_toilet_flush_flush.php (May 21, 2008, 15:56 EST).

⁶⁸ See Elisabeth Malkin, *Thousands in Mexico City Protest Rising Food Prices*, NY TIMES, Feb. 1, 2007, available at 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 (citing analyst agreement that US ethanol production has helped raise food prices in Mexico). See also Aditya Chakraborty, *Secret Report: Biofuel Caused Food Crisis*, THE GUARDIAN, July 4, 2008, available at <http://www.guardian.co.uk/environment/2008/jul/03/biofuels.renewableenergy> (referencing confidential report claiming biofuels have raised global food prices by 75%).

⁶⁹ See GARY S. BECKER & GUILTY NASHAT BECKER, *THE ECONOMICS OF 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 AND SOC’Y 156, 160 (1991) (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). See also Andrew P. Morriss & Benjamin Cramer, *Disestablishing Environmentalism* (Univ. of Illinois Law & Econ., Working Paper LE07-041, 2008) (summarizing literature).

⁷⁰ 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 pre-

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.⁷¹ 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.⁷² 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.⁷³ The problem then is figuring out how to make sure that source of the emissions is paying for the costs it imposes in doing so.⁷⁴ Of course, today's waste is sometimes tomorrow's product and so these problems can resolve themselves.⁷⁵ In at least some cases, however, they will not.

human environment. Nonetheless, for purposes of our argument we assume that human action is the defining characteristic of what most people define as “environmental problems.”

⁷¹ Clean Energy, How Coal Works – Union of Concerned Scientists, http://www.ucsusa.org/clean_energy/fossil_fuels/offmen-how-coal-works.html (last visited Aug. 9, 2008).

⁷² See FREDRIC BECK ET AL., RENEWABLE ENERGY POLICY PROJECT, RENEWABLE ENERGY FOR CALIFORNIA: BENEFITS, STATUS & POTENTIAL – RESEARCH REPORT NO. 15 (2002), available at http://www.crest.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*, NY TIMES, Dec. 7, 2007, available at <http://www.nytimes.com/2007/12/07/business/worldbusiness/07power.html?scp=10&sq=reducing%20coal%20emissions%20+%20expensive&st=cse> (“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.”).

⁷³ 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 your property, you likely have an action for nuisance. The Supreme Court noted that even for regional pollution more than a century ago. *Georgia v. Tennessee Copper Co.*, 206 U.S. 230, 27 S.Ct. 618 (1907). When property rights are not specified, then the problems of infringement by pollution is much greater.

⁷⁴ 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. See Sen. Edmund S. Muskie, *The Meaning of the 1977 Clean Water Act*, EPA JOURNAL, July/Aug. 1978, available at <http://www.epa.gov/history/topics/cwa/04.htm>. He was either clueless that zero pollution is impossible if humans live or just being a good politician.

⁷⁵ See Pierre Desrochers, *How did the Invisible Hand Handle Industrial Waste? By-product Development before the Modern Environmental Era*, 8 ENTERPRISE & SOC’Y 348 (2007); and *Industrial Ecology and the Rediscovery of Inter-Firm Recycling Linkages: Historical Evidence and Policy Implications*, 11 INDUS. & CORP. CHANGE 1031 (2002).

In general, the cost of preventing environmental harm has a rising marginal cost curve, as do most activities.⁷⁶ 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.⁷⁷ (The same is true of protecting the n^{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^{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.)⁷⁸ 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.⁷⁹ 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 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.⁸⁰

The importance of the shape of the marginal cost curve is that it means that buying n^{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 $2n$

⁷⁶ See, e.g., BARRY C. FIELD, *NATURAL RESOURCES ECONOMICS* 139 (2001); for a discussion of the general failure of most policies to link costs and benefits, see STEPHEN BREYER, *BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION* (1993).

⁷⁷ 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 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.

⁷⁸ See, e.g., EDWARD M. GRAMLICH, *A GUIDE TO BENEFIT-COST ANALYSIS* (2nd ed. 1997).

⁷⁹ 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 BRUCE 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* (1981).

⁸⁰ 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.

units were bought at one location and nothing 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.⁸¹ 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.⁸² 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.⁸³ While some sites were cost effective in preventing harm, most provided almost no measurable benefit.

The distribution of the benefits may be different depending on both the mechanism by which the harm is caused and where the reductions occur, however. 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.⁸⁴ If the problem is long distance air pollution, where location A is far enough upwind 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 C for the problems connected to B’s emissions to appear at C but not B, spending $\$2n$ reductions at A yields benefits for B, while spending $\$n$ on reductions at A and B, yields benefits for B

⁸¹ See, e.g., WALTER J. WESSELS, *ECONOMICS* 538 (4th ed. 2006).

⁸² Meaning merely that at particular points, once current technology has been brought to bear on helping resolve a problem that there may be a rush to adopt the technology once it is demonstrated to be successful and the cost of implementing it is reduced.

⁸³ W. Kip Viscusi & James T. Hamilton, *Are Risk Regulators Rational? Evidence from Hazardous Waste Cleanup Decisions*, 89 *AMER. 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 LAB. STAT., U.S. DEPT OF LAB., *CPI DETAILED REPORT TABLE 24* (Malik Crawford ed., June 2008), available at <http://www.bls.gov/cpi/cpid0806.pdf>.

⁸⁴ Always assuming that the costs are justified for n units of reduction.

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 at B yields more total reduction than spending \$ $2n$ at A and \$0 at B, 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 12,866 issued in 1993 by President Bill Clinton, EPA, like other agencies, conducts costs and benefits analyses of various major regulations.⁸⁵ 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, incremental costs should be calculated as the area under the marginal cost curve over the relevant range.⁸⁶

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.”⁸⁷ Hence, when the National Ambient Air Quality Standards were revised for ground-level ozone in 2008, a cost benefit analysis was performed.⁸⁸ The 2008 standard of 0.075 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. In Table 2 we summarize the

⁸⁵ Exec. Order No. 12,866, 3 C.F.R. 638 (1993), *reprinted in* 5 U.S.C. § 601 (2000).

⁸⁶ OFFICE OF MANAGEMENT AND BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, ECONOMIC ANALYSIS OF FEDERAL REGULATIONS UNDER EXECUTIVE ORDER 12866 (1996), *available at* <http://www.whitehouse.gov/omb/inforeg/riaguide.html> (last visited August 11, 2008).

⁸⁷ *Id.*

⁸⁸ *See* Environmental Protection Agency, Regulatory Impact Analyses, <http://www.epa.gov/ttnecas1/ria.html> (last visited July 3, 2008).

major costs and benefits of that standard relative to the more stringent alternative.⁸⁹ 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. 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.⁹⁰

One may quibble with various aspects of how EPA conducted this particular cost-benefit analysis.⁹¹ 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.

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"⁹² or worthwhile programs. That is what members of Congress get elected and paid to do.⁹³ What needs

⁸⁹ For a summary of the Ozone rules approved in 2007 see CLEAN AIR ACT ADVISORY COMM.: MOBILE SOURCES TECHNICAL REV. SUBCOMM., OZONE NAAQS REGULATORY IMPACT ANALYSIS (2007), available at http://www.epa.gov/air/caaac/mstrs/sept2007/evans_adler.pdf.

⁹⁰ Ozone Air Quality Standards – Environmental Protection Agency, <http://www.epa.gov/air/ozonepollution/standards.html> (last visited July 3, 2008).

⁹¹ Some political conservatives complained the new standard was not worth the cost. See generally Nicolas Loris & Ben Lieberman, *EPA Should Not Increase the Ozone Regulation Burden*, THE HERITAGE FOUNDATION, Feb. 26, 2008, <http://www.heritage.org/Research/EnergyandEnvironment/wm1827.cfm> (last visited July 3, 2008). Others thought it did not go far enough. See, e.g., New Federal Ozone Standard Falls Short – Utah Moms for Clean Air, <http://www.utahmomsforcleanair.org/2008/03/15/new-federal-ozone-standard-falls-short/> (Mar. 15, 2008) (last visited July 3, 2008).

⁹² See Ronald D. Utt, *The Bridge to Nowhere: A National Embarrassment*, THE HERITAGE FOUNDATION, Oct. 20, 2005, <http://www.heritage.org/Research/Budget/wm889.cfm> (last visited July 3, 2008); Earmarks – Office of Management and Budget, <http://earmarks.omb.gov/> (last visited July 3, 2008). That one was particularly large, but not uncommon as the federal budget is packed with such items of minimal benefits; see generally Earmarks – Office of Management and Budget, <http://earmarks.omb.gov/> (last visited Aug. 9, 2008).

⁹³ Convincing politicians to make budget judgments in a principled way is a problem well beyond the scope of this article.

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 to mean "more environmental quality for the same money" and/or "the same environmental quality for less money." 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.⁹⁴ 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 effect⁹⁵ and liberal immigration policies in all three countries, people have sorted themselves 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.

⁹⁴ 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.

⁹⁵ 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, then it goes to the state level and, last, to the national level. There is a small industry based on this notion; a paper years ago counted 200 empirical studies published that examined the Tiebout effect; see K. Dowding et al., *Tiebout: A Survey of the Empirical Literature*, 31 URBAN STUDIES 767 (1994).

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.⁹⁶ Economia uses the law of nuisance to enforce rights against damaging invasions as well as allow 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.⁹⁷ 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 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

⁹⁶ 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*, LA TIMES, Mar. 20, 2005, available at

<http://www.latimes.com/classified/jobs/news/la-tr-cruisenews20mar20,0,7607180.column> (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*, NY TIMES, July 1, 2004, available at <http://query.nytimes.com/gst/fullpage.html?res=9C0DEFD81338F932A35754C0A9629C8B63&sc=1&sq=california%20+%20nation's%20most%20stringent%20pollution%20standards&st=cse> (describing California's attempts to improve air quality with some of most stringent agricultural pollution standards in nation).

⁹⁷ Let the Cuyahoga River be an industrial sewer. See Jonathan H. Adler, *Fables of the Cuyahoga: Reconstructing a History of Environmental Protection*, 14 FORDHAM ENV'T L. L. REV. 89 (2002).

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.⁹⁸

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.⁹⁹ If they all had roughly equal voting age populations to start, the Economia voters would be the swing bloc on environmental legislation.¹⁰⁰ 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.¹⁰¹ Similarly, in the summer Ecotopia would cut a similar deal with Industrialia. Because Industrialia is not willing to pay for pollution reductions, no 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

⁹⁸ 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) and Robert H. Nelson, *Environmental Calvinism: The Judeo-Christian Roots of Environmental Theology*, in TAKING THE ENVIRONMENT SERIOUSLY (Roger E. Meiners & Bruce Yandle eds., 1993).

⁹⁹ Not being fools, the Industrialia voters would likely reject a proposal to unite, as they'd lose out on most of the votes. Collective solutions are thus unlikely.

¹⁰⁰ We're 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.

¹⁰¹ States were involved in compacts before the dominance of federal environmental controls. *See* Bruce Yandle on this point.

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.¹⁰² 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.¹⁰³ 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 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 affect 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.¹⁰⁴ 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 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

¹⁰² JAMES M. HENDERSON & RICHARD E. QUANDT, MICROECONOMIC THEORY: A MATHEMATICAL APPROACH, 255 (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 someones’s utility can be increased without harming anyone else.”).

¹⁰³ 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. 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.* at 279.

¹⁰⁴ See C. Steven Bradford, *As I Lay Writing: How to Write Law Review Articles for Fun and Profit*, 44 J. LEG. ED. 13, 22-23(1994) (providing generic law and economics analysis which justifies “any type of regulation you want to propose”).

and not at all about their environment.¹⁰⁵ 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.¹⁰⁶

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.¹⁰⁷ 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.¹⁰⁸ 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 platforms¹⁰⁹ and even "generous" nations tend to spend relatively little on other nations compared to domestic spending.¹¹⁰

¹⁰⁵ On the general relationship between national wealth and state of the environment, see BRUCE YANDLE ET AL., PROP. AND ENVIRONMENT RES. CENTER (PERC), ENVIRONMENTAL KUZNETS CURVES: A REVIEW OF FINDINGS, METHODS, AND POLICY IMPLICATIONS – RESEARCH STUDY 02-1 (2004), available at http://www.perc.org/pdf/rs02_1a.pdf (last visited August 11, 2008).

¹⁰⁶ If the conquered territory was 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.

¹⁰⁷ ANTHONY DOWNS, AN ECONOMIC THEORY OF DEMOCRACY (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).

¹⁰⁸ In our example, the beneficiaries are in Industrialia and so don't care about this.

¹⁰⁹ A 2005 Harris poll of public attitudes toward various public programs ranked foreign aid last. Only eight percent claimed to strongly support it and 32 percent provided modest support; 60 percent wanted none or little. See Government Services With Strongest Public Support, a Survey – Harris Interactive, http://www.harrisinteractive.com/harris_poll/index.asp?PID=620 (last visited July 4, 2008).

¹¹⁰ See generally Steven Radelet, *A Primer on Foreign Aid* (Ctr. for Global Dev., Working Paper No. 92, July 2006), available at http://aideffectiveness.developmentgateway.org/uploads/media/aideffectiveness/file_WP92.pdf (last visited July 4, 2008) (recognizing Norway, Denmark, Luxembourg, the Netherlands, and Sweden as world's most generous donors in 2004, with their foreign aid measuring between 0.79-0.92 percent of their respective 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* (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 U.S., next was the U.K. at \$1.61 billion (although incomplete numbers from Germany and Canada indicate those countries could, proportionally, surpass the U.K. a bit). Giving from Norway, which ranks high in governmental giving, was \$0.25 billion, or .07 percent of U.S. giving. Adjusted for GDP, that would be a private giving rate from Norway

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 on 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 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 distance 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.

II. 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 help us understand changes by the process of exchange that can improve the situation of all parties involved. In this section 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 estimates, using EPA figures, that the

that is about 40 percent of the private giving from the U.S. Private giving from France, adjusted for GDP, is about seven percent of the U.S. level. *See* THE CENTER FOR GLOBAL PROSPERITY, INDEX OF GLOBAL PHILANTHROPY 2008 50 (Darrell Delamaide ed., 2008), *available at* <https://www.hudson.org/files/documents/2008%20Index%20-%20Low%20Res.pdf>. One might also consider the consequences of relatively lax immigration laws that allows 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 U.S.; no other country was one-tenth that sum, so as a share of GDP, the U.S. had the highest level of remittances. *Id.* at 67. Private charity and remittances generally go directly to people, not to government leaders who often have discretion to use the giving as they see fit.

2006 Clean Air Mercury Rule for Electric Utility Steam Generating Units will result in benefits of between \$0.2 and \$2 million by 2020 at a cost of \$896 million.¹¹¹ 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 \$2,000 in costs per barrel of oil spilled.¹¹² 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.¹¹³ 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.¹¹⁴ EPA's reformulated gasoline rule had a mid-point cost estimate of \$760 million and benefits estimate of just \$535 million.¹¹⁵

Although no one appears to collect or calculate marginal costs and marginal benefits in a systematic way,¹¹⁶ 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 tons of the 234 thousand ton reduction in lead emissions were due to the removal of lead from gasoline;¹¹⁷ highway VOC controls accounted for more than 15 million of the 17 million ton improvement in VOCs;¹¹⁸ 84 million of the 89 million ton reduction in CO emissions were due to highway vehicle controls;¹¹⁹ and 10 million of the 16 million ton reduction in SO₂ emissions came from controls on electric utilities.¹²⁰ Thus between 62% and 94% of the benefits of the Clean Air Act regulation of these substances appear to have come from

¹¹¹ 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 62 (2006), *Available at* http://www.whitehouse.gov/omb/inforeg/2006_cb/2006_cb_final_report.pdf (last visited August 11, 2008). It should be noted that in the opinion of many independent economists, agencies generally under-estimate costs and over-estimate benefits to build the case for their actions. We will take agency reported numbers as given.

¹¹² *Id.* at 75; that regulation was imposed during FY 1994-95.

¹¹³ *Id.* at 76; that regulation was imposed during FY 1992-93.

¹¹⁴ *Id.* at 75; that regulation was imposed during FY 1993-94. Of course, there are other regulations that are dubious on a cost-benefit basis which are not in the traditional environmental area, such as OSHA's Occupational Exposure to Asbestos regulations, which are estimated to cost \$448 million to generate benefits of \$92 million. *Id.*, that regulation was imposed during FY 1993-94.

¹¹⁵ *Id.*; that regulation was imposed during FY 1993-94.

¹¹⁶ See U.S. ENVIRONMENTAL PROTECTION AGENCY, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT, 1970 TO 1990, EXECUTIVE SUMMARY ES-10 (1997), *available at* http://www.cleairaction.org/pubs/pdfs/old_pubs/es2.pdf (historical 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....").

¹¹⁷ *Id.* at 17.

¹¹⁸ *Id.* at 15.

¹¹⁹ *Id.* at 15-17.

¹²⁰ *Id.* at 15.

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,”¹²¹ although the agency was quick to qualify this conclusion by noting that there were substantial non-monetized benefits of regulations and benefits from controls on one pollutant that occurred due to side effects of reducing others as an incident of controlling the target pollutant.¹²² 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 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 25 times as great as controlling a ton of VOC emissions.¹²³ 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. The Committee expressed concern that using crops for fuel was helping drive up food prices. The Committee position has been rejected by the European Commission, but the essential tradeoffs are clear.¹²⁴

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,¹²⁵ 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, 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 6 lists the total pollution

¹²¹ *Id.* at ES-9.

¹²² *Id.* at ES-9-ES-10.

¹²³ AEA TECHNOLOGY ENVIRONMENT, DAMAGES PER TONNE EMISSION OF PM_{2.5}, NH₃, SO₂, NOX AND VOCs FROM EACH EU25 MEMBER STATE (EXCLUDING CYPRUS) AND SURROUNDING SEAS 4 (2005), available at http://ec.europa.eu/environment/archives/air/cafe/activities/pdf/cafe_cba_externalities.pdf.

¹²⁴ James Kanter, *Europeans Reconsider Biofuel Goal*, NY TIMES, July 7, 2008, available at http://www.nytimes.com/2008/07/08/business/worldbusiness/08fuel.html?_r=1&em&ex=1215662400&en=305ffd12e0b0fab1&ei=5087%0A&oref=slogin.

¹²⁵ 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 (last visited July 8, 2008) (citing a federal budget cut of \$56 billion over five years as “almost a rounding error”).

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 suggests 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 compared to another, it need not be the case that only when costs exceed benefits in a rich country that it might not be better to invest in environmental protection in another 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 U.S. 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 mid-range benefits of about the same, so the program has been a wash.¹²⁶ 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.¹²⁷ 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 problem caused by people breathing smoke while cooking or heating with wood or dung.¹²⁸ Such indoor air pollution has serious health consequences and, of course, adds to global emission levels from relatively inefficient burning for heat purposes.¹²⁹ Burning solid fuels is estimated to cause 1.6 million deaths annually from

¹²⁶ OFFICE OF MANAGEMENT AND BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, 2007 DRAFT REPORT TO CONGRESS ON THE COSTS AND BENEFITS OF FEDERAL REGULATIONS 66 (2008), available at http://www.whitehouse.gov/omb/inforeg/regpol-reports_congress.html (last visited August 11, 2008) (that regulation was imposed in FY 1995-96).

¹²⁷ INSTITUTE OF MARINE SCIENCES, UNIVERSITY OF DAR ES SALAAM, COST-BENEFIT ANALYSIS CASE STUDIES IN EASTERN AFRICA FOR THE GPA STRATEGIC ACTION PLAN ON SEWAGE 8, 52 (2002), available at <http://www.gpa.unep.org/documents/cost-benefit-analysis-east-africa-english.pdf> (note that the cost estimate is admittedly “crude”).

¹²⁸ Anthony Leiman et al., *Reducing the Healthcare Costs of Urban Air Pollution: The South African Experience*, 84 J. ENVIRO. MGMT. 27 (2007). The authors note that industrial intervention flunks a cost-benefit test; interventions should begin at the household level.

¹²⁹ The U.S. 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 \$1,000 of GDP produced is much lower than in less-wealthy nations. For 2005, it was estimated that

acute respiratory infection; about a third of that is in sub-Saharan Africa and another third in South Asia.¹³⁰ In addition, solving indoor air pollution can reduce greenhouse gas emissions.¹³¹

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 1,500 to 2,000 micrograms per cubic meter air to 76 – 101 micrograms.¹³² 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.¹³³ By using kerosene, the cost in those locales is \$36 and \$60 per year. In rough terms, for as little as \$1,000 a healthy life of 70 years can be purchased for a person. This contrasts to standard value of \$5 million per cancer death prevented in benefit estimates for environmental measures adopted in the U.S.,¹³⁴ a 5,000 to 1 ratio of value. Sophisticated mathematics is not necessary to demonstrate that in such circumstances overall human welfare would be dramatically increased by shifting some resources from environmental protection in the United States to environmental projects in South Asia or sub-Saharan Africa.

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 cutting wood for cooking.¹³⁵ The loss of groundcover then contributes to global distribution of

GHG emissions per \$1,000 of GDP were 0.6 tons CO₂, while they were 3.1 in China, 6.3 in Ukraine, and 11.0 in Indonesia. See MCKINSEY & COMPANY, REDUCING U.S. GREENHOUSE GAS EMISSIONS: HOW MUCH AT WHAT COST? 28 (2007), available at http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf.

¹³⁰ DISEASE CONTROL PRIORITIES PROJECT, HOW TO REDUCE INDOOR AIR POLLUTION THROUGH COST-EFFECTIVE SOLUTIONS 1 (July 2007), available at <http://www.dcp2.org/file/123/DCPP-IndoorAirPollution.pdf>.

¹³¹ GEO Y.B. 2006: An Overview of Our Changing Env’t 44-46, UNEP Job No. DEW/0773/NA (2006) available at 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 CO₂”).

¹³² *Id.* at 3. The lower level of exposure would be about triple the EPA particulate standard, but would obviously be a massive improvement.

¹³³ *Id.* citing Nigel Bruce et al., *Indoor Air Pollution*, in DISEASE CONTROL PRIORITIES IN DEVELOPMENT COUNTRIES, 2nd ed. (D.T. Jamison et al. eds., 2006).

¹³⁴ \$5 million per life is the number used by OMB in its calculations; *supra* note 110, Table C-2 at 79.

¹³⁵ 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, thereby reducing alternative employment or educational possibilities. Girls report frequent beatings and rape as they go into forests looking for wood. 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

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.¹³⁶ 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.¹³⁷ 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.¹³⁸ A large scale project in Nigeria is estimated to cost \$300,000 to provide gas for 5,400 families, which then need an LNG-type stove for cooking. (Biogas is estimated to cost about one-quarter the price of LNG.) Since 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. 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 on the costly margins of pollution reduction. We are not the first to recognize this, of course. As a World Bank

same thing. Scott Baldauf, *Saving Ethiopia's Forest, and Its Cutters*, CHRISTIAN SCIENCE MONITOR, Jan. 24, 2007, available at: <http://www.csmonitor.com/2007/0124/p06s01-woaf.html>

¹³⁶ Trishna Gurung, *Biogas — Saving Nature Naturally in Nepal*, WWF, Mar. 6, 2007, http://www.panda.org/news_facts/newsroom/index.cfm?uNewsID=95320 (last visited July 8, 2008) (describing the health and environmental benefits of biogas use in Nepal).

¹³⁷ For a description of the Biogas Sector Partnership in Nepal, where the program is particularly large, see Biogas Sector Partnership (BSP) – Nepal, <http://www.bspnepal.org.np/> (last visited July 8, 2008). As with any environment action, there are tradeoffs; for an assessment, see BIOGAS SUPPORT PROGRAMME (BSP), BIOGAS SECTOR PARTNERSHIP-NEPAL, ENVIRONMENTAL MANAGEMENT AND MITIGATION PLAN (Revised Feb. 2007), available at http://www.bspnepal.org.np/pdfs/EnvironmentMitigationPlanofBSP-Updated2_18_2007.pdf.

¹³⁸ Valerie J. Brown, *Biogas: A Bright Idea for Africa*, 114 ENVIRON. HEALTH PERSPECT. 300 (2006), available at <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1459950>. The discussion that follows is from that source. The \$50 cost cited may be true, but a project in Tanzania reports a cost of about \$100, see THE GLOBAL ENV'T FACILITY'S SMALL GRANTS PROGRAMME, UNITED NATIONS DEV. PROGRAMME, BIOGAS TECHNOLOGY IN AGRICULTURAL REGIONS, TANZANIA, available at http://sgp.undp.org/download/SGP_Tanzania2.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.

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.”¹³⁹ 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 non-traditional 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.¹⁴⁰ 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.¹⁴¹ It is our contention that there exist opportunities 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 the developing country could compensate the developed country for the reduction in environmental quality that would occur there if the resources 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

¹³⁹ Deepak Rajagopal & David Zilberman, *Review of Environmental, Economic and Policy Aspects of Biofuels 2* (World Bank Policy Research, Working Paper 4341, 2007), Available at http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469372&piPK=64165421&menuPK=64166322&entityID=000158349_20070904162607. The authors discuss details of lower greenhouse gas emission as a consequence of biofuel projects.

¹⁴⁰ Henderson & Quandt, *supra* note 102.

¹⁴¹ 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) (amid general attack on law and economics analysis, criticizing Kaldor-Hicks standard as “worsen[ing] the incoherence” of Pareto-based 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’ll address this below.

be receiving a transfer payment (in the form of improved standards of living that happen to improve environmental quality) from Americans. If this is 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” / “not green,” there is little hope that such trades could occur.¹⁴² 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 they were done.)¹⁴³ 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,¹⁴⁴ they 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

¹⁴² *E.g.*, Kleercut, Wiping Away Ancient Forests – Greenpeace, <http://www.greenpeace.org/usa/campaigns/forests/kleercut> (last visited July 21, 2008). 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.

¹⁴³ 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. While his motives and actions appear purely environmental, he faced populist hostility and governmental opposition *See* Knight, *supra* note 35.. A rich foreigner moving in and taking over a lot of land always spurs suspicion.

¹⁴⁴ These are among the important reasons why these countries are rich ones. *See, e.g.*, HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL: WHY CAPITALISM TRIUMPHS IN THE WEST AND FAILS EVERYWHERE ELSE* (2003) and PAUL COLLIER, *THE BOTTOM BILLION: WHY THE POOREST COUNTRIES ARE FAILING AND WHAT CAN BE DONE ABOUT IT* (2007).

benefits would thus put pressure on these countries to be more careful purchasers of environmental goods.

III. 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 (as with Kyoto) that has been selected for either scientific or political reasons (also as with Kyoto).¹⁴⁵

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).¹⁴⁶ Similarly, Scandinavian countries were recipients of acid rain from sources in eastern and southern Europe.¹⁴⁷ 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 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

¹⁴⁵ The Kyoto Protocol is an agreement tied to the United Nations Framework Convention on Climate Change. It is “binding” on 37 nations as to greenhouse gas emission levels. The U.N. Convention encourages nations to reduce emissions. *See generally* Kyoto Protocol - United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int/kyoto_protocol/items/2830.php (last visited August 4, 2008).

¹⁴⁶ *See* Richard Meyer & Bruce Yandle, *The Political Economy of Acid Rain*, 7 CATO J. 527 (1987). 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. When science does not square with politics, scientists can be unfunded.

¹⁴⁷ *See* note 3 *supra*.

the cost curve. A policy analysis sensitive 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 design. 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' 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.¹⁴⁸

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

¹⁴⁸ 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.

improve.¹⁴⁹ 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.¹⁵⁰ 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.¹⁵¹ 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.¹⁵² 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.¹⁵³ Part of the critique was based on a misunderstanding of the

¹⁴⁹ “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.” Jean Argas & Duane Chapman, *A Dynamic Approach to the Environmental Kuznets Curve Hypothesis*, 28 *ECOLOGICAL ECON.* 267 (1999). The origin of the literature in this area (which played on earlier work by Nobel-laureate Simon Kuznets that as incomes in a nation rise, income inequality increase, but eventually begins to become more equal) is attributed to Gene M. Grossman & Alan B. Krueger, *Economic Growth and the Environment*, 110 *QUART. 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 *supra* note 104.

¹⁵⁰ For a description, see Welcome to the Aldo Leopold Legacy Center, <http://www.aldoleopold.org/legacycenter/> (last visited August 4, 2008).

¹⁵¹ 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.

¹⁵² See note 16 *supra*.

¹⁵³ See Sheila Foster, *Race (ial) Matters: The Quest for Environmental Justice*, 20 *ECOLOGY L.Q.* 721, 721-722 (1993) (discussing a consensus that low-income areas bear a larger proportion of environmental exposure and health risks); Rachel D. Godsil & James S. Freeman, *Jobs, Trees, and Autonomy: The Convergence of the Environmental Justice Movement and Community*

economics of land use.¹⁵⁴ Unattractive land uses locate on low value land because it would be wasteful to build them on land that had a higher alternative use.¹⁵⁵ Poor people also tend to cluster on low value land because they cannot afford higher valued land.¹⁵⁶ As a result, the poor often end up as neighbors to unpleasant-to-be-near locations such as Superfund sites.¹⁵⁷ In short, the high price of real estate, and the attendant reduction in property values it would cause, makes it unlikely that a new oil refinery will be built in Manhattan,¹⁵⁸ while the much smaller drop (or even improvement) 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.¹⁵⁹ That is unlikely to change.

There is an important insight from the environmental justice literature 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.¹⁶⁰ Identifying the marginal costs and benefits of various environmental policies is one way to create pressure to do so.¹⁶¹ Most of the environmental justice literature has

Economic Development, 5 Md. J. Contemp. Legal Issues 25, 34 (1993/1994) (discussing “environmental justice’s” struggle to address the disparate impact of pollution on poor communities).

¹⁵⁴ H. Spencer Banzhaf & Randall P. Walsh, *Do People Vote with Their Feet? An Empirical Test of Tiebout’s Mechanism*, 98 AM. ECON. REV. 843 (2008).

¹⁵⁵ For an overview of the issues regarding the impact of “dirty” industrial areas and the poor, see NAT’L ENV’T L. JUST. ADVISORY COMMITTEE, 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>.

¹⁵⁶ See Vicki Been, *Locally Undesirable Land Uses in Minority Neighborhoods: Disproportionate Siting or Market Dynamics?* 103 YALE L. J. 1383, 1385 (1994).

¹⁵⁷ See generally Katherine A. Kiel & Michael Williams, *The Impact of Superfund Sites on Local Property Values: Are all Sites the same?* 61 J. URB. ECON. 170, 170-171 (2007) (citing EPA studies confirming that Superfund sites lower local house prices).

¹⁵⁸ 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 U.S. since 1978. See Dirk Lammers, *S.D. County Approves Rezoning for New Oil Refinery*, ASSOCIATED PRESS, June 4, 2008, available at http://www.boston.com/news/nation/articles/2008/06/04/sd_county_approves_rezoning_for_new_oil_refinery/.

¹⁵⁹ 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, 1037-1039 (describing efforts to build refinery in Yuma, Arizona).

¹⁶⁰ It may be that there are specific instances where deviations from this principle are justified, but it is a strong presumption.

¹⁶¹ See OFFICE OF MGMT. & BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, DRAFT 2003 REPORT TO CONGRESS ON THE COSTS AND BENEFITS OF FEDERAL REGULATIONS, 68 FED. REG. 5492, 5521 (Feb. 3, 2003), available at http://www.whitehouse.gov/omb/fedreg/2003draft_cost-benefit_rpt.pdf (last visited August 11, 2008) (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)); U.S. ENV’T L. PROT. AGENCY, FINAL RULE FOR CLEANER LARGE INDUSTRIAL SPARK-

focused on two issues. First, there have been critiques of the location of polluting facilities in poorer areas within rich countries.¹⁶² Second, there have also been extensive critiques of the export of polluting activities (whether waste disposal or the production of goods) to poor countries.¹⁶³ There has not, however, been much criticism of the practice of buying relatively costly marginal improvements in rich countries while neglecting relatively cheap marginal improvements in poor countries.¹⁶⁴ 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 U.S., 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 SO₂ emissions is lower in China, Mexico, and Tanzania, buying the reductions there instead of in Germany, the U.S., 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

IGNITION ENGINES, RECREATIONAL MARINE DIESEL ENGINES, AND RECREATIONAL VEHICLES § 10.3.9 (2002), available at <http://www.epa.gov/otaq/regs/nonroad/2002/cleanrec-final.htm> (calculating the value of the life of an elderly individual at 38% less than someone under 70). There is a particularly unfortunate example of a failure to adequately explain one such instance. See OFFICE OF MGMT. & BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, DRAFT 2003 REPORT TO CONGRESS ON THE COSTS AND BENEFITS OF FEDERAL REGULATIONS, 68 FED. REG. 5492, 5521 (Feb. 3, 2003), available at http://www.whitehouse.gov/omb/fedreg/2003draft_cost-benefit_rpt.pdf (last visited August 11, 2008) (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)); U.S. ENVT'L. PROT. AGENCY, FINAL RULE FOR CLEANER LARGE INDUSTRIAL SPARK-IGNITION ENGINES, RECREATIONAL MARINE DIESEL ENGINES, AND RECREATIONAL VEHICLES § 10.3.9 (2002), available at <http://www.epa.gov/otaq/regs/nonroad/2002/cleanrec-final.htm> (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*, TIME, July 10, 2008, available at <http://www.time.com/time/nation/article/0,8599,1821797,00.html> (terming the EPA report's calculations "politically explosive").

¹⁶² See Foster, *supra* note 153, at 721-722.

¹⁶³ 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 Loy. L.A. L. Rev. 1145, 1149 (1994) (referring to the exportation of waste and polluting industries to third world as "environmental colonization").

¹⁶⁴ See, e.g., Don Surber, *Saving Our Coasts by Ravaging Nigeria*, CHARLESTON DAILY MAIL, June 26, 2008, available at <http://www.dailymail.com/Opinion/DonSurber/200806260164>.

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 confronted 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 50 parts per billion (ppb) to 10 ppb at a cost per life saved (using EPA’s own numbers) of \$6.1 million when that same money could fund over 160,000 wells in India?¹⁶⁵ We cannot conceive of a rational, non-racist 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 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 rules¹⁶⁶ to greenhouse gas emissions reductions.¹⁶⁷ 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.¹⁶⁸ But progress is difficult and extremely costly, as these nations generally use

¹⁶⁵ Well cost of \$1300 assumed based on Ashok Gadgil, 23 ANN. REV. ENERGY ENVIRON. 253, 270 (1998), available at

<http://ewb-uiuc.org/system/files/Drinking%20Water%20in%20Developing%20Countries.pdf>.

¹⁶⁶ See Mexico etc Versus US: ‘Tuna-Dolphin’ – World Trade Organization (WTO), http://www.wto.org/english/tratop_e/envir_e/edis04_e.htm (last visited July 23, 2008) (tuna and dolphins); The Environment – A Specific Concern, A World Trade Organization (WTO) Dispute: The ‘Shrimp-Turtle’ Case, http://www.wto.org/English/thewto_e/whatis_e/tif_e/bey2_e.htm (last visited July 23, 2008) (shrimp and turtles).

¹⁶⁷ See Gerald Wynn, *Greenhouse Gas Cap Unlikely for Poor at Bali Talks*, REUTERS ALERTNET, Dec. 7, 2007, available at <http://www.alertnet.org/thenews/newsdesk/SP204393.htm>.

“Indigenous groups worry they will be marginalised by a scheme under discussion in Bali to allow poor countries to earn money by selling carbon credits to preserve their rainforests.”

¹⁶⁸ Greenhouse gas emissions in 2006 in the U.S. declined by 1.5 percent. It was not all due to novel environmental controls—some was attributed to weather, some to rising energy prices, and some to greater reliance on non-fossil fuels. See Emissions of Greenhouse Gases Report - Energy Information Administration (EIA), <http://www.eia.doe.gov/oiaf/1605/ggrpt/> (last visited July 23,

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 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.¹⁶⁹ 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.”¹⁷⁰

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 U.S. or the E.U. 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.¹⁷¹ 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.¹⁷² If such estimates were shown to be valid, it could be less costly to

2008). Given that the economy grew by about 3 percent that year, 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 European Environment Agency, *Reducing the Environmental Impact of Our Activities*, <http://www.eea.europa.eu/> (last visited July 23, 2008). See also David Charter, *EU's Carbon Trading Fails to Cut Emissions*, THE TIMES, April 3, 2007, available at <http://www.timesonline.co.uk/tol/news/world/europe/article1605038.ece> (“The 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*, THE GUARDIAN, June 18, 2005, available at <http://www.guardian.co.uk/uk/2005/jun/18/environment.society> (citing an increase of 1.1% from 2003-2004 for 15 countries who were EU members).

¹⁶⁹ One study estimates that China’s CO₂ emissions will grow at an average annual rate of 11 percent, 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*, J. ENV’T L. ECON. & MGMT. 2008 (forthcoming), available at http://repositories.cdlib.org/are_ucb/971/

¹⁷⁰ Press Release, Sarah Yang, UC Berkeley, *New Analysis Finds Alarming Increase in Expected Growth of China CO₂ Emissions* (10 Mar. 2008), available at http://www.berkeley.edu/news/media/releases/2008/03/10_chinaco2.shtml

¹⁷¹ 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.

¹⁷² 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

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.

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 non-governmental 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.¹⁷³

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

there are numerous uncontrolled mine fires, CO₂ and other emissions are generated for no beneficial purpose such as producing electricity. See Kevin Krajick, *Fire in the Hole*, SMITHSONIAN, May 2005, available at, <http://www.smithsonianmag.com/travel/firehole.html>. There are some such fires in the U.S. but they are a larger problem in China, where little is done about most of them.

¹⁷³ 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 the Office of Management and Budget (OMB) website for examples: The President's Management Agenda – Results.gov, <http://www.whitehouse.gov/results/agenda/index.html> (last visited July 24, 2008). 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.

Governments regularly calculate the benefits and costs of regulatory measures.¹⁷⁴ 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 non-transparent methods.¹⁷⁵ 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.¹⁷⁶ Transparency is good and 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

¹⁷⁴ The Office of Information and Regulatory Affairs (OIRA) in the OMB has long done much of the cost-benefit work. *See id.* The GAO 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.,* General Accounting Office Review – National Center for Environmental Economics, <http://yosemite.epa.gov/ee/epalib/riaepa.nsf/7f727a0dc1d97c3a852567840015b9a3/b0b647ced4a5b42485256757006ea0f0!OpenDocument> (last visited July 24, 2008). Outside groups may object to cost-benefit analysis as they can be inconsistent with special interests. *See, e.g.,* Kenny S. Crump & Robin Gentry, *Graham's Nomination to Head OMB-OIRA Threatens Health, Safety, and Environmental Safeguards*, 13 RISK ANALYSIS 487-489 (1993), available at <http://www.citizen.org/congress/regulations/graham/oiraoverview.html>.

¹⁷⁵ *Why Should an Outhouse Cost Taxpayers \$1 Million?*, USA TODAY, Dec. 16, 1997, at 14A, available at <http://pqasb.pqarchiver.com/USAToday/access/23929987.html?dids=23929987:23929987&FMT=ABS&FMTS=ABS:FT&date=Dec+16%2C+1997&author=&pub=USA+TODAY&edition=&startpage=14.A&desc=Why+should+an+outhouse+cost+taxpayers+%241+million%3F>. Congressional earmarks for boondoggles in national parks are something to behold, given the shabby condition of the parks.

¹⁷⁶ *E.g.,* CONG. BUDGET OFF., CONGRESS OF THE UNITED STATES, POLICY OPTIONS FOR REDUCING CO₂ EMISSIONS (Feb. 2008), available at <http://www.cbo.gov/ftpdocs/89xx/doc8934/02-12-Carbon.pdf>.

them by establishing benchmarks will lead to a convergence on more generally accepted numbers.¹⁷⁷

When higher quality, and more, data are available, it will be possible to have a more informed debate about environmental policy along the following lines. Suppose EPA is considering a rule like the change in the Safe Drinking Water Act standard for arsenic imposed as part of the Clinton Administration's midnight regulations in 2001.¹⁷⁸ This was a high-marginal-cost, low-marginal-benefit regulation relative to improving drinking water availability in countries lacking basic sanitation.¹⁷⁹ Instead of the rather emotional debate over arsenic levels that followed the Bush Administration's reconsideration of the arsenic standard change,¹⁸⁰ 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

¹⁷⁷ 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. 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. Cass R. Sunstein, *Lives, Life-Years, and Willingness to Pay*, 104 COLUM. L. REV. 205 (2004).

¹⁷⁸ The Arsenic in Drinking Water Rule (66 FR 6976, published Jan. 22, 2001) 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. See 40 C.F.R. §§ 9, 141, 142 (2001), available at http://www.epa.gov/OGWDW/arsenic/regulations_techfactsheet.html. 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 (2003). The arsenic regulation provoked a considerable scholarly controversy. Compare Cass R. Sunstein, *The Arithmetic of Arsenic*, 90 GEO. L. J. 2255 (2002) and Thomas O. McGarity, *Professor Sunstein's Fuzzy Math*, 90 GEO. L.J. 2341 (2002); Lisa Heinzerling, *Markets for Arsenic*, 90 GEO. L. J. 2311 (2002); Shi-Ling Hsu, *Fairness versus Efficiency in Environmental Law*, 31 ECOLOGY L. Q. 303 (2004).

¹⁷⁹ EPA's estimate showed the costs to outweigh the benefits. EPA SCIENCE ADVISORY BOARD, ARSENIC RULE BENEFITS ANALYSIS (2001), available at <http://www.epa.gov/OGWDW/arsenic/pdfs/ec01008.pdf>. This estimate was critiqued by an AEI-Brookings Joint Center for Regulatory Studies analysis. See JASON K. BURNETT AND ROBERT W. HAHN, AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES, EPA'S ARSENIC RULE: THE BENEFITS OF THE STANDARD DO NOT JUSTIFY THE COSTS (2001), available at <http://aei-brookings.org/admin/authorpdfs/redirect-safely.php?fname=../pdffiles/phppu.pdf>. This showed costs to exceed the benefits by \$187 million; meaning an estimated \$65 million per statistical life saved.

¹⁸⁰ 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 Aug. 10, 2008).

environmental quality overall.¹⁸¹ 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.¹⁸² 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.¹⁸³

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.¹⁸⁴ This would create an incentive for shifting expenditures to where they bought the greatest valued increase 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.¹⁸⁵

¹⁸¹ 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 (2002), available at: <http://www.rff.org/Documents/RFF-Resources-147-arsenicrule.pdf>

¹⁸² The World Health Organization estimates that 1.5 million children die annually due to contaminated water; see Lack of Water and Inadequate Sanitation, Children’s Environmental Health – World Health Organization, <http://www.who.int/ceh/risks/cehwater/en/> (last visited Aug. 10, 2008). If these lives were valued at \$5 million each, the cost would be \$7.5 trillion annually.

¹⁸³ “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. 15, 2007, available at <http://www.dallasnews.com/sharedcontent/dws/news/texasouthwest/stories/101607dntexcancer.367c273.html>. 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.

¹⁸⁴ 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* (2005). Integrity in federal spending is beyond the ken of this paper.

¹⁸⁵ 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, August 4, 2008, <http://thehill.com/leading-the-news/white-house-says-no-to-special-session-of-congress-2008-08-04.html> (last visited August 4, 2008).

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 U.S. which yields benefits of \$23 million¹⁸⁶ than to provide safe drinking water and sanitation to an additional half-million people each year in developing countries for the same cost.¹⁸⁷ The World Health Organization (WHO) estimates a benefit of water and sanitation facilities of \$2 to 5 for every \$1 spent in Asia and Africa.¹⁸⁸ (It must be noted that the WHO benefit analysis is much more conservative than how benefits are measured in the U.S., where the value of every life is common presumed to be at least \$5 million. Most of the rest of the world is much more modest, only measuring direct lost wages from illness and death.¹⁸⁹ If U.S. benefit presumptions were applied to such projects, the benefit measures would 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.

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.¹⁹⁰ Our analysis suggests that it is likely that the United States ought to

¹⁸⁶ Burnett & Hahn, *supra* note 1798, at 14.

¹⁸⁷ 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 \$193-249 per capita for sanitation (septic tanks are cheaper); so presume \$400 per capita total to provide and maintain such facilities. 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 to 22 annually. Hence, over ten years, infrastructure for water and sanitation could be provided to five million persons. For water alone, it would be more than double that number, but doing both at once has significant advantages. See GUY HUTTON & JAMIE BARTRAM, WORLD HEALTH ORGANIZATION, REGIONAL AND GLOBAL COSTS OF ATTAINING THE WATER SUPPLY AND SANITATION TARGET (TARGET 10) OF THE MILLENNIUM DEVELOPMENT GOALS (2008), available at http://www.who.int/water_sanitation_health/economic/mdg_global_costing.pdf

¹⁸⁸ GUY HUTTON & LAURENCE HALLER, WORLD HEALTH ORGANIZATION, EVALUATION OF THE COSTS AND BENEFITS OF WATER AND SANITATION IMPROVEMENTS AT THE GLOBAL LEVEL 35 (2004), available at http://www.who.int/water_sanitation_health/wsh0404.pdf.

¹⁸⁹ *Id.* 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 U.S., see Donald J. Boudreaux et al., *Talk Is Cheap: The Existence Value Fallacy*, 29 ENVTL. LAW 765 (1999).

¹⁹⁰ See, e.g., Mark A. Uhlig, *Mexico Closes Giant Oil Refinery to Ease Pollution in the Capital*, N.Y. TIMES (March 19, 1991) (available at

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.¹⁹¹ 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.¹⁹² 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.¹⁹³ This is true for Mexico, the U.S., 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.

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

<http://query.nytimes.com/gst/fullpage.html?res=9D0CE1DD1331F93AA25750C0A967958260> (describing closure of a refinery accounting for 7% of national capacity because of pollution it caused).

¹⁹¹ We leave aside the problem of the perception of the American public that “foreign aid” is generally unimportant.

¹⁹² Constitución Política de los Estados Unidos Mexicanos [Const.], *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*, NY TIMES, Feb. 17, 2002, *available at*

<http://query.nytimes.com/gst/fullpage.html?res=9B05E0DF113FF934A25751C0A9649C8B63&sec=&spon=&&scp=1&sq=mexican%20government%20%20forbids%20foreign%20investment%20in%20oil&st=cse> (describing presidential promises to allow foreign participation in oil industry and opposition from labor unions and other nationalist forces).

¹⁹³ *See generally* Robert L. Glicksman, *Balancing Mandate and Discretion in the Institutional Design of Federal Climate Change Policy*, 102 Nw. U. L. Rev. Colloquy 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 ENV'T L. L. REP. NEWS & ANALYSIS 10388, 10397 (2008) (describing a history of “manipulation and obfuscation” with carbon offsets trading systems that reduce beneficial effects).

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,¹⁹⁴ 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 Bush administration gave in on the issue and adopted a more stringent (and costly) rule for mercury.¹⁹⁵ 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.

¹⁹⁴ 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 53, at 957; Andrew P. Morriss, *The Politics of the Clean Air Act*, in *POLITICAL ENVIRONMENTALISM* (Terry L. Anderson ed., Hoover Institution 2000). In the case of the Clean Air Act, that was borne out in practice. See Ackerman & Hassler, *supra* note 79. In the case of the Clean Water Act, see Anand Bhansali et al., *Sewage Treatment as an Industry Subsidy*, 68 *ECON. GEOG.* 174 (1992).

¹⁹⁵ See 40 C.F.R. §§ 60, 63, 72, 75 (2005) (EPA's "Final Mercury Rule").

Table 1: Pollution Control Expenditures

Country		% GDP		Per Capita Expenditures					
		Total expenditures		Wastewater		Air		Waste	
		All	Public	Public	Business	Public	Business	Public	Business
Developed Economies	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
Developing & Former Soviet	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 Environmental Information and Outlooks, Pollution and Abatement and Control Expenditure in OECD Countries, March 2007, Tables 1 & 4. 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

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

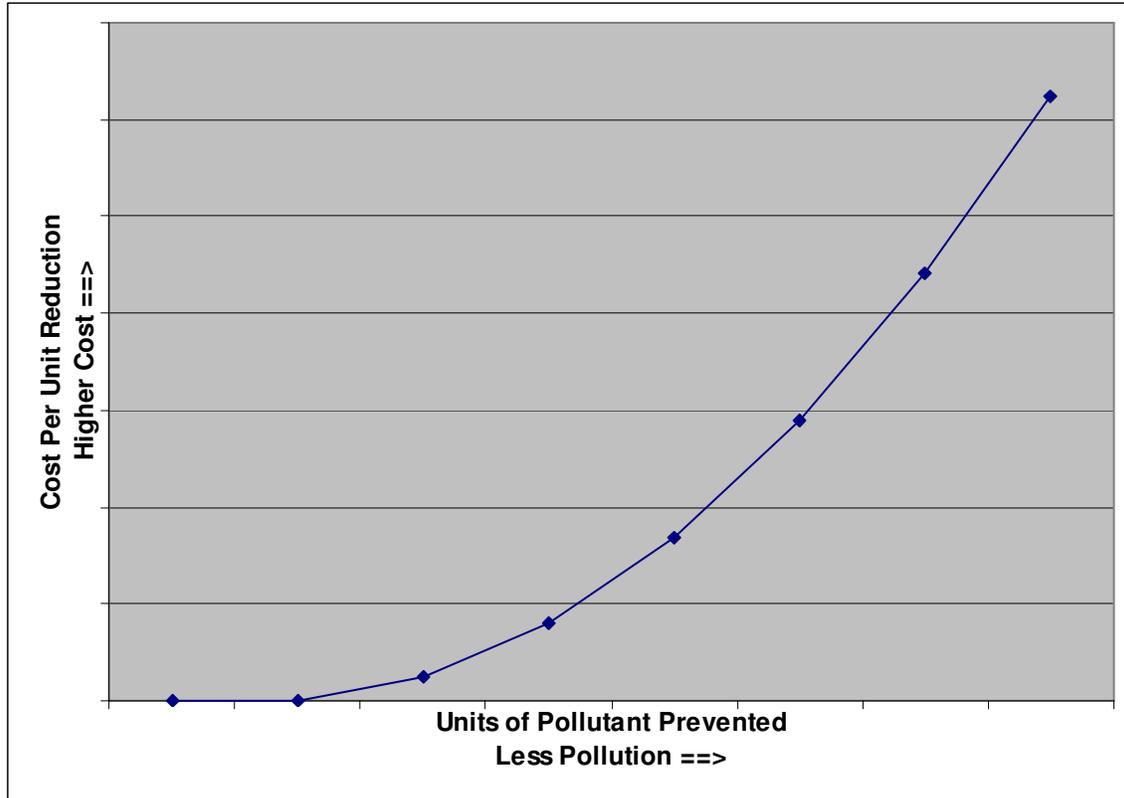


Figure 1: Marginal Cost of Pollution Reduction

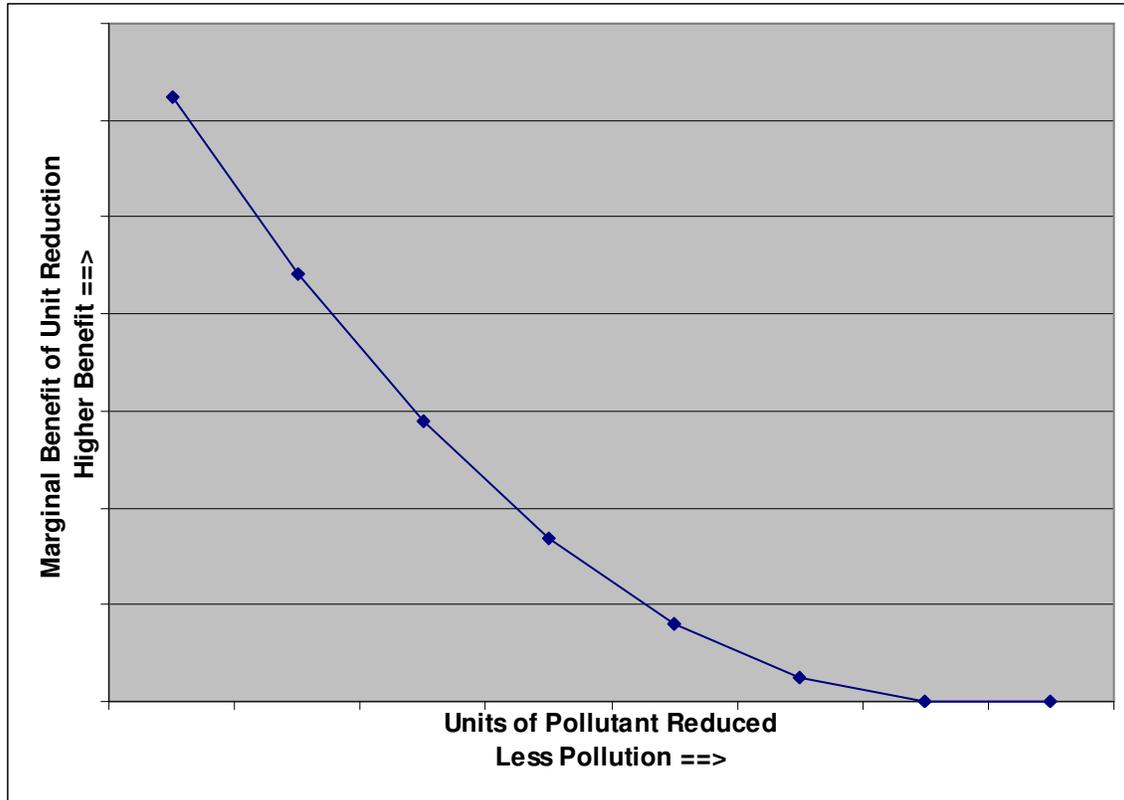


Figure 2: Marginal Benefits

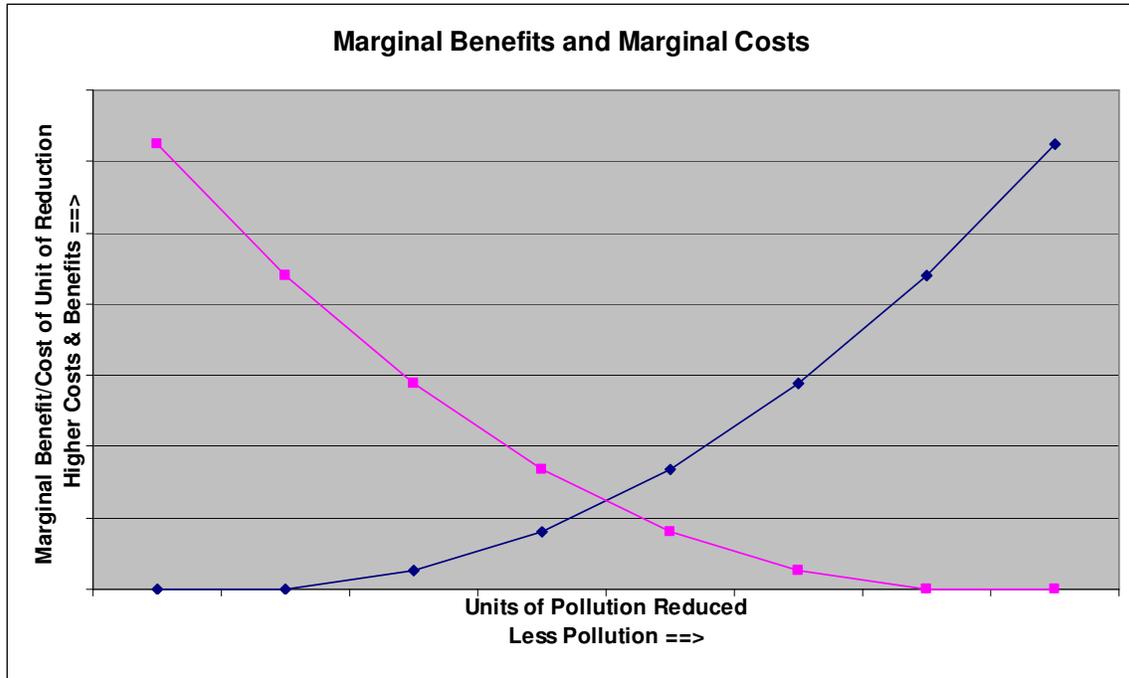


Figure 3: Marginal Benefits and Marginal Costs

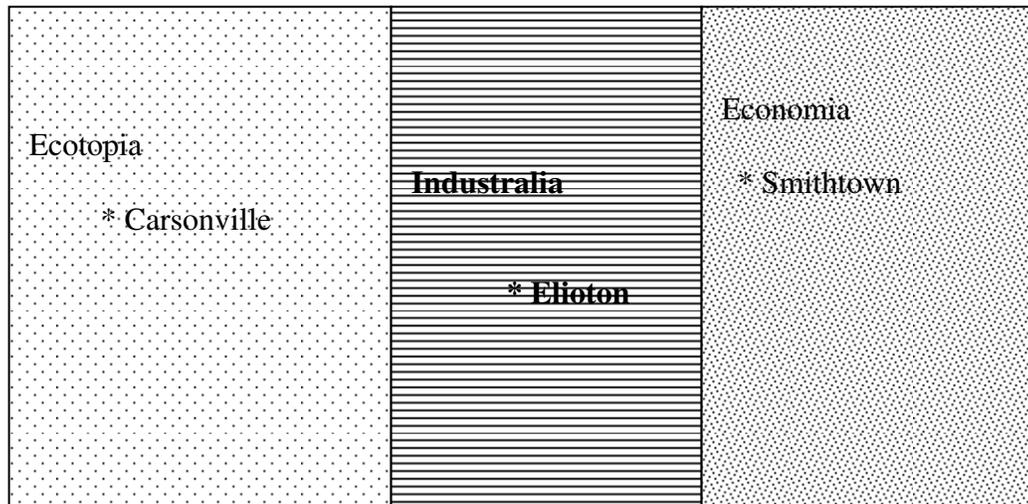


Figure 4: Borders