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Articles

Why and How to Tax Carbon[†]

Michael Waggoner*

Samuel Gompers, founder of the American Federation of Labor, was asked what labor wanted. He replied, "More."[1] *We cannot afford very much "more" anymore, but we can have "better." "Better" is the new, less carbon-intensive world.*

ABSTRACT

Increased concern about possible global warming due to rising levels of greenhouse gases such as carbon dioxide ("CO_2") suggests the need to control emissions of CO_2. This article explores a system of revenue-neutral carbon taxes as a supplement or alternative to other CO_2 control systems such as subsidies, regulation, and cap-and-trade. A system of carbon taxation should be, the Article suggests, sufficiently fairer and simpler and more efficient than the other possible systems of CO_2 control and that it merits serious consideration. Because the carbon

[†] This article was presented at the CU-Energy Initiative Research Symposium in Boulder, Colo. (Nov. 2008). It will be presented at the Society for Environmental Law and Economics meeting in Vancouver, Canada (Mar. 2009) and the Law and Society Association meeting in Denver, Colo. (May 2009).

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1. Rosanne Currarino, *The Politics of "More": The Labor Question and the Idea of Economic Liberty in Industrial America***,** THE JOURNAL OF AMERICAN HISTORY 17, (June 2006), *available at* http://www.historycooperative.org/journals/jah/93.1/currarino.html.

tax that is suggested would be revenue neutral, it should be politically acceptable. Problems with a carbon tax such as regressivity, possible disruption of international trade, and impact on other societal values are explored.

The carbon tax, it is suggested, should be enacted along with a Value Added Tax ("VAT") for two reasons. First, the carbon tax should start low (so as not to disrupt the economy) and increase steadily (to create substantial incentives to reduce CO_2 emissions). Revenue from the carbon tax will rise initially as the rate increases, but eventually the expected reduction in carbon use will cause carbon tax revenues to fall even though rates remain high and even increase. To keep the carbon tax revenue-neutral, other taxes will have to fall as carbon tax revenues rise, then rise as carbon tax revenues fall. To avoid upsetting the expectations that underlie long-term investments and planning, it may be desirable to have relatively stable income tax rates, and thus it would be best to have the variation occur in the VAT rates. Second, the carbon tax will be regressive, so it should be accompanied by some form of rebate or income maintenance program for people with low incomes. The carbon tax initially will generate too little revenue to justify creating such a program, but the VAT will be similarly regressive and from the start it can generate enough revenue to justify and fund such a rebate program.

I. INTRODUCTION

To address the challenge of global warming more effectively, and to improve its tax base, the United States should impose a revenue-neutral carbon tax on all domestic production and importation of coal, petroleum, and natural gas. The United States should seek to persuade other nations that carbon taxation is a critical tool in confronting the dangers of global warming. This Article first argues that a carbon tax is a necessary and politically feasible tool to resist the rise in global temperatures attributable to increased carbon dioxide ("CO_2") that human activities have injected into the atmosphere. The Article then explores how a carbon tax might be designed and implemented.

This carbon tax would have two major purposes. First, imposing a tax on carbon production would create an incentive to reduce carbon dioxide emissions. This reduction is desirable because carbon dioxide emissions appear to be contributing significantly to global warming and climate change, developments that may cause serious environmental damage.[2] The carbon tax may be a better tool for carbon reduction than

2. The discussion here accepts the argument that human conduct risks increasing greenhouse gases, and hence the risks of global warming, without exploring the role of

alternatives such as subsidies, regulation, or cap-and-trade.[3] However, the solution for reducing carbon emissions may include all four of these and other approaches, as a matter of both practical politics and administrative feasibility.

The second major purpose of taxing carbon would be to create a more efficient and equitable means of raising revenue than taxing income, consumption, or other typical bases for taxation. Because of this efficiency and fairness, it is less important to determine precisely how much and how fast the emission of CO_2 is changing the world's climate, or to determine the possible consequences of those changes on humans and other inhabitants of the planet.

The carbon tax proposal is based in part on agnosticism and humility. First, while there appear to be solid reasons to believe that human activity is contributing to global warming and that global warming may present serious risks to humans and other inhabitants of this planet, neither of those statements is entirely free from doubt. Even accepting those statements, it is not clear how serious the impact will be or how soon it will arrive. There is also uncertainty as to the trade-off between alleviating these risks and other social values, such as freedom and economic well-being.[4] Second, it is not clear how best to proceed. The Appendix briefly describes and evaluates systems of subsidies, regulation, and cap-and-trade. These systems might promise more definite reductions in carbon emissions, but the value of that definiteness is constrained by the limits of our knowledge. Those approaches thus

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other possible causes, such as fluctuations in the sun's output or the Earth's absorption or radiation of energy. This discussion also accepts the argument that global warming may present very serious risks, even though some areas or activities might benefit.

3. This Article addresses only the carbon tax, leaving to others the exploration of such approaches as subsidies, regulation, and cap-and-trade, which are briefly described in the Appendix. These different approaches will need to be evaluated carefully to determine their effectiveness and costs, as well as political and administrative problems in their implementation. *See, e.g.*, Maxine Burkett, *Just Solutions to Climate Change: A Climate Justice Proposal for a Domestic Clean Development Mechanism*, 56 BUFF. L. REV. 169 (2008); Eric Posner & Cass R. Sunstein, *Climate Change Justice*, 96 GEO. L.J. 1565 (2008); Carol M. Rose, *From H_2O to CO_2: Lessons of Water Rights for Carbon Trading*, 50 ARIZ. L. REV. 91 (2008); Alan Carlin, *Global Climate Change Control: Is There a Better Strategy Than Reducing Greenhouse Gas Emissions?*, 155 U. PA. L. REV. 1401 (2007); Christina K. Harper, *Climate Change and Tax Policy*, 30 B.C. INT'L & COMP. L. REV. 411 (2007); Cass R. Sunstein, *Irreversible and Catastrophic*, 91 CORNELL L. REV. 841 (2006); Cinnamon Carlarne, *The Kyoto Protocol and the WTO: Reconciling Tensions Between Free Trade and Environmental Objectives*, 17 COLO. J. INT'L ENVTL. L. & POL'Y 45 (2006).

4. *See generally* BJØRN LOMBORG, THE SKEPTICAL ENVIRONMENTALIST: MEASURING THE REAL STATE OF THE WORLD (2001) (arguing that the economic costs of mitigating carbon emissions outweigh the benefits).

might reduce carbon too little or too much, and they might impose excessively or too little on other values such as freedom and economic well-being. With experience, a system of carbon taxes can be modified more easily than subsidies that may already have been spent (perhaps unwisely), regulations that may require substantial business expenditures for compliance and government expenditures for enforcement, and purchases of carbon emission rights that may lose value. It is clear that the carbon tax will have the desired effect of putting downward pressure on the level of carbon emissions, and that pressure may be adjusted relatively easily by increasing or decreasing the tax rate in light of experience. However, it must be admitted that all of these approaches will have substantial costs and are likely to involve mistakes and false starts.

This proposal is not for an add-on tax, but rather for a carbon tax to replace revenues that would otherwise be generated. The level of revenue to be generated should depend on political choices that are beyond the scope of this Article. These choices include the appropriate level and mix of governmental expenditures and the appropriate levels and subjects of taxation, both determined in light of government revenue needs and the reductions that taxes may impose on the economy and on incentives. The point is that the carbon tax should not be a fund to resolve environmental problems; rather, it should be one among many sources of governmental funds. There may be little relationship between the level of carbon tax needed—based on both environmental concerns and the need to avoid too severely crimping the economy—and the expenditures needed for environmental remediation. The amount and proportion of each source of tax revenue to be used should be based on economic and political considerations, and the funds generated by all sources should be allocated through the political process.

A.Carbon Taxes and $4 Gasoline

This carbon tax proposal is not motivated by any hostility to energy company prices or profits. That industry is highly competitive, and prices can go down as rapidly as they rise. This was demonstrated by the roughly fifty percent fall in petroleum prices from July to October of 2008, after a substantial run-up. The goal is rather to reduce carbon emissions and to provide a fair and efficient tax system.

The first barrier to fair consideration of a carbon tax proposal is the recent high price of petroleum products. To add a carbon tax of one dollar or more per gallon to the price of gasoline, recently selling for more than four dollars per gallon, will create serious political pushback, jeopardizing the agendas, political careers, and perhaps even the physical

safety of such a proposal's advocates. The recent reduction in energy prices may soon be replaced by another increase. There are three major reasons, however, why those high petroleum prices should not prevent enacting a carbon tax.

First, the proposed carbon tax is a substitute for other taxes, not an addition to them. For example, an individual's average income tax rate might be twenty percent, and that individual might use seven percent of his or her income for carbon products. That individual would be no worse off after taxes, if a carbon tax increased the cost of the carbon products by five percent of that taxpayer's income (from seven percent to twelve percent of income), so long as the average rate of the income tax were lowered by five percent (from twenty percent to fifteen percent). In this situation, the extra cost of the carbon tax would be offset by the reduction in the income tax.

Second, it is not clear that the price of consumed carbon will rise by the amount of the carbon tax. Some of the tax may be absorbed by the producers of carbon. The degree of price-shifting depends on the relative elasticities of supply[5] and demand,[6] but it is unlikely that the tax will be borne entirely by consumers. One would expect sales of carbon-based products to fall because of the price increase created by the carbon tax. To mitigate that drop in sales, the producer of those carbon-based products might slightly reduce the price to avoid an overly steep drop in sales, thus absorbing part of the tax.

This second point may have great potential. If only one nation imposes a carbon tax, it may be that much of that tax would be borne by that nation's population. Under these conditions, world carbon prices will largely be set in carbon-tax-free markets, and the few carbon-taxing nations' populations will have to pay much of the carbon tax. If most nations impose a carbon tax, however, it may be that more of the tax will be borne by the producers of carbon; world carbon prices will be set in largely carbon-taxed markets, with more of the tax absorbed by the producers. This shift of carbon taxes to carbon producers could help undo the recent shift in world balances of power to the carbon-exporting nations such as Iran and Venezuela—with their arguably authoritarian regimes—and return world power back to carbon-consuming nations.

Third, individuals can change their conduct to reduce their carbon tax liability. Although some users of certain carbon products, such as gasoline, may have little ability to reduce their carbon-based purchases,

5. *See* BusinessDictionary.com, Definition of Elasticity of Supply, http://www.businessdictionary.com/definition/elasticity-of-supply.html (last visited Nov. 11, 2008).

6. *See* BusinessDictionary.com, Definition of Elasticity of Demand, http://www.businessdictionary.com/definition/elasticity-of-demand.html (last visited Nov. 11, 2008).

other users may be flexible even in the short run, and even more users should be flexible in the long run. In the short run, possibilities for decreasing carbon use include: reducing recreational driving; planning accordingly to accomplish several social, shopping, and business excursions in one trip; walking, bicycling, carpooling, or using mass transit more often; and scheduling work for four days rather than five, reducing commuting by twenty percent. Many persons may be able to choose to use their fuel-efficient sedan more than their fuel-guzzling SUV, minivan, or pickup truck. Moreover, in the long run, individuals can buy or rent more fuel-efficient cars, homes, and appliances; live closer to work or to mass transit; invest in alternatives such as hybrid, plug-in, or perhaps hydrogen or fuel cell[7] vehicles; and use energy collected from solar, wind, water, geothermal, biomass, or other sustainable sources.

Note that these three mechanisms are cumulative. As discussed in the first point, other taxes will be reduced by the full amount of the carbon tax. Additionally, it is likely that some of the tax will be borne by producers, so that consumers' carbon tax burden will be less than the benefit of the income tax cut. Finally, as explained in the third point, consumers can change their behavior to further reduce the impact of the carbon tax, coming out still further ahead.

These points should not be overstated. Although in this scenario the average citizen comes out ahead, the citizenry is composed of both those who use little carbon and those who use too much. While light users will come out far ahead, heavy users will likely suffer, unless they can change their conduct to reduce their carbon use or can find some method to pass on some of their increased carbon costs. In addition, revenues will have to be maintained, so greater than projected reductions in carbon use will have to be made up by increasing the carbon tax. Thus, only those who can reduce their carbon use faster than the norm will come out ahead under the third mechanism. On the positive side, however, if a particular business can reduce its carbon tax liability more than others in its industry while matching competitors' prices and earning higher profits, it

7. For more information regarding hydrogen fuel and fuel cells see, e.g., Robert F. Service, New Catalyst Marks Major Step in the March Toward Hydrogen Fuel, 321 Science 620 (2008), *available at* http://www.sciencemag.org/cgi/content/full/321/5889/620 (discussing electrolysis to produce hydrogen); Bjorn Winther-Jensen, Orawan Winther-Jensen, Maria Forsyth, & Douglas R. MacFarlane, High Rates of Oxygen Reduction over a Vapor Phase–Polymerized PEDOT Electrode, 321 Science 671 (2008), available at http://www.sciencemag.org/cgi/content/full/321/5889/671 (discussing fuel cells); J. Garcia-Barriocanal et al., Colossal Ionic Conductivity at Interfaces of Epitaxial ZrO_2:Y_2O_3/$SrTiO_3$ Heterostructures, 321 SCIENCE 676 (2008), *available at* http://www.sciencemag.org/cgi/content/full/321/5889/676 (discussing fuel cells).

would have a substantial incentive to widen the gap between its carbon use and that of the industry norm.

Along with the benefits discussed above, there is an additional reason why a carbon tax is desirable. Taxes are necessary to provide revenue to pay for government programs, but any tax has ill effects. There will always be inefficiencies in collecting taxes. Taxpayers incur costs to plan and comply with taxes, to avoid taxes, or perhaps to evade taxes. Tax collectors incur costs to enforce taxes. Tribunals incur costs to resolve disputes over taxes. These costs waste resources. In addition, any tax distorts behavior, slowing economic activity by withdrawing funds from the economy and reducing incentives to work, innovate, and take risks. What is taxed may affect these harms. A tax on income, for example, may reduce incentives for working, saving, and financial risk-taking. A tax on consumption may reduce expenditures on food, clothing, shelter, health care, and entertainment, which are some of the main goals of human activity and should not be discouraged unnecessarily. In contrast, a tax on carbon discourages carbon use, which should have two major benefits. The first is the reduction of carbon emissions that threaten to accelerate global warming. The second is the value of carbon in its native form. Coal and petroleum can be the raw materials for chemicals and medicines that can have great value to society.[8] To burn those raw materials unnecessarily is wasteful. We will, of course, continue to tax incomes and consumption, but we must ask how much higher to push the marginal tax on each, or how much of a tax reduction on either to forgo, as opposed to imposing a tax on carbon. While there are clear losses to society in discouraging either income or consumption, it is hard to see a comparable loss to society from a reduction in carbon usage.

The counterargument to the preceding paragraph is that carbon consumption per se is not valuable, but energy is necessary to our society, and much of that energy is likely to come primarily from fossilized carbon for the foreseeable future. There are two responses to this counterargument. First, the carbon tax should be gradually phased in, so that there will be time to develop new sources of energy to replace carbon. Second, we may simply have to live with less energy. Most sources of energy have potential problems: nuclear reactors create plutonium and other radioactive materials with long half-lives, risking accidents or terrorism; bio-fuels seem to be driving up food prices; hydroelectric power requires dams that harm fish and other wildlife and that may fail catastrophically; windmills may endanger birds and bats,

8. HANS-GEORG ELIAS, AN INTRODUCTION TO PLASTICS §3.1.1, at 31 (2d ed. 2003) ("The main raw material for [plastics] is petroleum . . . Coal tar is the raw material for aromatics such as benzene, toluene, and xylenes . . .").

and some consider windmills to be visual pollution. However, to use less energy need not mean a lower standard of living. Our society, our machines, our homes, and our lives have evolved to their present state only in the very recent past and in a world of very inexpensive energy. With energy becoming more expensive, design and habits should change as we learn to substitute more time, labor, material, and engineering for some of the energy we now expend. The historic link between energy consumed and quality of life need not control the future.[9]

A carbon tax will merely speed up inevitable societal changes and cause them to occur in a more orderly manner. The extent of the Earth's fossil carbon resources is uncertain and although there are likely to be further major discoveries, these resources are ultimately finite. World economic growth is consuming them at accelerating rates. The recent sudden rise in petroleum prices warns us of what might happen in the future unless we smooth the transition to a less carbon-intensive world.

Finally, the carbon tax could be reduced or suspended during an energy emergency, such as when normal supplies of energy are cutoff by natural disasters, wars, or boycotts. The reduction or suspension could be achieved by legislation, authority delegated to the executive, or automatic triggers. However, one should remember that high prices discourage consumption, and reduced consumption is an appropriate response to energy supply disruption. Moreover, reduction or suspension of the carbon tax will benefit both users and producers of carbon in uncertain proportions. While one would hope that the suspension would benefit the users, the suspension is also likely to benefit the producers to some extent. To increase the producers' profits at a time when they are already swollen by an emergency energy price increase does not seem to be a wise policy.

On the other hand, to adjust the carbon tax to produce a steady rise in carbon costs would promote efficient development of new technologies. Too often in the past, sudden price increases have found the substitute technology undeveloped or not yet deployed. Additionally, sudden price decreases have frequently derailed development and deployment of new technologies.[10] Under this approach, instead of steadily increasing carbon taxes, Congress might provide for a steady rise in the price of carbon, including the tax. Under this approach, the tax

9. *See* DEP'T OF ENERGY, ENERGY INFORMATION ADMIN., ENERGY CONSUMPTION, EXPENDITURES, AND EMISSIONS INDICATORS, 1949-2007 tbl. 1.5, http://www.eia.doe.gov/emeu/aer/txt/ptb0105.html. (last visited Nov. 11, 2008) (indicating declining carbon emissions per real dollar of GDP since 1980).

10. See Clifford Kraus, Alternative Energy Suddenly Faces Headwinds, N. Y. TIMES, Oct. 20, 2008, *available at* http://www.nytimes.com/2008/10/21/business/21energy.html?em.

would rise less as carbon prices rose faster, and the carbon tax would rise more when carbon prices were not rising. This smoothing might ease the weaning from carbon dependence.

On balance, there should be enough winners from enacting a carbon tax to make it worthwhile to explore how such a tax might operate.[11] Part II of this article outlines the mechanics of a carbon tax system. Part III addresses the need to reduce the serious regressivity in consumption taxes generally, including a carbon tax. Part IV discusses combining a carbon tax with another kind of consumption tax, a Value Added Tax ("VAT"). Part V focuses on the international issues presented by a carbon tax. Part VI considers the interrelationship of the carbon tax and other social goals.

II. THE MECHANICS OF A CARBON TAX

In its simplest form, a carbon tax would be imposed on the production of fossil carbon, whether by mining coal, pumping petroleum, or extracting natural gas. The tax would not be based on the value of the product or on its energy content, but solely on its carbon content. Coal consists overwhelmingly of carbon, so all of the material removed would be taxed. Natural gas consists largely of methane or CH_4, in which each molecule consists of one carbon atom and four hydrogen atoms, so only a portion of the material removed would be taxed. Petroleum is a mixture of hydrocarbon molecules that is intermediate between coal and natural gas, with each petroleum molecule including both hydrogen and carbon atoms, but with more carbon and less hydrogen than natural gas.

A carbon tax will resemble the gasoline taxes imposed by the federal government and by state governments in the United States, but with three major differences. The first arises in the point along the chain from mining to ultimate consumption where the tax is imposed. The carbon tax would be imposed at the point of extraction, the very start of

11. The winner of a political contest may be difficult to predict. That more people would win from a carbon tax than would lose does not necessarily mean that the tax will be enacted. Those fearing loss of what they now enjoy may be more highly motivated to act than those expecting future uncertain and often broadly-shared gains. *See generally* GENE M. GROSSMAN & ELHANAN HELPMAN, SPECIAL INTEREST POLITICS (2001). The losers may fear not just the extra costs they will bear under a carbon tax, but that those costs will reduce the value of economic interests they now hold. For example, an increase of $10,000 annually in the cost to heat and cool a house from a carbon tax is certainly a problem, but an even greater problem would be a $100,000 drop in the value of that house as prospective buyers capitalize those extra costs, and still greater a problem if the house has a large mortgage so that the price drop takes much or all of the owner's equity. This article does not predict that a carbon tax can be enacted; it only suggests that there is a sufficient possibility that there is reason to proceed.

that chain, when the coal, petroleum, or natural gas is first removed from the ground, whereas the gasoline tax is imposed at the end of the chain when it is sold to the consumer. The second difference is the breadth of the taxes. The carbon tax would be imposed on all forms of carbon extraction, and it would be applied regardless of end-use. Coal or petroleum used to make plastics or fertilizer would be taxed, as would coal or petroleum used for fuel. On the other hand, the gasoline tax applies to gasoline, which is only a part of the spectrum of products made from petroleum—and to a limited but perhaps growing extent made from coal or natural gas—and only if the gasoline is to be used for certain purposes. Gasoline taxes are imposed on gasoline to be used in motor vehicles to pay for highways, on fuel for boats to protect and improve inland waterways, and on fuel for aircraft to operate airports and the air traffic control system.[12] Gasoline to be used for farm equipment or to fuel cooking stoves, however, is normally exempt from the gasoline tax. The third difference is in the use of the proceeds. Carbon tax revenue could be used for general government purposes, while the gasoline tax revenue is used only to build, maintain, and operate highways, waterways, or airways.

At its core, a carbon tax is fairly simple because relatively few entities control virtually all carbon production. Although particular entities may own thousands of coal mines or petroleum or natural gas wells, these entities tend to be relatively large and their extraction activities have fixed locations at the source—unlike sellers or transporters or manufacturers, whose locations may easily shift—which simplifies the process of identifying them and collecting the carbon tax. There are about 13,000 oil and natural gas extractors in the United States, although the largest fifty control over seventy percent of both markets.[13] Thirty "major coal producers" control eighty-six percent of the U.S. coal market.[14] The tax need not be collected from other entities along the chain of extraction, refining, manufacturing, distribution, and finally consumption, because of two effects. First, the tax may cause a reduction in carbon output, making less carbon available along the chain and thus lowering carbon emissions. Second, the tax will be passed along the

12. *See, e.g.*, CONG. RESEARCH SERVICE, RL30304, THE FEDERAL EXCISE TAX ON GASOLINE AND THE HIGHWAY TRUST FUND: A SHORT HISTORY (Apr. 4, 2006), *available at* http://www.cnie.org/NLE/CRSreports/06May/RL30304.pdf. The taxes are imposed by 26 U.S.C. § 4042 (inland waterways) and 26 U.S.C. § 4081 (motor and aviation).

13. *See* EIA, *Operator Data by Size Class, Energy Information Administration*, 2006 U.S. CRUDE OIL, NAT. GAS, & NAT. GAS LIQUIDS RESERVES ANN. REP. tbl A6, *available at* http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/crude_oil_natural_gas_reserves/current/pdf/appa.pdf.

14. EIA, *Major U.S. Coal Producers*, 2007 EIA REP. NO. 0584 tbl. 10, *available at* http://www.eia.doe.gov/cneaf/coal/page/acr/table10.html.

chain to a substantial extent, giving entities and individuals at all places along the chain an incentive to reduce carbon consumption.

A carbon tax could be imposed later in the distribution chain, such as when a consumer fills a car's tank with gasoline or pays electric or heating bills, which would allow fine-tuning of the tax. For example, it might be harder to find substitutes for carbon use in aircraft than in trains, trucks, or automobiles, so there might be a lower carbon tax on aircraft fuel. Such fine-tuning, if done as a matter of careful thought and wisdom, might be desirable. However, fine-tuning of the carbon tax might instead be the product of political power and logrolling. In addition, to impose the carbon tax later in the distribution chain would be much more complicated. Many of the benefits sought by imposing the carbon tax at a later point could be achieved through refundable credits for carbon sequestration, discussed below.

Three other sources of carbon deserve brief mention. First, diamonds are virtually pure carbon; however, because they are so valuable, they are very rarely burned, and therefore do not pose a risk of global warming. Second, the destruction of forests, which serve as major "sinks" for CO_2, is a major problem under any carbon emission control system.[15] While controlling carbon extraction through wells and mines may be relatively simple because of the limited number of entities doing such extraction, control of forest destruction may be more difficult because timber poaching can be done in any forested area and by many small-scale operations.[16] Controlling tree cutting might best be done by using more carrots than sticks. For example, the forests might be operated on a sustainable multiple-use basis, providing incomes for landowners and creating jobs for others through activities such as logging and tree replanting, harvesting fruits and nuts that do not destroy the tree, searching for valuable chemical and medicinal compounds, and promoting tourism. The stick could be limits on importation of lumber and wood products, similar to limits that have been imposed on diamonds and ivory.[17]

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15. *See, e.g.*, Science Daily, Destruction of Sumatra Forests Driving Global Climate Change and Species Extinction, Feb. 29, 2008, http://www.sciencedaily.com/releases/2008/02/080226193141.htm.

16. *See* WWF, Forest Illegal Logging, http://www.panda.org/about_wwf/what_we_do/forests/problems/forest_illegal_logging/index.cfm (last visited Nov. 11, 2008).

17. *See, e.g.*, NICOLAS COOK, CONG. RESEARCH SERVICE, RL30751, DIAMONDS AND CONFLICT: BACKGROUND, POLICY, AND LEGISLATION (2003), *available at* http://www.au.af.mil/au/awc/awcgate/crs/rl30751.pdf; Marc Kaufman, *U.S. is Major Market for Illegal Ivory*, WASH. POST, Sept. 24, 2004, at A4, *available at* http://www.washingtonpost.com/wp-dyn/articles/A45635-2004Sep23.html.

Unfortunately, the carbon tax will increase the already great pressure on the world's forests. As the fossil sources of fuel—coal, petroleum, and natural gas—are subject to the carbon tax, the temptation and pressure to cut wood for fuel will increase. This pressure will further increase because building materials will be subject to the carbon tax based on their content—if made of plastic or other carbon-based materials—or on the carbon released in their production—if made of steel or concrete—making wood structures comparatively more attractive. Extra emphasis will be required on the carrots and sticks that help to preserve the world's forests.

The third source of carbon is the process of making powdered cement, used in creating concrete by adding such materials as water, sand, and aggregate. Cement is made by heating raw materials, which releases CO_2.[18] Typically the heating process requires use of carbon fuels, and there is an additional release of carbon from the raw materials. Because so much construction involves concrete or asphalt, and because other alternatives are not apparent, construction may be among the most difficult industries in which to reduce carbon emissions. In addition to new alternatives, part of the solution to this problem will be to recycle concrete[19] and asphalt, and part will likely be carbon capture credits, discussed below. The problem is probably somewhere between the easily controlled mine and well situation, and the more problematic issue of tree cutting. For example, a cement kiln requires high temperatures, but one could probably be built fairly informally and on a small scale, and if one were destroyed, a replacement might be built without much difficulty. This means cement kilns would probably be harder to control within the legal system than coal mines and petroleum or natural gas wells. Cement kilns might be only slightly more complicated than illegal alcohol distilleries used to make bootleg liquor, and thus almost as difficult to control. On the other hand, it should be far easier to cut down and haul away a few trees than to set up and operate a cement kiln.

A. Credits for Carbon Recapture

Another important aspect of carbon taxation would be the extent to which credits should be allowed for carbon capture—i.e., for activities that remove CO_2 from the atmosphere. For example, a coal-fired electric

18. *See* Elisabeth Rosenthal, *Cement Industry is at Center of Climate Change Debate*, N.Y. TIMES, Oct. 26, 2007, *available at* http://www.nytimes.com/2007/10/26/business/worldbusiness/26cement.html.

19. Rosenthal's statement, "Cement has no viable recycling potential; each new road, each new building needs new cement," is true, but it overlooks the use of old broken up concrete as aggregate.

power plant would have indirectly paid a tax on the coal it consumed. It could earn a refundable credit if it creates systems to capture the carbon dioxide produced by burning the coal, rather than release the carbon dioxide into the atmosphere. Ideally, such a credit should be allowed so that the reduction in carbon use will be less drastic but net carbon emissions will still significantly decline. Before the law authorizes such a credit, there should be confidence that the carbon is in fact very likely to be immobilized indefinitely.

There are various possible immobilization technologies. Carbon dioxide might be trapped underground. Under high pressure, carbon dioxide condenses from a gas to a liquid, and the liquid form is much denser and less mobile than the gas, so it can be injected into porous rock formations that are capped by non-porous rock—perhaps rock formations from which natural gas or petroleum has been extracted.[20] Because rock formations have confined naturally occurring CO_2 and methane for millions of years, they should be able to confine sequestered carbon. Nevertheless, it will be necessary to determine which formations are appropriate. A possible problem with this technology is that if the mineral rights have been severed from the surface ownership—as has occurred in many areas—it may be unclear to whom the rights to the porous rock formation belong.[21]

Another possible immobilization technology is to encourage algae growth in the ocean. This would allow algae to soak up carbon dioxide through the process of photosynthesis, which could be encouraged by adding to the dissolved iron content of the surface waters. These algae blooms, however, may block sunlight and absorb oxygen needed by other wildlife.[22] This process may remove carbon dioxide indefinitely, but this result would seem to be achieved only to the extent that the algae

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20. Carbon dioxide injection has long been used to enhance recovery of petroleum and natural gas. U.S. Environmental Protection Agency, Geologic Sequestration of Carbon Dioxide, http://www.epa.gov/safewater/uic/wells_sequestration.html. On July 15, 2008, the Environmental Protection Agency proposed rules on "Geologic Sequestration of Carbon Dioxide" under the Safe Drinking Water Act. The proposed rules' focus on safe drinking water is different from the concerns raised here. Press Release, U.S. Environmental Protection Agency, EPA Lays Groundwork for Promising Technologies to Help Mitigate Climate Change (July 15, 2008), *available at* http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/d35b72dfe481043b85257487005e47cd!OpenDocument.

21. Wyoming recently enacted a statute providing that ownership of subsurface pore space belongs to the surface owner unless there has been an express severance. WYO. STAT. ANN. § 34-1-152 (2008). Oklahoma recognizes a similar right for surface owners in regard to pore space. Ellis v. Ark. La. Gas Co., 450 F. Supp. 412, 421 (E.D. Okla. 1978).

22. *See* David Biello, *Oceanic Dead Zones Continue to Spread*, SCI. AM., Aug. 15, 2008, *available at* http://www.sciam.com/article.cfm?id=oceanic-dead-zones-spread&sc=WR_20080819.

sinks to the bottom of the ocean—whether as algae or incorporated into skeletons of wildlife higher up the food chain—and does not decay.[23]

Forests recapture carbon through the process of photosynthesis, as the trees combine carbon dioxide with water to produce cellulosic compounds. Yet forests may be cut down, and forest fires are a normal part of a forest's life cycle. Each of these events risks a return of the carbon dioxide to the atmosphere. Only a large forest with limited logging and at least moderate fire suppression is likely to be an effective long-term "carbon sink." However, forests grown on a sustainable basis for fuel use or carpentry would likely be exempt from the carbon tax.

Some products of petroleum could be considered so long-lived as to qualify under a system of carbon capture. Asphalt for roads might be such a use, as might some plastic products with long-lived uses. There is a recent proposal to use CO_2 to make calcium or magnesium carbonate by bubbling the CO_2 through seawater, then using the calcium carbonate as aggregate in concrete that should last indefinitely.[24] Upon further investigation, this proposal may be proven to be a satisfactory method of recapturing carbon.

Ideally, there should be credits for carbon capture, if there are appropriate technologies and the means to monitor and control them, and if we can be confident that such technologies and means are effective.

B. Other Greenhouse Gases

Carbon dioxide is not the only greenhouse gas. Others include methane, nitrous oxide, and some chlorofluorocarbons.[25] Their treatment is beyond the scope of this article. It is possible—but by no means certain—that steps similar to those proposed here for carbon may be applicable to these other greenhouse gases. For example, both nitrous oxide and chlorofluorocarbons are produced largely by industrial processes that might be fairly easily taxed, but methane exists in large

23. " One of the largest sources of atmospheric carbon dioxide is through plant and animal decay as microorganisms break down the dead material, releasing carbon dioxide," Envtl. Literacy Council, *Sources and Sinks*, http://www.enviroliteracy.org/article.php/439.html (last visited Dec. 18, 2008).

24. David Biello, *Cement from CO_2: A Concrete Cure for Global Warming?* SCI. AM., Aug. 7, 2008, *available at* http://www.sciam.com/article.cfm?id=cement-from-carbon-dioxide.

25. Earth Sciences Research Laboratory, Nat'l Oceanic & Atmospheric Admin., *Radiative Forcing of Climate by Non-CO_2 Atmospheric Gases*, http://www.esrl.noaa.gov/research/themes/forcing/ (last visited Nov. 11, 2008).

quantities in nature and is also produced by such widespread sources as digestion by cattle, rice paddies, wetlands, and termite colonies.[26]

C. Gradual Phase-In of the Carbon Tax

The carbon tax should be phased in over several years, with low initial rates that slowly but substantially increase, to allow both consumers and producers to adjust gradually to the new system. Old energy-intensive personal and business investments will lose their value under a system of carbon reduction. However, allowing time for the change will permit the value of the old investments to be recovered through depreciation because they will be used for a period not much shorter than their normal useful life. That useful life, it may be noted, will already be shortened by the increasing prices of energy, which will in many cases make old investments economically impractical well before their physical useful lives are exhausted. As a matter of both politics and equity, it would be unwise to impose windfall losses unnecessarily. The mirror image of phasing out the old is developing and implementing the new. It will take time to develop and create the ability to mass produce new energy-efficient products and processes, and one would not want unnecessarily large and sudden windfall gains to those who own such assets. A carbon tax enacted with low initial rates, but with steady and eventually substantial rate increases, would allow a smooth and fair transition from our current system to one much less carbon-intensive.[27]

Even after an initial phase-in, carbon tax rates should continue to rise to promote further reductions in carbon emissions. Ultimately, these rates may be expected to become high enough to virtually eliminate net carbon emissions, so that the current high levels of carbon dioxide in the atmosphere can begin to return to normal. Thus, ideally the carbon tax yield eventually will decline, even though the rates will have become quite high, because net carbon emissions will have been reduced significantly.[28]

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26. *See* U.S. Environmental Protection Agency, Methane, Sources and Emissions, http://www.epa.gov/methane/sources.html (last visited Dec. 18, 2008).

27. *See* discussion *supra* note 10, suggesting a goal of a steady rise in the price of carbon including the tax, as opposed to a steady increase in the tax itself.

28. If raised beyond a certain point, tax rates are likely to reduce tax revenue by providing a disincentive to work or invest. *See, e.g.*, Economyprofessor.com, Laffer Curve, http://www.economyprofessor.com/economictheories/laffer-curve.php (last visited Nov. 11, 2008). However, in the context of a carbon tax, an increasingly higher tax rate provides not a disincentive to work, but a disincentive to emit carbon. A primary purpose of a carbon tax is to reduce carbon emissions, not merely to raise revenue, and so diminishing returns over time are desirable. *See* Arthur B. Laffer, *The Laffer Curve: Past,*

III. REGRESSIVITY UNDER A CARBON TAX

In many ways, a carbon tax will resemble a tax on consumption, and thus it will be regressive. Carbon is included in the creation, manufacture, distribution, or use of virtually all products. Clothing is often made from synthetics, which are often made from petroleum. The same is true for the plastics used in everything from cars to kitchen utensils and from aircraft components to surgical instruments. Other products containing little carbon may nonetheless require a significant amount of carbon in their creation. Steel, for example, is basically iron with small amounts of alloying metals and carbon, but its production typically requires large amounts of carbon to remove the oxygen from the iron oxide ores in which iron is normally found. Carbon-based fuels are used to transport many products vast distances along the chain from extraction to end-use consumption. In addition, the operation of many products—such as cars, furnaces, air conditioners, and stoves—requires energy normally derived from carbon. Of course, some individual lifestyles are more carbon-intensive than are others, but individuals generally use many products and services that employ carbon, so the carbon tax will resemble a tax on consumption generally.

A consumption tax is usually regressive; that is, it takes a higher percentage of low incomes than of high incomes, for the following reasons. Persons of low income tend to do little saving and spend nearly all of their incomes on consumption because they have few extra resources to buy anything beyond food, clothing, shelter, health care, and other necessities. Persons of low income may even consume more than their incomes, as they spend all their past savings and borrow against future income from sources such as credit cards, payday lenders, and loan sharks. Thus, persons of low income may pay a consumption tax on amounts approaching or even exceeding their incomes. Persons of increasingly high incomes, in contrast, may be able to invest or save increasing portions of their incomes, thus leaving decreasing portions of their incomes to be consumed and thus subject to the consumption tax.[29]

Present, and Future, 1765 EXECUTIVE SUMMARY BACKGROUNDER (The Heritage Foundation, D.C.), June 1, 2004, http://www.heritage.org/Research/Taxes/bg1765.cfm.

29. The problem of regressive consumption taxes may be particularly acute for carbon taxes. Carbon taxes may make commuting much more expensive so that those of higher incomes who have fled to suburbia in the past will find it to be in their interest to return to central cities to reduce their commuting costs, outbidding and thus displacing the lower income residents of the central cities, forcing those low income people to move to the suburbs and thus incur expensive commutes. *See, e.g.*, *France's Suburbs: Two Years On*, ECONOMIST, Nov. 8, 2007 (discussing economic depression and unrest in France's low income suburbs).

The United States does not have a steeply progressive tax system. The top income tax bracket now is thirty-five percent, far below the above ninety percent rates reached in World War II and the post-War period, the seventy percent rate of the late 1960s and the 1970s, and the fifty percent rate in the early 1980s.[30] To shift from a mild progression to the regression of a consumption tax would seem unwise, particularly in light of the increasing inequality of income and wealth that has been developing over the past generation.[31] One might consider three possible approaches to reducing the regressivity of a consumption tax: (1) an exemption from the tax on items likely to be heavily used by the poor; (2) a provision of economic transfers to those of low income; and (3) an implementation of other taxes that are progressive so that the tax system—although it includes a regressive consumption tax—is progressive on the whole.

A. Exempt Certain Consumption

One way to reduce the regressivity of a consumption tax is to exempt items such as food or health care. The food exemption, however, may be unwise, and the health care exemption may be better explained as "not consumption" rather than "regression reduction."

In the case of a food exemption, persons of lower incomes may be expected to use more of their incomes for food than do those of higher incomes, so that exempting food may tend to reduce regression. However, this solution is very expensive. One would expect that most food is consumed by those of middle and higher incomes, who buy increasingly more expensive foods as incomes rise. Each of these higher-income individuals is likely to spend more on food than does a person of lower income. Consequently, exempting this food does little to reduce regression. Because so much revenue is lost due to the food exemption, the rates on other consumption must be higher. As the tax rate rises, it increasingly distorts normal economic activities and personal choices, and increases the incentive to avoid or evade the tax.[32]

Not taxing health care may be justified by an acknowledgement that health care differs from other consumption. A person who spends more on food, clothing, shelter, or travel is generally thought to be better off

30. JOSEPH PECHMAN, FEDERAL TAX POLICY 313-14 tbl.A-1 (5th ed. 1987).

31. CHYE-CHING HUANG & CHAD STONE, CTR. ON BUDGET & POLICY PRIORITIES, AVERAGE INCOME IN 2006 UP $60,000 FOR TOP 1 PERCENT OF HOUSEHOLDS, JUST $430 FOR BOTTOM 90%: INCOME CONCENTRATION AT HIGHEST LEVEL SINCE 1928, NEW ANALYSIS SHOWS, Oct. 22, 2008, http://www.cbpp.org/3-27-08tax2.htm.

32. *See generally* JOEL SLEMROD & JON BAKIJA, TAXING OURSELVES 114-56 (3rd ed. 2004).

than those who spend less. A person who spends more on health care, however, is probably less well-off than someone with a similar income but lower expenditures for health care.[33]

Thus, it does not seem to be a wise policy to exempt food from a consumption tax, but it may be wise to exempt health care. For the carbon tax imposed at the point of extraction, however, it is probably not possible to exempt particular types of expenditures. Even if it were possible, while many medicines are made or processed in part using carbon-derived raw materials or fuels, the carbon content is typically such a low proportion of the cost of medicine or other health care that no exemption should be needed.

More generally, the danger of targeted exemptions surfaces in the process of political prioritization and cost-benefit analysis. Some believe that certain activities are beneficial and so should be more lightly taxed, and that other activities—or the same activities with an opposing spokesperson—are harmful and should be more heavily taxed. These ideas may have merit; however, it is very hard to determine benefit and harm. Even if they are determined, it is difficult to define them in reasonably administrable ways, and the process of so doing is likely to yield a complicated system. The mind-numbing complexity of the U.S. Internal Revenue Code stands as a warning against the dangers of straying from general principles to particularized rules, and of using the tax system to reward the beneficial and restrain the harmful. Ultimately, practical politics may introduce such complexity, but in theory that complexity should be avoided or at least minimized.

B. A System of Financial Transfers

The regressivity of consumption taxes may be offset by a system of payments to those of lower incomes. For example, the tax that finances Social Security is regressive, because it only applies to wages and self-employment income—not to the dividends and interest, rent and royalties, and capital gains more likely to be enjoyed by those of higher incomes—and only up to a certain annual amount (annual salary of $106,800 in 2009). The Earned Income Credit, although now a major wealth transfer and anti-poverty program, was initially enacted to refund

33. *See* William D. Andrews, *Personal Deductions in an Ideal Income Tax*, 86 HARV. L. REV. 309, 335-36 (1972) (arguing that "[w]hat distinguishes medical expenses from other personal expenses at bottom is a sense that large differences in their magnitude between people in otherwise similar circumstances are apt to reflect differences in need rather than choices among gratifications").

this regressive tax to persons of low income.[34] A federal consumption tax, such as the carbon tax proposed here, might be made less regressive by a similar system of transfer payments.[35]

It should be noted that a carbon tax with a transfer payment to those of low incomes would still provide an incentive for low-income persons to reduce their carbon use. Because the transfer would be based on income, not carbon use, the recipient could keep more of the transfer payment by reducing carbon use. In contrast, an exemption of items heavily used by the poor would provide no such incentive to low income people to reduce carbon consumption, and thus would conflict with one of the major goals of the carbon tax: encouraging all to reduce their carbon consumption.

A system of transfer payments may be expensive to administer in order to get the payments to the right people without too much paperwork and inconvenience, while at the same time minimizing mistakes and the opportunity for fraud. This cost might be hard to justify, given the relatively small amounts of revenue to be collected by a carbon tax, at least initially. Such a transfer payment system may be justified, however, as part of the tax system as a whole. The next section discusses how the United States might improve its tax system by replacing the lower income tax brackets with a Value Added Tax ("VAT"). This VAT will allow transfer payments to offset the regressive effects of a carbon tax and will permit adjustments between carbon taxation and other taxation, as the carbon tax first increases revenue as rates rise, then yields less revenue as carbon use falls.

C. The Carbon Tax in the Larger Tax System

A progressive tax system may include regressive elements. The regression of a consumption tax such as the carbon tax proposed here may be offset at least in part if the tax system also includes progressive elements, such as a progressive income tax. This section discusses how a carbon tax would fit into the entire tax system.

A tax system may have several components. Income may be taxed to individuals, to entities such as trusts or corporations, or under specialized taxes such as those on wages and self-employment income to fund Social Security. Property is commonly taxed in the United States by local governments. States and local governments tax consumption under

34. JONATHAN BARRY FORMAN, MAKING AMERICA WORK 155-56 (Urban Institute Press 2006).

35. *See* SLEMROD & BAKIJA, *supra* note 32, at 258.

general sales taxes (most other nations use VATs).[36] Specialized consumption taxes include the "sin taxes" on alcohol and tobacco and the taxes on vehicle fuels that are, in effect, user fees that pay to build and maintain highway systems.

As suggested by Professor Michael Graetz of the Yale Law School, the United States might replace its largely income-tax-based tax system with a combination of income tax and VAT, the norm in most other industrialized nations.[37] Under such a combined income tax and VAT system, the VAT might be considered the lowest tax bracket of the income tax system. For example, a broad-based fifteen percent VAT could serve as the equivalent of the fifteen percent income tax bracket.[38] Then all income tax brackets at or below fifteen percent could be eliminated—so that people currently in those marginal income tax brackets would no longer be required to file income tax returns—and income tax brackets above fifteen percent could be reduced by fifteen percent. For example, the current top bracket of thirty-five percent would then be twenty percent. This change would have several desirable effects, in addition to being a part of implementing a carbon tax.

Supplementing the income tax with a VAT would reduce the benefits of tax avoidance, tax evasion, and tax preferences. Income successfully shielded from the income tax would still be potentially subject to the VAT, and vice versa—income spent in ways not subject to the VAT may still be subject to the income tax.

Although the slowing that taxes impose on an economy may be measured by the total amount of taxes in comparison with the size of the economy, many of the distortions and disincentives that taxes impose are based on the marginal tax rate. The policy to reduce distortion was at the

36. A VAT resembles a sales tax, in that it raises the price of consumption to the ultimate consumer. Where a sales tax is imposed only on the ultimate retail sale to the consumer, the VAT is collected at each stage of the production and distribution process, from mine to factory to wholesaler to retailer, with each step allowed a credit for the VAT already paid in regard to the product. For example, with a 10% VAT, a mine would pay a $2 VAT on $20 sale of mined material. The smelter would owe a $3 VAT on a $30 sale of that refined material, but would have a credit for the $2 already paid, and thus pay only $1 more. The factory selling its product for $80 would be liable for a VAT of $8, but with the credit for $3 already paid would have to pay only $5 more. When the retailer sold the product for $100, the VAT liability would be $10, but with the $8 credit for the VAT already paid would remit only $2. Taxing all units in the chain under a VAT makes evasion more difficult, an important concern with the relatively high rates at which VATs are applied, compared to sales taxes.

37. MICHAEL GRAETZ, 100 MILLION UNNECESSARY RETURNS 64-67 (Yale University Press 2008).

38. This discussion is somewhat over-simplified, because a 1% income tax is not the same as a 1% VAT, because the income tax base and the VAT tax base differ. This oversimplification however is sufficient for the purpose of making this point.

heart of the 1986 Tax Reform Act, which kept total revenues roughly constant but dramatically reduced the highest marginal tax rate from fifty percent to twenty-eight percent.[39] Replacing a part of the income tax with a VAT would allow a reduction in marginal income tax rates and thus reduce distortions and disincentives.

The United States currently has a complex array of tax provisions to encourage saving; these provisions include the favorable treatment of long-term capital gains and retirement saving through employer pensions, self-directed pensions, and IRAs.[40] A consumption tax, such as a carbon tax, directly and simply encourages saving by not taxing savings until the savings and their yield ultimately are consumed.

It is unclear whom the income tax burdens, highlighting another problem with an exclusively income-based tax system.[41] Ideally, the tax incidence would be on the income earner, so that distortion would be minimal. However, it may be that income taxes could be shifted to some extent. In particular, the corporate income tax may operate like other costs, thus reducing profits, but the business would prefer either to reduce costs or to boost prices in order to maintain profits. To the extent that the tax results in increased prices, it may operate like a sales or consumption tax. To the extent that the tax results in decreased costs, it may operate like a wage tax because wages are a large component of costs in most businesses. To the extent that the tax neither increases prices nor decreases wages, it may reduce the return to capital generally.

This issue of tax incidence may cause problems in international trade, when U.S. corporations that operate in the U.S. income-tax-only regime compete with foreign corporations operating in their nation's income-tax-and-VAT regime. Goods imported to the United States will bear no part of the foreign nation's VAT, because the VAT is rebated on exports, but they will compete with U.S. products that may include some U.S. income tax burdens. Goods exported by the United States may have some part of the U.S. corporate income tax built-in, but the goods will still be fully subject to the foreign nation's VAT. The large foreign trade deficit of the United States might be reduced if part of the U.S. tax system switched from the income tax to the VAT. Generally, a switch to the VAT may smooth international trade because then the trading countries would have similar tax systems, rather than the United States being the only major commercial power without a VAT.

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39. Tax Reform Act of 1986, Pub. L. No. 99-514, § 104 (Oct. 22, 1986).

40. 26 U.S.C. § 1(h) (Long term capital gains); 26 U.S.C. § 401(employer and self-directed pensions): 26 U.S.C. §§ 408–408A (Individual Retirement Accounts).

41. *See generally* Arnold C. Harberger, *The Incidence of the Corporation Income Tax*, 61 NAT'L.TAX J. 303 (2008).

A combined income tax and VAT system can still be progressive. Lower-income progressivity may be maintained by the transfer payments discussed above. For much of the middle class, consumption is proportional to income, so as far as progression goes there may be little difference between an income tax and a VAT. For those of high income whose rates of consumption may significantly drop as a percentage of rising incomes, progressivity cannot be obtained solely through a consumption tax; there must also be a progressive income tax and perhaps a tax on large gifts, estates, and inheritances.[42]

IV. A VAT AND A CARBON TAX

The first step in implementing a carbon tax is to replace the lowest income tax bracket(s) with a VAT. The second step is to replace a part of the VAT with a carbon tax in which the carbon tax rates start low but rise and the VAT rates start high but fall. This approach may appear complicated, but the following paragraphs will show why a VAT is a sensible companion to the income tax, and why a VAT will ease implementation of a carbon tax.[43]

Professor Graetz proposes a VAT rate between ten and fourteen percent, and estimates that at ten percent, the VAT would yield between $735 billion and $850 billion in 2008.[44] The suggestion here is that some portion of the projected VAT collections should instead be carbon tax collections. The United States is estimated to emit approximately 6 billion tons of carbon dioxide annually.[45] Thus, a ten percent VAT is equivalent to a carbon dioxide tax of $120 to $150 per ton,[46] or a carbon tax of $450 to $550 per ton.[47] Of course, a tax that high would be prohibitive. The run-up in energy prices in 2008 has increased the price

42. *See* SLEMROD & BAKIJA, *supra* note 32, at 52-53.

43. For a somewhat similar carbon tax proposal, but without the VAT, see Gilbert Metcalf, *Designing a Carbon Tax To Reduce U.S. Greenhouse Gas Emissions* (Nat'l Bureau of Econ. Research, Working Paper No. 14375, 2008), *available at* http://www.nber.org/paperss/w14375.

44. GRAETZ, *supra* note 37, at 216.

45. The Pew Center on Global Climate Change, U.S. Greenhouse Gas Emissions by Gas, http://www.pewclimate.org/global-warming-basics/facts_and_figures/us_emissions/usghgemgas.cfm (last visited Nov. 11, 2008).

46. The product of $120 and six billion is $720 billion; the product of $150 and six billion is $900 billion.

47. Carbon dioxide has the chemical symbol CO_2. Because carbon has an atomic weight of 12 and oxygen has an atomic weight of 16, the total atomic weight of a CO_2 molecule is 44. A tax on CO_2 must be multiplied by 44/12 to determine the tax equivalent if carbon alone is taxed rather than CO_2.

of coal futures to over $120 per ton.[48] It is hard to see how the carbon tax could start any higher than $20 to $25 per ton—thus replacing roughly one-half of one percent of the ten percentage points of the VAT—without causing too much economic dislocation and political resistance, and perhaps an even lower initial figure would be appropriate. That initial rate would be increased over time.

The VAT is necessary for the carbon tax because the carbon tax is regressive and will therefore require a system of transfer payments to persons of low income. Initially the collection from the carbon tax will be too small to justify the administrative costs of setting up and operating such a system of transfer payments, but VAT collections will be high enough to fund the transfer payment system. The VAT is also necessary to mesh the regular tax system with the carbon tax. Initially, the carbon tax rates—and hence carbon tax collections—should steadily increase; if total revenues are to remain constant, other taxes must be reduced. It should be easier to have periodic changes in VAT rates than in income tax rates because income tax rates have a major impact on long-lived economic investments, where the normal economic risks are best not complicated by risks of varying tax rates. Although the carbon tax rates will continue to increase, carbon tax collections will eventually decline as net carbon use is reduced, thus requiring VAT rates to go back up to maintain revenue neutrality.

The similarities between carbon taxes and VATs should not be overstated. Although a VAT and a carbon tax both generally affect consumption, a carbon tax will disproportionately impact those who use more carbon. Some individuals or regions may have a greater need for heating or cooling, [49] transportation, plastics and textiles made from carbon, and so on. In general, however, greater efficiencies and new techniques should minimize these unusual costs, and our highly integrated economy suggests that the costs are likely to be broadly shared. For example, if the costs of rural ranching and farming rise because of carbon taxes, those costs should in large part be passed on to the consumers of the farm and animal products. If we are to reduce carbon emissions, it may be that we also must have fewer individuals working in occupations and living in regions with higher carbon consumption. Phasing in the carbon tax will reduce disruption in these regions as well.

48. Kris Maher, *Coal Producers Struggle to Meet Demand*, WALL ST. J., June 24, 2008, at A4.

49. EIA, 2006 U.S. COAL CONSUMPTION BY END USE SECTOR, BY CENSUS DIVISION AND STATE tbl 26, *available at* http://www.eia.doe.gov/cneaf/coal/page/acr/table26.html (last visited Nov. 3, 2008) (showing energy (coal) use for heating/cooling by region).

Of course, reducing carbon emissions will be disadvantageous to those in the business of producing or using carbon. Although unfortunate for those affected, that disadvantage is inevitable if we are to do something about carbon emissions. To say that carbon extraction and usage will become less advantageous does not mean that the businesses so occupied, and their workers, must be rendered unemployable. They may modify their activities by producing energy from renewable sources, distributing that energy and its products, sequestering carbon, and so forth. One might fairly generalize that much of current engineering has evolved in an era of relatively inexpensive energy, and so has focused more on labor, materials, and manufacturing costs. As energy costs rise, engineers will weigh such factors of cost and productivity differently. So long as the rise in energy cost is phased in, there should be minimal disruption in the transition. Producing more efficient homes, equipment, and the like should keep the economy humming.

V. INTERNATIONAL ASPECTS

Unlike some forms of air, water, and soil pollution that primarily impact those nearby, the risk from carbon emissions is felt worldwide. Thus, controlling carbon emissions requires worldwide cooperation, a fact that has major consequences.[50]

First one must ask: Where should the carbon tax be imposed: in the nation where the carbon is emitted, or in the nation where the product of the carbon emission is consumed? To avoid serious economic disruption, the tax belongs where the consumption occurs, as the next questions demonstrate: Could a manufacturer in a carbon-taxing jurisdiction maintain its foreign sales if its competitors from other nations were not required to pay carbon taxes? Could that manufacturer maintain its sales within its home nation if imports from other nations were not subject to a carbon tax? The answer to both questions is no. Therefore, a carbon tax must apply much as a VAT does,[51] with a remitted tax on exports and a full tax on imports.

To impose the carbon tax on the carbon content of imports, and to rebate it on the carbon content of exports, is probably permissible under the World Trade Organization ("WTO"), the General Agreement on

50. A number of nations have imposed something like a carbon tax, but none has the broad carbon tax proposed here. *See* Christina Harper, *Climate Change and Tax Policy*, 30 B.C. INT'L & COMP. L. REV. 411, 433-43 (2007).

51. *See* Council Directive 112/49, art. 146, 2006 O.J. (L 347) 32 (EC), *available at* http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_347/l_34720061211en00010118.pdf.

Tariffs and Trade ("GATT"), and similar tax and trade treaties. Thus, rebates of VAT on exports are permitted as is an imposition of the VAT on imports. The problem is the carbon that is consumed in the process of manufacturing but is not incorporated in the finished product, such as the carbon used in the manufacturing of steel. GATT appears to allow consideration of only the contents of the product and not the process of producing a product.[52] GATT and other treaties should be amended to allow such taxes and rebates as part of the replacement for the Kyoto Protocol. That replacement should go beyond merely allowing carbon taxes; it should affirmatively encourage or even require them.

To require treaty signatories to impose regulations, as the Kyoto Protocol does, may not be effective because political pressure at home is likely to be heavily against regulation that harms domestic businesses and does not respond to a clearly and broadly perceived domestic threat. To require signatories to impose a carbon tax will at least offer the home government a carrot—it presumably needs the revenue the tax would raise, and it could gain political support by reducing other taxes—to accompany the stick of duty to comply with treaty obligations. Fully rebating the carbon tax on exports and imposing it on imports—helping both domestic businesses and workers—should increase the political acceptance of the carbon tax.

Unfortunately, much of the developing world subsidizes fuel costs and thus subsidizes carbon emissions, rather than adopting policies to reduce carbon emissions.[53] The shift from subsidizing to taxing carbon emissions must be gradual to reduce the strain on the citizens and reduce the risk of electoral defeat or even riots and government overthrow. One would hope that developing nations and their citizens could be persuaded that, while an energy-intensive infrastructure could be copied relatively quickly and cheaply from more developed nations with older economies,

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52. *See* Joost Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law* (Nicholas Inst. for Envtl. Pol'y Solutions, Duke University, Working Paper, 2007), *available at* http://www.nicholas.duke.edu/institute/internationaltradelaw.pdf; *see also* Cinnamon Carlarne, *The Kyoto Protocol and the WTO: Reconciling Tensions Between Free Trade and Environmental Objectives*, 17 COLO. J. INT'L ENVTL. L. & POL'Y 45, 53-56, 71-72 (2006).

53. *See Fuel Subsidies: Crude Measures*, ECONOMIST, May 29, 2008, *available at* http://www.economist.com/finance/displaystory.cfm?story_id=11453151. Similarly, the U.S. has various tax provisions favorable to the extractive industries, including the extraction of fossil carbon. *See, e.g.*, 26 U.S.C. §§ 263(a)(1)(a), (c) (both allow the deduction of what otherwise would likely to be non-deductible capital expenditures), and Section 613 [limited by 613A] (allowing percentage depletion). Such provisions should be made inapplicable to the fossil carbon extractive industries, probably best phased-in over a period of years, with the existing investments subject to some form of grandfathering protection.

the infrastructure being built now will endure far into the future. To start building a highly energy-intensive infrastructure now would be very unwise, because energy is very likely to continue to become increasingly expensive. One would hope that the citizens would begin to believe that it would be better to build now the lean-energy infrastructure that the future demands.

What can be done about excessive carbon use that is little related to other markets? Suppose that a nation uses domestically produced carbon to desalinate water for local consumption, or that it subsidizes fuel for domestic heating and cooling, hot water, and local transportation. This may be one of the problems that are most difficult to control, and a failure to control it might have to be accepted. However, the collective disapproval of the rest of the world, supported by trade sanctions, might be enough to induce a gradual cessation of such subsidies, with a gradual phasing-in of a carbon tax. Furthermore, a nation using local carbon to produce exports would be limited if other nations imposed carbon taxes on imports, as suggested above.

The carbon content of imports may be quite extensive. It includes not just the physical carbon content of the item imported, but also the carbon used to find, extract, and transport raw materials, to transport the products of intermediate steps in production, to transport the finished products to their ultimate destinations, and the carbon consumed in the processes of smelting and manufacturing. Should one include the carbon use of the inhabitants working to make the exports? The needed rebate of carbon taxes on exports would be similarly complex. Presumably, similar rules would be applied to both imports and exports, so that a nation seeking a possible benefit in regard to one would incur costs and losses in regard to the other. Such detailed inquiries and computations might be avoided for trade between nations having similar carbon taxes.

A related problem is determining the carbon content of imports. To use data on the actual carbon content may be difficult because such information may not exist. Yet to presume that the imports have the same carbon content as domestic manufacture is probably unrealistic because the domestic carbon tax will have encouraged efficiency among domestic manufacturers, an efficiency unlikely to be found among manufacturers not subject to a carbon tax. Perhaps international data would be available to provide a rough measure of each nation's carbon use per unit of economic output, and the ratio of the exporting nation's carbon use to the importing nation's carbon use could be applied to the measured carbon

use by the importing nation in producing an equivalent product, based on data that would be required to rebate the carbon tax on exports.[54]

VI. AVOIDING THE CREATION OF OTHER PROBLEMS WHEN IMPOSING A CARBON TAX

While trying to solve the carbon problem, we must be careful not to create other problems. Alternative sources of energy may affect the environment in unforeseen ways, such as endangering animal habitats, and the risks must be weighed with the possible benefits. Thus, the carbon tax may need to be accompanied by other energy taxes or regulation.

Nuclear fission produces energy without releasing carbon, but it may present other risks. It is not clear that we have solved the problem of long-term storage of the highly radioactive and long-lived products of nuclear reactors.[55] Furthermore, it is not clear that the risk of terrorists using nuclear reactors—whether by stealing enriched uranium or plutonium for a fission bomb, stealing radioactive by-products for a dirty bomb, or crashing a truck or airplane into a reactor—has been resolved.[56]

The push for biofuels competes with people's need for food, either because the biofuel is made from food stocks, or because the biofuel requires land, water, and labor that would otherwise produce food.[57]

Hydroelectric power normally requires damming rivers. Those dams and reservoirs may endanger wildlife that otherwise would inhabit, reproduce in, or migrate via the rivers, streams, and wetlands changed by the dams.[58] The dams may be vulnerable to catastrophic failure,

54. For example, international data might suggest that exporting and non-carbon-taxing Nation X emits 150% as much CO_2 per units of economic output as does importing and carbon-taxing Nation Y. If a car produced in Nation Y is shown to require emitting six tons of CO_2, cars imported from Nation X might be taxed as though they required 150% of six tons, or nine tons of CO_2.

55. U. S. NUCLEAR REG. COMM'N BACKGROUNDER ON RADIOACTIVE WASTE (2007), http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/radwaste.html.

56. *See* CARL BEHRENS & MARK HOLT, CONG. REPORTING SERVICE, RS21131, NUCLEAR POWER PLANTS: VULNERABILITY TO TERRORIST ATTACK (Feb. 4, 2005), *available at* http://www.globalsecurity.org/military/library/report/crs/rs21131.pdf.

57. VALERIE MERCER-BLACKMAN ET AL., INT'L MONETARY FUND, IMF SURVEY: BIOFUEL DEMAND PUSHES UP FOOD PRICES (Oct. 17, 2007), http://www.imf.org/external/pubs/ft/survey/so/2007/RES1017A.htm; James Kanter, *Europeans Reconsider Biofuel Goal*, N.Y. TIMES, July 8, 2008, *available at* http://www.nytimes.com/2008/07/08/business/worldbusiness/08fuel.html.

58. ENVTL. ENCYCLOPEDIA 249 (William P. Cunningham et. al. eds., 2d ed. 1998) (environmental effect of dams); EnviroHub.net, Hydroelectric Energy, http://www.

unleashing devastating floods on those downstream; this risk might be increased by terrorists.

Using the wind to generate electricity appears benign, but large wind turbines may disrupt the migration of birds, bats, or insects, and present a risk of harm to the ecological system.[59] On the other hand, although we have no studies to back up this surmise, wind turbines may have beneficial impacts. Turbines slow and perhaps cool the wind as they extract energy from it. If the wind is slower and potentially cooler, it will probably drop more snow in the winter, as occurs at the snow fences common in the U.S. Mountain West.[60] A slower and cooler wind will probably also reduce evaporation. The sum of these two effects could be more soil moisture, although it is unclear whether the impact would significantly improve crops or range land. These possible benefits must be balanced against risks of harm.

Using tides and currents in the oceans to generate electricity appears similarly benign, but here too there may be risks to birds, fish, insects, and other sea creatures.[61] On the other hand, slowing the tide and current may reduce beach erosion and even offer some protection against storm surges or tsunamis. These possible benefits must also be balanced against risks of harm.

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envirohub.net/hydroelectric-energy.html (last visited Nov. 11, 2008).

59. *See generally* David Biello, *On a Wing and Low Air: The Surprising Way Wind Turbines Kill Bats*, SCI. AM., Aug. 26, 2008, *available at* http://www.sciam.com/article.cfm?id=wind-turbines-kill-bats&sc=WR_20080902; WALLACE P. ERICKSON ET AL., NAT'L WIND COORDINATING COMM., AVIAN COLLISIONS WITH WIND TURBINES (Aug. 2001), http://www.west-inc.com/reports/avian_collisions.pdf; NAT'L WIND COORDINATING COMM., WIND TURBINE INTERACTIONS WITH BIRDS AND BATS (Nov. 2004), http://www.nationalwind.org/publications/wildlife/wildlife_factsheet.pdf; GREGORY D. JOHNSON ET. AL., WESTERN ECOSYSTEMS TECHNOLOGY, INC., AVIAN MONITORING STUDIES AT THE BUFFALO RIDGE, MINNESOTA WIND-RESOURCE AREA: RESULTS OF A 4-YEAR STUDY (2000), http://www.west-inc.com/reports/avian_buffalo_ridge.pdf; CAL. ENERGY COMM'N 2000, CALIFORNIA GUIDELINES FOR REDUCING IMPACTS TO BIRDS AND BATS FROM WIND ENERGY DEVELOPMENT (2007), http://www.energy.ca.gov/2007publications/CEC-700-2007-008/CEC-700-2007-008-CMF_MINUS_AP-E.PDF; John Ritter, Wind Turbines Taking Toll on Birds of Prey, USA Today, Jan. 1, 2005, *available at* http://www.usatoday.com/news/nation/2005-01-04-windmills-usat_x.htm.

60. Institute of Arctic and Alpine Research, University of Colorado, http://culter.colorado.edu/Niwot/Niwot_Ridge_LTER_snowfence4.html (last visited Dec. 19, 2008). Snow fence in operation near the Continental Divide in Colorado. In this experiment, the snow bank created by the snow fence is as high as the fence is, and the width of the snow bank is twenty times the fence's height. However, latitude, elevation, and precipitation might affect a snow fence.

61. *See, e.g.*, Generating Electricity from Tidal Power, U. K. Env't Agency, http://www.environment-agency.gov.uk/aboutus/512398/289428/930386/?lang=_e (last visited Nov. 11, 2008).

Using the sun to generate electricity or to heat water or living space appears benign, but one should be alert to possible ill effects, both in current planning and as the use of solar energy expands.

In light of the concerns outlined in the preceding paragraphs, it may be necessary to impose some tax or regulation on energy-generating technologies that compete with carbon in order to reduce the risk of serious problems in other areas caused by the drop in carbon use. The time to examine these possibilities is before the carbon tax is enacted, not after the tax has been implemented and caused harmful side effects.

VII. CONCLUSION

One might ask what the lean-energy future will be. It may look something like this:

Compared to the United States today, homes will be smaller, so less energy will be used in building, heating, cooling, and lighting them. Homes will be closer together, so the next unit may reduce unwanted loss of heating or cooling. Homes will be mixed with workplaces and shopping places, so that commutes will be shorter and walking, bicycling and public transportation will be more practical, with much less time spent in traffic jams. Building these denser cities will be good for the construction industry, although there may be more rehabilitation and in-fill than new construction and development. Personal and business activities will be more localized, so less energy will be consumed in commuting and transportation.

Industrial processes will be more energy efficient. By analogy, Israel, with limited water, has become quite water-efficient,[62] while the United States, with abundant water, is very water-inefficient. One may expect U.S. energy efficiency to follow a path similar to Israel's water efficiency path as energy becomes scarcer and more costly. Americans will have fewer things—so less energy will be consumed in making and transporting them—because we will have less space to fill with them. However, the things we do have may be of superior quality. For instance, some suggest that Europeans tend to have fewer clothes than do Americans, but European clothes are of a higher style and quality.[63]

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62. Isr. Ministry of Foreign Affairs, Israel's Water Economy: Thinking of Future Generations (Aug. 10, 2002), http://www.mfa.gov.il/MFA/MFAArchive/2000_2009/2002/8/Israel-s%20Water%20Economy%20-%20Thinking%20of%20future%20genera.

63. MSN Encarta, *United States Culture: Ways of Life: Dress*, http://encarta.msn.com/encyclopedia_1741500820_2/United_States_Culture.html (last visited Nov. 11, 2008).

The energy extractive industries will likely shrink because the carbon tax will reduce demand. There will likely be a similar decrease in other extractive industries, such as metals and stone, because there will be less energy to extract, smelt, manufacture, and transport them. This will reduce the strain that humans impose on the environment.

Agriculture now is very carbon intensive because fertilizers and pesticides are made from petroleum and substantial amounts of diesel fuel are needed to move tractors repeatedly across the field to plow, plant, apply fertilizer or pesticides, and harvest. But with less carbon available at higher costs, less carbon-intensive methods will be necessary.[64] Increased costs of transportation will result in more agricultural products being consumed closer to where they are produced.

World trade, travel, and globalization will be reduced as energy prices rise and carbon taxes are imposed.[65] In some regards, that reduction is truly a loss, not just of trade in goods, but also of trade in ideas, such as health care, science, literature, and ultimately, understanding. That loss may be a necessary one, however, dictated by energy scarcity and the need to reduce carbon emissions. Fortunately, much trade and exchange of ideas can be digital, which does not require physical transportation. Further, reductions in physical transportation may be in the public interest. Less transport of people should reduce the risk of epidemics, or at least slow their spread and thus allow more time to develop countermeasures.[66] Less transportation should reduce the problems caused by invasive species.[67] Finally, less transportation of components and products should reduce the risk that a few large factories will provide all of the world's needs for particular items, such that a fire,

64. David Elstein, U.S. Dept. of Agriculture, *No-Till Farming Can Decrease "Global Warming Potential,"* Aug. 31, 2004, http://www.ars.usda.gov/is/pr/2004/040831.htm; Press release, Ohio State Univ., No-Till Farming Offers a Quick Fix To Help Ward Off Host Of Global Problems (Apr. 15, 2004), http://researchnews.osu.edu/archive/notill.htm; Lisa Raffensperger, *A Fresh Green for No-Till Farming*, WORLD RESOURCES INST., Feb. 19, 2008, http://earthtrends.wri.org/updates/node/286.

65. Larry Rohter, *Shipping Costs Start To Crimp Globalization*, N.Y. TIMES, Aug. 3, 2008, *available at* http://www.nytimes.com/2008/08/03/business/worldbusiness/03global.html?_r=1&em&oref=slogin.

66. ScienceDaily.com, SARS: A Model Disease, Nov. 25, 2007, http://www.sciencedaily.com/releases/2007/11/071121085715.htm.

67. ENVTL. ENCYCLOPEDIA 559-60 (William P. Cunningham et al., 2d ed. 1998) (introduced species); USGS, Frequently Asked Questions About the Zebra Mussel, http://fl.biology.usgs.gov/Nonindigenous_Species/Zebra_mussel_FAQs/zebra_mussel_faqs.html (last visited Nov. 11, 2008).

flood, war, or earthquake at such a factory might devastate the world economy.[68]

Living conditions should continue to have the high qualities we have come to expect—including health care, communications, and product reliability and safety—but without the material excesses we can no longer afford. When Samuel Gompers, the founder and long-time leader of the American Federation of Labor, was asked what American workers wanted, he replied, "More."[69] We cannot afford very much "more" anymore, not in the United States and not in other parts of the world,[70] but we can have "better" worldwide. "Better" is the new, less carbon-intensive world.

68. *See* Lawrence V. Snyder & Zuo-Jun Max Shen, Nat'l Acad. of Eng'g, *Managing Disruptions to Supply Chains*, THE BRIDGE, 2006, http://www.nae.edu/nae/bridgecom.nsf/weblinks/MKEZ-6WHQGT?OpenDocument.

69. Currarino, *supra* note 1.

70. *Special report: How our economy is killing the Earth*, NEW SCIENTIST, Oct.16, 2008, http://www.newscientist.com/channel/opinion/mg20026786.000?promcode=nletter&DCMP=NLC-nletter&nsref=mg20026786.000.

APPENDIX

This appendix contains brief discussions of methods other than carbon taxation for reducing CO_2 emissions.

A. Subsidies

Examples of subsidies would include tax credits for purchasing fuel-efficient automobiles, 26 U.S.C. § 30 (2007), or for installing home renewable energy systems, 26 U.S.C. § 25C (2007). A major problem with subsidies is that we may not be able to afford them in light of the very large federal deficits and national debt.

Subsidies may effectively encourage the development of new technologies or bring to the citizen the benefit of positive externalities, but they also may go awry. For example, the subsidies for solar collectors in the Carter Administration often produced equipment with high prices and low quality.[71]

Questions that should be asked when designing a system of subsidies to reduce CO_2 emissions include:

1. For a subsidy to encourage switching from older vehicles to more efficient hybrids, is it better to subsidize the average citizen who will use the hybrid only a small part of each day, or to subsidize a delivery or taxi business that may use the vehicle many hours per day?

2. How much does subsidizing a fuel-efficient car result in reduced fuel consumption as the same miles are driven more efficiently, and how much does the increased fuel efficiency merely allow more driving, rather than fuel use reduction?

3. Is it better to subsidize wind energy or solar energy or biomass or efficiency?

4. Is it better to subsidize home installations or the probably more efficient, better maintained, and more carefully purchased large industrial installations? Even if the industrial facility might be more efficient, should home installations still be favored to garner political support and to raise public consciousness?

5. How can one get the greatest carbon reduction per dollar of subsidy, when both legislative and administrative decisions are often the product as much of horse-trading as of wisdom?

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71. *See, e.g.*, Energy Tax Act of 1978, Pub. L. No. 95-618 (30% of the first $2,000 and 20% of the next $8,000)*;* Crude Oil Windfall Profits Tax Act of 1980, Pub. L. No. 96-223, (40% of the first $10,000 in expenditures).

Most of these questions, it may be noted, would not need to be asked about a carbon tax.

B. Regulations

Regulations might set limits on the allowable emissions of CO_2. The problem with a limit is that it gives no incentive to those already below the limit to improve further even though a significant increase in efficiency could be obtained inexpensively, and it may close operations above the limit whose output is still needed.

Regulations may be effective, but they may also have unintended consequences. The original Corporate Average Fuel Economy ("CAFE") standards attempted to reduce gasoline consumption by increasing the miles per gallon of cars sold in the United States.[72] Although CAFE improved gas mileage in cars, CAFE did not apply to trucks such as minivans, sport utility vehicles, and pickup trucks, so CAFE contributed to the expansion of production of these gas-guzzling vehicles.

A carbon tax would not present problems like these, although it would raise other issues, as discussed in the text.

C. Cap-and-Trade

A cap-and-trade program creates allowances to pollute. Those allowances might be awarded to those already in the industry based on their current pollution levels, or they might be owned by the public and auctioned off to industry. Those most easily able to reduce their pollution might buy the pollution rights of an old polluting facility to allow the opening of several cleaner facilities. Compared to regulation, cap-and-trade provides incentives for even the cleaner facilities to improve, while not shuttering the dirty facilities until some new facility is ready to replace the dirty facility's output. The cap can be set to decrease over time, perhaps five percent annually, to incentivize further cleaning up the environment.

Cap-and-trade programs can be successful, but the U.N. program on carbon cap-and-trade has drawn criticism. [73]

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72. 49 U.S.C. §§ 32901-32919 (2007).

73. *See, e.g.*, Jeffrey Ball, *U.N. Warming Program Draws Fire*, WALL ST. J., July 11, 2008, at A1, *available at* http://online.wsj.com/article_print/SB121573736662544537 (criticizing approval of natural-gas-fueled electric generating plants under the cap-and-trade system); Leila Abboud, *Carbon King: Economist Strikes Gold In Climate-Change Fight*, WALL ST. J., Mar. 13, 2008, at A1, *available at* http://online.wsj.com/article_print/.

It is not clear how cap-and-trade will operate in regard to international trade between nations that subscribe to cap-and-trade and nations that do not or that have significantly differing systems of cap-and-trade.[74]

In a cap-and-trade system, someone must decide how to allocate carbon emission allowances. The allowances might be awarded based on existing emissions, but that system would favor those who now have high emissions because they have not acted to reduce their emissions and penalize those who have been working hard to lower emissions. Awarding emissions rights based on evaluation of particular industries and practice is likely to be highly politicized. To have the public own the right to emit, and then to sell this right to industry, may be desirable, but to do so may be withdrawing capital from the industries most needing to invest capital in emissions reduction. "The truth, perhaps inevitably, is that as carbon-cap laws become closer to reality, almost no one is happy. Coal-burning energy firms fear they'll be destroyed. Environmentalists worry that the energy lobby will gut the bills."[75]

A carbon tax would avoid many of these issues.

SB120535230851631199.html (noting that the London-based Climate Exchange PLC, "which handles about 90% of the trading on carbon exchanges, [has] a market capitalization of roughly $1.31 billion.").

74. See, e.g., the discussion of possible solutions and problems in Stavins, *Addressing Climate Change with a Comprehensive U.S. Cap-and-Trade System*, pp. 11-13, Fondazione Eni Enrico Mattei (Sept. 2008), http://ssrn.com/abstract=1262323.

75. *See, e.g.*, Robin Pagnamenta, *Royal Dutch Shell Threatens to Quit Europe Over Carbon-Charging Proposals*, TIMES OF LONDON, Apr. 10, 2008, *available at* http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article3716388.ece. Clive Thompson, *A Green Coal Baron?*, N. Y. TIMES MAGAZINE, June 22, 2008, *available at* http://www.nytimes.com/2008/06/22/magazine/22Rogers-t.html?_r=1&scp=1&sq=green%20coal%20baron&st=cse&oref=slogin; James Kanter, *The Trouble With Markets for Carbon*, N. Y. TIMES, June 20, 2008, *available at* http://www.nytimes.com/2008/06/20/business/worldbusiness/20emissions.html.

Global Climate Change: Can Human Rights (and Human Beings) Survive this Onslaught?†

Sumudu Atapattu*

ABSTRACT

The fact that global climate change is occurring is no longer seriously debated; rather, the discussion now focuses on the range and severity of its consequences. These consequences extend beyond harm to the natural environment and human health and implicate the whole range of human rights recognized under international law—civil, political, economic, social, and cultural. The international community must not only find a legal solution to this problem within existing structures of governance, but must also adapt the very structures of international law in order to address such a pervasive and truly global problem which now requires the adoption of both mitigation and adaptation strategies. The response of the international community thus far has been inadequate, as the link between environmental and socioeconomic issues, such as

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poverty and underdevelopment, has only recently entered the debate on climate change. It is time for international lawmakers to take a holistic approach to climate change that addresses its impacts on human rights, economic development, and international conflict, as well as the natural environment. In other words, the international community should adopt a sustainable development approach to the issue of climate change.

I. INTRODUCTION

Global climate change has received unprecedented attention in recent months. From the Nobel Peace Prize award to the Intergovernmental Panel on Climate Change ("IPCC") and former U.S. Vice President Al Gore, to the Climate Change conference in Bali in December 2007, much has been discussed and debated about climate change.

Never before has the international community been faced with an "environmental" problem of this magnitude, threatening not only the present generation but also generations yet unborn. While global climate change originated as an environmental problem, it now impinges on every aspect of human life. It affects the international economy, public health, and social issues such as migration and loss of livelihood. Ultimately, it has the potential to impact international peace and security. In short, global climate change could jeopardize the very survival of human beings on the planet. It would not be wrong to consider this an all-pervasive problem of unprecedented proportions facing the international community today. As the President of the World Bank, Robert Zoellick, noted at Bali: "Climate change is a development, economic, and investment challenge. It offers an opportunity for economic and social transformation that can lead to an inclusive and sustainable globalization. That is why addressing climate change is a critical pillar of the development agenda."[1]

Much has been written and argued about global climate change since its emergence in the late 1970s.[2] From its total rejection to a

1. *Towards a Strategic Framework on Climate Change and Development for the World Bank Group* 9, (World Bank Concept and Issues Paper Consultation Draft, 2008), *available at* http://siteresources.worldbank.org/INTCC/Resources/SFCCD_Concept_and_Issues_Paper_Consultation_Draft_27March2008sm.pdf.

2. There is a wealth of literature on the subject, both general and scholarly. *See* Erin Casper Borissov, *Global Warming: A Questionable Use of the Political Question Doctrine*, 41 IND. L. REV. 415 (2008); John C. Dernbach & Seema Kakade, *Climate Change Law: An Introduction*, 29 ENERGY L.J. 1 (2008); Daniel A. Farber, *Apportioning Climate Change Costs*, 26 UCLA J. ENVTL. L. & POL'Y 21 (2007/2008); Christopher D. Stone, *Beyond Rio: "Insuring" Against Global Warming*, 86 AM. J. INT'L L. 445 (1992);

gradual and rather reluctant acceptance, the shift in debate on climate change has not been smooth. It has been wrought with controversy, with its existence challenged by scientists as well as by policy makers around the world.

Today, the occurrence of global climate change is no longer challenged. Rather, the debate in the global community now centers on "how much change" and "when will this change occur?" The present erratic climate patterns, including the increased incidence of hurricanes and storms, the melting of polar ice caps, and very warm summers have all been attributed to climate change.[3] While some of these changes may be the result of natural causes, there is no longer serious doubt that human activity has exacerbated this problem.[4]

The human costs of global climate change will be astronomical. These range from the very survival of human beings to adapting to different livelihoods, crops, cultural practices, and different lifestyles, as well as displacement and migration on a massive scale.[5] Thus, a broad range of human rights may be violated as a result of global climate change. Moreover, adaptation strategies—as it is no longer possible to rely solely on mitigation measures—must themselves be informed by a human rights approach in order to ensure that they do not further violate the protected rights of vulnerable communities.[6] Despite the clear link between global climate change and human rights, it was not until recently that the debate on climate change has been framed within the human rights discourse. It was only in April 2008 that the United Nations Human Rights Council discussed the issue of climate change and requested that the Office of the High Commissioner for Human Rights

Symposium, *Global Climate Change: Individual, Private Sector, and State Responses*, 26 VA. ENVTL. L.J (2008); Erica J. Thorson, *The Failure of The United States and The World Heritage Committee to Take Climate Change Mitigation Pursuant to The World Heritage Convention Seriously*, 38 ENVTL. L. 139 (2008).

3. *See* Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report, Summary for Policymakers* (unedited ed. 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf [hereinafter *IPCC 4th Report*].

4. *Id.*

5. *Id.*

6. *See* Ira Feldman & Joshua H. Kahan, *Preparing for the Day After Tomorrow: Frameworks for Climate Change Adaptation*, 8 SUSTAINABLE DEV. L & POL'Y 61 (2007); *Overcoming the Barriers: Mainstreaming Climate Change Adaptation in Developing Countries* (Tearfund Climate Change Briefing Paper No. 1, 2006), *available at* http://www.tearfund.org/webdocs/website/Campaigning/Policy%20and%20research/Overcoming%20the%20barriers%20briefing%20paper.pdf.

submit "a detailed analytical study of the relationship between climate change and human rights" to the Council prior to its tenth session.[7]

This Article seeks to discuss the impact that global climate change has on the realization of human rights and its implications for international law. It discusses the potential rights violations resulting from climate change, the international community's response to this serious problem, the adequacy of that response, and how international law-makers must respond to the threat posed by climate change, particularly in relation to international peace and security. The increasing challenge posed by the emergence of a new category of displaced persons—environmental refugees who have become displaced as a result of either a natural disaster or who are fleeing a place that can no longer sustain them—will not be discussed in detail here as it has been covered elsewhere by the author.[8] It is also predicted that global climate change will play a major role in increasing the incidence of conflict, thereby undermining regional and/or international peace and security.[9] In short, global climate change can give rise to complex, interwoven issues at the international level. The question is: can the present international legal order cope with these challenges?

Given that these concerns cut across a wide spectrum of issues—environmental, economic and social—global climate change poses a

7. Draft Res. 7/23, ¶ 1, U.N. Hum. Rts. Council, 7th Sess., U.N. Doc. A/HRC/7/L.21/Rev.1 (Mar. 26, 2008). *See also* Male' Declaration on the Human Dimension of Global Climate Change (Nov. 14, 2007), *available at* http://www.ciel.org/Publications/Male_Declaration_Nov07.pdf. *See generally* Sarah Aminzadeh, *A Moral Imperative: The Human Rights Implications of Climate Change*, 30 HASTINGS INT'L & COMP. L. REV. 231 (2007); Simon Caney, *Cosmopolitan Justice, Rights and Global Climate Change*, 19 CAN. J.L. & JURIS. 255 (2006); Marguerite E. Middaugh, *Linking Global Warming to Inuit Human Rights*, 8 SAN DIEGO INT'L L.J. 179 (2006); Hari Osofsky, *The Inuit Petition as a Bridge? Beyond Dialectics of Climate Change and Indigenous People's Rights*, 31 AM. INDIAN L. REV. 675 (2006/2007); Jorge Daniel Taillant, *Human Rights, Development and Climate Change Negotiations* (2007), *available at* http://www.cedha.org.ar/en/initiatives/climate_change/docs/human_rights.pdf; Human Rights and Equal Opportunity Commission, *Background Paper: Human Rights and Climate Change* (2008) (Austl.), *available at* http://www2.ohchr.org/english/issues/climatechange/docs/submissions/Australia_HR_Equal_Opportunity_Commission_HR_ClimateChange_4.pdf; U.N. Dev. Programme [UNDP], *Human Development Report 2007/2008: Fighting Climate Change: Human Solidarity in a Divided World* (2007), *available at* http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf.

8. *See* Sumudu Atapattu, *Global Climate Change and Forced Migration: Implications for International Law* (Int'l Council on Hum. Rts. ed., Cambridge University Press) (forthcoming).

9. *See* discussion *infra* Part V.A.

particular challenge to sustainable development.[10] In other words, climate change can undermine the very process of sustainable development that the international community endorsed at the Rio Conference on Environment and Development in 1992,[11] and reiterated at the World Summit on Sustainable Development in 2002.[12]

The human focus of this paper should not be taken as an acknowledgement that other species or ecosystems are not important. While advocating for an ecocentric approach to environmental problems,[13] this paper focuses on human beings in order to draw attention to the devastating consequences of this human-made catastrophe. Drastic action is needed now to deal with the consequences of climate change, in the form of both mitigation and adaptation.[14]

II. GLOBAL CLIMATE CHANGE – FACTS AND MYTHS[15]

In a report released in 2006, the World Meteorological Organization ("WMO") stated that the "heat-trapping greenhouse gases in the atmosphere reached a record high in 2005 and are still increasing."[16] According to this report, there are no signs that increases in nitrous oxide or carbon dioxide levels are slowing down. Despite some attempt at reducing greenhouse gases,[17] such gases have continued to rise. As a

10. *See* Jaap Spier, *Legal Aspects of Global Climate Change and Sustainable Development* (2006), *available at* http://www.indret.com/pdf/346_en.pdf.

11. Conference on Environment and Development, Rio de Janeiro, Brazil, June 3-14, 1992, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26 (Aug. 12, 1992), *available at* http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=78&ArticleID=1163.

12. World Summit on Sustainable Development, Johannesburg, South Africa, Aug. 26-Sept. 4, 2002, Report of the World Summit on Sustainable Development, U.N. Doc. A/CONF.199/20 (Jan. 8, 2003), *available at* http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POI_PD.htm.

13. I have written elsewhere about the pros and cons of a human rights approach to environmental issues. *See* Sumudu Atapattu, *The Right to a Healthy Life or the Right to Die Polluted?:The Emergence of a Human Right to a Healthy Environment Under International Law*, 16 TULANE ENVTL. L. REV. 65 (2002).

14. It is generally accepted that both mitigation and adaptation are necessary to deal with climate change. With regard to the need for this dual approach, see *IPCC 4th Report*, *supra* note 3.

15. *See generally* JAMES WANG & MICHAEL OPPENHEIMER, ENVIRONMENTAL DEFENSE, THE LATEST MYTHS AND FACTS ON GLOBAL WARMING (2005), *available at* http://www.edf.org/documents/4418_MythsvFacts_05.pdf.

16. Eliane Engeler, *U.N. Says 2005 Set Greenhouse Gas Record*, CBS NEWS, Nov. 3, 2006, http://www.cbsnews.com/stories/2006/11/03/ap/tech/mainD8L5M2MG1.shtml (last visited Oct. 16, 2008).

17. See the discussion on the international response, *infra* Part III.

result of the accumulation of these gases the atmosphere has become like a greenhouse, trapping solar radiation and causing the temperature of the Earth to slowly rise over the years. The negative impacts of this gradual warming of the Earth's surface include: melting polar glaciers causing the sea level to rise; changes in the world's weather patterns, leading to an increased incidence of hurricanes, storms, and cyclones; increasing incidence of disease as a result of changing weather patterns and increased temperature; and increasing prevalence of many vector-borne, food-borne and water-borne infectious diseases which are sensitive to changes in climatic conditions—malaria and dengue are expected to increase along with heat-related deaths and illnesses, particularly in urban populations.[18]

Furthermore, increased flooding will not only increase the risk of death by drowning, but also the risk of diarrhea and respiratory diseases, as well as hunger and malnutrition in developing countries.[19] Climate change is also projected to diminish crop yields and food production in some regions, particularly in the tropics, resulting in malnutrition, impaired child development, and in some cases, loss of livelihood which, in turn, would lead to other socioeconomic problems. Diminished crop yield will have implications for trade and economic development as well as for food security.

In a special report on global warming in April 2006, *Time* magazine warned that the Earth is at the tipping point.[20] According to the report, polar ice caps are melting faster than ever, more land is being devastated by drought, and rising waters are drowning low-lying communities:

> From heat waves to storms to floods to fires to massive glacial melts, the global climate seems to be crashing around us. Scientists have been calling this shot for decades. This is precisely what they have been warning would happen if we continued pumping greenhouse gases into the atmosphere, trapping the heat that flows in from the sun and raising global temperatures.[21]

Three factors point to the need for urgent action: "societies are becoming increasingly interdependent; the climate system is changing;

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18. *See* Posting of Jesse Jenkins to *It's Getting Hot in Here, Warnings from a Warming World: World Meteorological Organization Reports on Extreme Weather Events*, http://itsgettinghotinhere.org/2007/08/07/warnings-from-a-warming-world-world-meteorological-organization-reports-on-extreme-weather-events/ (Aug. 7, 2007).

19. *Id*.

20. Jeffrey Kluger, *Global Warming Heats Up*, TIME, Mar. 26, 2006, *available at* http://www.time.com/time/printout/0,8816,1176980,00.html.

21. *Id.*

and losses associated with climatic hazards are rising."[22] Increased societal interdependency poses both positive and negative effects. Among the positive consequences are the increased mobility of societies and the easier movement of labor and products. Challenges are presented by the difficulty in containing environmental crises, as everything is interrelated and interdependent. Thus, a local environmental issue could become a global issue because of this interdependency. Global climate change is a prime example of this relationship. Two to three decades ago, the energy policy of a country was considered an internal matter. Deforestation, land use, industrial pollution, vehicular emissions, and farming industries were also considered internal issues. We now know that all these internal policies and activities have created a global "monster"—global climate change.

In its latest report, the IPCC stated unequivocally:

> Global atmospheric concentrations of CO_2 [carbon dioxide], methane (CH_4) and nitrous oxide (N_2O) have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. . . . Global increases in carbon dioxide concentrations are due primarily to fossil fuel use, with land-use change providing another significant but smaller contribution. It is very likely that the observed increase in CH_4 concentration is predominantly due to agriculture and fossil fuel use.[23]

Thus, there seems to be little doubt that global climate change due to human activity is taking place today. However, most consequences of this change will be gradual and will be felt in years to come. It is not clear exactly what the consequences will be or when they will materialize. What seems certain, however, is that global climate change is taking place now and the poorer sectors of society will bear a disproportionate share of the burden.[24] Among those affected by climate change are indigenous communities, such as the Inuit in the Arctic. Thinning ice caused by rising arctic temperatures and shifting winds

22. *Living with Climate Variability and Change*, 29 WORLD CLIMATE NEWS (World Meteorological Org., Geneva, Switz.), June 2006, at 3.

23. *IPCC 4th Report*, *supra* note 3, at 5.

24. *See* U.N. Dev. Programme [UNDP], *Fighting Climate Change: Human Solidarity in a Divided World*, HUMAN DEVELOPMENT REPORT (2007/08), http://hdr.undp.org/en/reports/global/hdr2007-2008; *see also* Paroma Basu, *Third World Bears Brunt of Global Warming Impacts*, UNIV. OF WIS.-MADISON NEWS, Nov. 16, 2005, http://www.news.wisc.edu/11878.html.

have put the traditional hunting patterns of thousands of years in jeopardy.[25]

The IPCC refers to some of the impacts of global climate change as follows: in Africa between seventy-five and 250 million people will be exposed to increased water stress by 2020; towards the end of the twenty-first century, large populations in low-lying coastal areas will be affected by sea-level rise, and the cost of adaptation could amount to at least five to ten percent of the Gross Domestic Product. In Asia, by 2050, the availability of freshwater will decrease, coastal areas will be at great risk due to increased flooding, and the pressures on natural resources will increase. In Latin America, by mid-century, an increase in temperature and a decrease in soil water could lead to the replacement of tropical forest by savanna. There are also significant risks of biodiversity loss and adverse consequences on food production due to decreased productivity of important crops and livestock. In addition, water availability for human consumption, agriculture and energy generation is projected to be significantly affected.[26]

In a report on climate change and human health, the World Health Organization ("WHO"), the United Nations Environmental Program ("UNEP") and the WMO demonstrate the magnitude of the problem and the intrinsic links between the disparate impacts of climate change. This, in turn, highlights the need to adopt an integrated approach to climate change:

> By contrast, the public health consequences of the disturbance of natural and managed food-producing ecosystems, rising sea-levels and of population displacement for reasons of physical hazard, land loss, economic disruption and civil strife may not become evident for up to several decades.[27]

III. INTERNATIONAL RESPONSE

Two binding international instruments comprise the international legal framework governing climate change: the UN Framework

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25. Beth Duff-Brown, *Global Warming Effects Hunting*, PEACE CORPS ONLINE, Mar. 1, 2007, http://peacecorpsonline.org/messages/messages/467/2093056.html.

26. *See IPCC 4th Report*, *supra* note 3. *See also* Hannah Reid & Saleemul Huq, *Adaptation to Climate Change*, INTERNATIONAL INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT: COP 13 BRIEFINGS AND OPINION PAPERS, Dec. 2007, at 18, *available at* http://www.sciencedev.net/Docs/climate%20change%20and%20development.pdf.

27. WORLD HEALTH ORG., SUMMARY: CLIMATE CHANGE AND HUMAN HEALTH: RISKS AND RESPONSES 7, http://www.who.int/globalchange/climate/en/ccSCREEN.pdf [hereinafter WHO SUMMARY].

Convention on Climate Change[28] ("UNFCCC") adopted at the Rio Conference on Environment and Development in 1992 and the Kyoto Protocol[29] adopted in 1997. These documents reflect a trend in international environmental law of adopting a framework convention first with general objectives and principles followed by a protocol within that framework embodying more specific obligations.[30]

The UNFCCC recognizes the need to protect human health and welfare in addition to protecting the environment from the adverse effects of climate change. Acknowledging that climate is "a common concern of humankind,"[31] the main objective of the UNFCCC is to achieve the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropocentric interference with the climate system.[32] Particular emphasis is placed on the need to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Article 3 of the UNFCCC embodies the principles that guide the parties to the Agreement: the climate system shall be protected for the benefit of present and future generations of humankind; the special needs and circumstances of developing countries must be given full consideration; precautionary measures must be adopted to mitigate the adverse effects of climate change; and finally, the parties have a right to, and should, promote sustainable development.[33] The UNFCCC specifically notes that full account must be taken of "the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty."[34]

The UNFCCC as a whole reflects the influence of sustainable development.[35] While almost all environmental treaties make the link

28. United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107 (entered into force Mar. 21, 1994) [hereinafter UNFCCC].

29. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, FCCC/CP/1997/L.7/Add.1 (entered into force Feb. 16, 2005).

30. The framework (umbrella) treaty and protocol approach has been adopted in relation to long-range transboundary air pollution and ozone depletion. A modified version of this approach can be seen in relation to biodiversity and hazardous waste.

31. UNFCCC, *supra* note 28, pmbl. This phrase was coined in order to avoid the controversy surrounding the common heritage of mankind principle while at the same time highlighting the global nature of climate change. For a discussion of these principles, see SUMUDU ATAPATTU, EMERGING PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW (Transnational Publishers, 2006).

32. UNFCCC, *supra* note 28, art. 2.

33. *Id*. art. 3.

34. *Id*. pmbl.

35. For a discussion of sustainable development, see ATAPATTU, *supra* note 31, ch. 2; *Report of the World Commission on Environment and Development: Our Common*

between environmental issues and human health,[36] only post-Rio instruments make a link between environmental issues and socioeconomic issues such as poverty and under-development. Participatory rights[37] also play an important role here. This is a direct result of the emergence of sustainable development as a framework governing the environmental decision-making process. While an in-depth discussion of sustainable development is beyond the scope of this paper, suffice it to note that sustainable development encompasses economic development, social development and environmental protection.[38] These three components are considered to be "interdependent and mutually reinforcing pillars of sustainable development."[39] There is no doubt that climate change threatens all three pillars.

Given its close link with economic development and its far-reaching and, in some instances, irreversible consequences on human beings and the environment, it seems that the climate change regime is not simply an environmental regime, but also a sustainable development regime. For this reason, climate change is a good case study of the impacts of a sustainable development regime on the environment, human beings and other species, and the economy. Since the present discussion is on the link between climate change and human rights, no detailed analysis will be made of the international instruments governing climate change other than to note that the international community will have to ensure that high greenhouse gas emitters—whether they are developing countries[40]

Future, UN DOCUMENTS COOPERATION CIRCLES, http://www.un-documents.net/wced-ocf.htm.

36. For the definition of "air pollution," *see, e.g.*, Convention on Long-Range Transboundary Air Pollution [LRTAP], Nov. 13, 1979, 18 ILM 1442 (entered into force Mar. 16, 1983); Oslo Protocol to the LRTAP on Further Reduction of Sulphur Emissions pmbl., UNDOC. EB. AIR/R.84; United Nations Convention on the Law of the Sea, 1833 U.N.T.S. 3 (entered into force Nov. 16, 1984) (definition of "pollution of the marine environment"); Vienna Convention for the Protection of the Ozone Layer pmbl., 1513 U.N.T.S. 293 (entered into force Sept. 22, 1988).

37. Rights to information, participation in the decision making process and access to remedies are now codified. *See* Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, June 25, 1998, 38 ILM 517 (1999) [hereinafter Aarhus Convention].

38. *See* World Summit on Sustainable Development, Aug. 26–Sept. 4, 2002, *Johannesburg Declaration on Sustainable Development*, UN Doc. A/Conf.199/L.6/Rev.2 (2002), *available at* http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POI_PD.htm (for adopted Plan of Implementation).

39. *Id.* ¶ 5.

40. China has surpassed the United States in greenhouse gas emissions although the United States has much higher per capita emissions than China. *See China Surpasses the U.S. in CO2 Emissions*, MONGABAY.COM, June 20, 2007, http://news.mongabay.com/2007/0620-china.html.

or developed countries—participate in the post-Kyoto regime. It is encouraging to note that at the UN Climate Change Conference in Bali in December 2007, all parties recognized that *deep* cuts in global emissions would be required to achieve the objective of the Convention.[41] Moreover, developing countries recognized for the first time the need to cut down on their greenhouse gas emissions, albeit in very cautious language. The parties decided to initiate enhanced national and international action on mitigation of climate change, including consideration of "[n]ationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner."[42]

IV. PROTECTED RIGHTS AFFECTED BY CLIMATE CHANGE

Virtually the whole gamut of human rights protected under international law—civil and political rights; economic, social and cultural rights; and perhaps even third generation rights to the extent such rights are accepted by the international community—may be affected as a result of climate change. This section analyzes these rights and discusses some of the case law that has emerged in this area. Before doing so, however, it is necessary to discuss what a rights-based approach adds to the discussion on climate change.

A rights-based approach may provide a conceptual framework for policies on climate change, "which is *normatively* based on international human rights standards and which is *practically* directed to promoting and protecting human rights."[43] The added value of a rights-based approach is as follows: it gives a human face to the issue, focuses on excluded and marginalized groups, encourages accountability and transparency in policy decisions, encourages participatory and democratic processes, and provides sustainable outcomes by building on the capacity of key stakeholders.[44]

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41. *See* U.N. Climate Change Conference, Dec. 3–15, 2007, *Bali Action Plan*, Decision - /CP.13 (advance unedited version), *available at* http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf.

42. *Id*.

43. Human Rights and Equal Opportunity Commission, Background Paper, *Human Rights and Climate Change* 12 (2008) (Austl.), *available at* http://www.hreoc.gov.au/about/media/papers/hrandclimate_change.htm.

44. *Id.*

A. Right to Life

The most fundamental of all rights is the right to life. It is protected under Article 6 of the International Covenant on Civil and Political Rights[45] ("ICCPR"), as well as under regional human rights treaties, and is considered a peremptory norm of international law.[46] It is one of the few rights from which no derogation is possible, even in times of an emergency.[47] It is the right from which all other rights flow and is one of the rights that constitutes "the irreducible core of human rights."[48]

The above discussion shows that as a result of climate change, the right to life of people all over the world will be at risk due to increased incidence of hurricanes, cyclones, flooding, heat waves, increased air pollution, and vector borne diseases. The Inuit case, which is discussed further in Part IV.F.2, highlights this link. The petitioners in this case—Inuit people from the United States and Canada—argued that they are facing extinction and have become endangered because of climate change.[49] Drawing a clear link between environmental degradation and their very survival, the petitioners further argued that:

> One of the most significant impacts of warming in the Arctic has been on sea ice. Commonly observed changes include thinner ice, less ice, later freezes and earlier, more sudden thaws. Sea ice is a critical resource for the Inuit, who use it to travel to hunting and harvesting locations, and for communication between communities. Because of the loss in the thickness, extent and duration of the sea

45. International Covenant on Civil and Political Rights art. 6, Dec. 16, 1966, 999 U.N.T.S. 171 (entered into force Mar. 23, 1976), *available at* http://www.unhchr.ch/html/menu3/b/a_ccpr.htm [hereinafter ICCPR].

46. The Vienna Convention on the Law of Treaties defines a peremptory norm (jus cogens) as "a norm accepted and recognized by the international community of States as a whole as a norm from which no derogation is permitted and which can be modified only by a subsequent norm of general international law having the same character." Vienna Convention on the Law of Treaties art. 53, May 23, 1969, 1155 U.N.T.S. 331 (entered into force Jan. 27, 1980).

47. See ICCPR, *supra* note 45, art. 4(2), which states that "No derogation from articles 6, 7, 8 (paragraphs 1 and 2), 11, 15, 16 and 18 may be made under this provision." Article 4 deals with situations when derogation can be lawfully made in times of public emergency which threatens the life of the nation. Such derogation is strictly limited to the exigencies of the situation and should not constitute discrimination solely on the grounds of race, color, sex, language, religion or social origin.

48. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, 506 (July 8) (opinion of Judge Weeramantry), *cited in* NIHAL JAYAWICKRAMA, THE JUDICIAL APPLICATION OF HUMAN RIGHTS: NATIONAL, REGIONAL AND INTERNATIONAL JURISPRUDENCE 243 (2002).

49. For a discussion of this case, see *infra* Part IV.F.2. *See also* Hari Osofsky, *supra* note 7.

> ice, these traditional practices have become more dangerous, more difficult or, at times, impossible. In many regions, traditional knowledge regarding the safety of the sea ice has become unreliable. As a result, more hunters and other travelers are falling through the sea ice into the frigid water below. The shorter season for safe sea ice travel has also made some hunting and harvest activities impossible, and curtailed others. For the Inuit, the deterioration in sea ice conditions has made travel, harvest, and everyday life more difficult and dangerous.[50]

Small island states are arguably the most at risk of being submerged as a result of climate change. In the Male Declaration on the Human Dimension of Global Climate Change, the Small Island Developing States expressed their concern as follows:

> *Concerned* that climate change has clear and immediate implications for the full enjoyment of human rights including *inter alia* the right to life, the right to take part in cultural life, the right to sue and enjoy property, the right to an adequate standard of living, the right to food, and the right to the highest attainable standard of physical and mental health.[51]

In other words, those who are living in these countries run the risk of a violation of their right to life. However, because this is a gradual process, we can reduce this risk by developing proper adaptation strategies which ensure the protection of the human rights of these vulnerable communities.

Thus, while the right to life of people will be violated in extreme cases related to climate change—and in the case of the Inuit this is already happening—we could minimize these violations with proper adaptation strategies and proactive measures.

B. Right to Health

While the link between climate and human health has been recognized for centuries, the present debate is centered on the scale of the change and the man-made nature of the problem. Although there have been many historical accounts of famines and malnutrition associated with climatic fluctuations, the present situation must be

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50. Petition to the Inter-American Commission on Human Rights Seeking Relief from Violations Resulting from Global Warming Caused by Acts and Omissions of the United States at 2 (Dec. 7, 2005), *available at* http://www.ciel.org/Publications/ICC_Petition_7Dec05.pdf.

51. *See* Male' Declaration on the Human Dimension of Global Climate Change, *supra* note 7, at 2.

distinguished from these past fluctuations.[52] Global climate change will permanently increase the global temperature by a few degrees, resulting in catastrophic consequences.

The WHO defines health as "a state of *complete* physical, mental and social well-being and not merely the absence of disease or infirmity."[53] Upon ratifying the WHO Constitution, states accept a set of nine principles that are basic to the happiness, harmonious relations and security of all peoples. Two such principles are:

> 1. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition.
>
> 2. The health of all peoples is fundamental to the attainment of peace and security and is dependent upon the fullest co-operation of individuals and States.[54]

Thus, health has been defined widely, encompassing physical, mental and social well-being. The WHO Constitution also recognizes the link between health, peace and security, as well as happiness and harmonious relations.[55] The objective of the WHO is for all peoples to attain the highest possible level of health.[56] In recent years, the WHO has interpreted its mandate widely by taking into account the link between health, socioeconomic development, and human security.[57] The following issues are identified as forming part of the WHO agenda: promoting development; fostering health security; strengthening health

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52. *See* R.T. Watson & A.J. McMichael, *Global Climate Change – the latest assessment: does global warming warrant a health warning?*, 2 GLOBAL CHANGE & HUMAN HEALTH 64, NO. 1 (2001).

53. Constitution of the World Health Organization pmbl., July 22, 1946 (emphasis added), *available at* http://www.searo.who.int/LinkFiles/About_SEARO_const.pdf [hereinafter WHO Constitution]. The word "complete" in the definition has been roundly critiqued drawing parallel with other specialized agencies—whether the Food and Agriculture Organization's constitution should refer to complete nourishment or whether the United Nations Educational, Scientific, and Cultural Organization's constitution should refer to complete education, whatever that may mean. *See* Sissela Bok, *Rethinking the WHO Definition of Health* (Oct. 2004) (Harvard Center for Population and Development Studies, Working Paper) *available at* http://www.globalhealth.harvard.edu/hcpds/wpweb/Bok_wp1407_3.pdf. The reference to social well-being has also been criticized as being vague.

54. WHO Constitution, *supra* note 53, pmbl.

55. However, see Sissela Bok, *supra* note 53, for a scathing attack on the definition of health and on the declaration that all nine principles are basic to happiness, harmonious relations and security of all peoples.

56. WHO Constitution, *supra* note 53, art. 1.

57. *See* WHO, The WHO Agenda, http://www.who.int/about/agenda/en/index.html (last visited Nov. 5, 2008).

systems; harnessing research, information and evidence; enhancing partnerships; and improving performance.[58]

The agenda also recognizes the vicious cycle of poverty: poverty contributes to poor health and "poor health anchors large populations in poverty."[59] The WHO agenda stresses that health development must be based on equity: "access to life-saving or health-promoting interventions should not be denied for unfair reasons."[60] In addition, health services must reach poor and marginalized populations.

Article 12 of the International Covenant on Economic, Social and Cultural Rights ("ICESCR") embodies the right of everyone to the enjoyment of the highest attainable standard of physical and mental health.[61] This right differs considerably from the definition of health in the WHO Constitution, as Article 12 makes no reference to social wellbeing, although Article 11 enshrines the right of everyone to an adequate standard of living.[62] It is not clear whether this amounts to social wellbeing. However, whatever the precise content of the right, it is clear that the right to health under ICESCR will be jeopardized as a result of climate change.

The WHO has clearly recognized the health risks associated with climate change:

> The first *detectable* changes in human health may well be alterations in the geographic range (latitude and altitude) and seasonality of certain vector-borne infectious diseases. Summer-time food-borne infections (e.g., salmonellosis) may show longer-lasting annual peaks. There has been debate, as yet unresolved, over whether recent increases of malaria and dengue in highland regions around the world may be due to climate factors or other factors . . . Hot weather would amplify the production of noxious photochemical smog in urban areas, and warmer summers would increase the incidence of food poisoning.[63]

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58. *Id.*

59. *Id*

60. *Id*.

61. International Covenant on Economic, Social and Cultural Rights, G.A. Res. 2200A (XXI), art. 12, U.N. Doc. A/6316 (Dec. 16, 1966) [hereinafter ICESCR].

62. *Id*. art. 11.

63. WHO SUMMARY, *supra* note 27, at 7. *See also* Steven D. Jamar, *The International Human Right to Health*, 22 S.U. L. REV. 1 (1994); Satvinder Juss, *Global Environmental Change: Health and the Challenge for Human Rights*, 5 IND. J. GLOBAL LEGAL STUD. 121 (1997); Watson & McMichael, *supra* note 52; WHO Climate and Health Working Group Meeting, May 18–19, 1999, *Climate and Health*, WHO/SDE/OEH/99.6, *available at* http://whqlibdoc.who.int/hq/1999/WHO_SDE_OEH_99.6.pdf; WHO, THE WORLD HEALTH REPORT 2003: SHAPING THE FUTURE ch. 1 (2003), *available at* http://www.who.int/whr/2003/chapter1/en/index.html.

The range of health effects that may be caused by climate change clearly shows that the right to mental and physical health will be affected as a result of climate change. While the link between climate change and health has been recognized for sometime by the WHO,[64] it is only recently that climate change has been considered a global health problem with ethical dimensions.[65]

C. Right to Food and Water

Article 11 of the ICESCR recognizes the right of everyone to an adequate standard of living including adequate food, clothing, and housing, and to the continuous improvement of living conditions.[66] It also refers to the fundamental right of everyone to be free from hunger. While water is not specifically mentioned here, people cannot survive without water, and in 2002 the United Nations Human Rights Committee recognized that access to water is a basic human right as well.[67]

As noted above, the IPCC has determined that millions of people in Africa, Asia, and Latin America will be subject to water stress as a result of climate change.[68] World crop production, particularly cereal production, would be severely affected as a result of climate-related change in water availability, which, in turn, will have impacts on health—in the form of malnutrition and disease—as well as on economic development and trade. Water is essential to life, yet it is becoming increasingly scarce. Climate change will exacerbate the situation. The United Nations Development Program ("UNDP") noted the seriousness of the situation:

> Water, the stuff of life and a basic human right, is at the heart of a daily crisis faced by countless millions of the world's most vulnerable people—a crisis that threatens life and destroys livelihoods on a devastating scale.
>
> Unlike wars and natural disasters, the global crisis in water does not make media headlines. Nor does it galvanize concerted international

64. *See Climate and Health*, *supra* note 63.

65. *See, e.g.*, Jonathan A. Patz et al., *Climate Change and Global Health: Quantifying a Growing Ethical Crisis*, 4 ECOHEALTH 379 (2007), *available at* http://www.springerlink.com/content/212lw8m6466n645p/fulltext.pdf.

66. ICESCR, *supra* note 61, art. 11.

67. *See* U.N. Econ. & Soc. Council, Comm. on Econ., Soc., & Cultural Rights, *General Comment No. 15: the Right to Water*, U.N. Doc. E/C.12/2002/11 (Jan. 20, 2003), *available at* http://www.unhchr.ch/tbs/doc.nsf/0/a5458d1d1bbd713fc1256cc400389e94?Opendocument.

68. *See IPCC 4th Report*, *supra* note 3.

> action. Like hunger, deprivation in access to water is a silent crisis experienced by the poor and tolerated by those with the resources, the technology and the political power to end it. Yet this is a crisis that is holding back human progress, consigning large segments of humanity to lives of poverty, vulnerability and insecurity. This crisis claims more lives through disease than any war claims through guns.[69]

The UNDP excerpt highlights the magnitude of the problem that undermines the realization of many protected rights, including the rights to water, food, health, development, environment, and livelihood. Similar to human security,[70] the debate on water has been moving towards accepting the concept of "water security," which seeks to ensure that every person has "reliable access to enough safe water at an affordable price to lead a healthy, dignified and productive life, while maintaining the ecological systems that provide water and also depend on water."[71]

The statistics are staggering: 1.8 million children die *each year* as a result of diseases associated with unclean water and poor sanitation.[72] The number of people that die as a result of violent conflict and natural disasters—disturbing as the numbers are—is minuscule compared to the number of people that die as a result of water-borne diseases. The saddest part is that these deaths are easily preventable. While public health pandemics such as HIV/AIDS and avian flu have received considerable international attention, the crisis of water-borne disease has received minimal attention.[73] The UNDP posits this may be due to the fact that this is a primarily poverty-related issue occurring in poor countries.[74]

Recognizing the magnitude of the problem, the international community pledged in the United Nations Millennium Development Goals to halve the number of people without access to clean drinking water and sanitation by 2015. Although we are past the half-way mark towards the deadline, there is little evidence that much progress has been made in addressing the problem. It is also necessary to recognize how this goal relates to other goals in the Millennium Declaration. For example, having access to clean water and sanitation would save the

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69. UNDP, *Human Development Report 2006: Beyond Scarcity* at 1 (2006), *available at* http://hdr.undp.org/en/media/HDR06-complete.pdf.

70. There is no universally accepted definition of human security. *See generally*, U.N. Comm'n on Human Sec., *Human Security Now* (2003), *available at* http://www.humansecurity-chs.org/finalreport/English/FinalReport.pdf.

71. UNDP, *supra* note 69, at 3.

72. *Id.* at 6.

73. *Id.* at 3.

74. *Id.*

lives of many children, support progress in education as many children miss school due to ill-health and their learning capacity becomes diminished,[75] and free people from illnesses that perpetuate their poverty.

The UNDP report highlights that "apart from the highly visible destructive impacts on people, water insecurity violates some of the most basic principles of social justice."[76] These principles are equal citizenship, the social minimum, equality of opportunity, and fair distribution of resources.

So how does climate change affect this picture? Climate change will alter weather patterns, with more land being devastated by drought on the one hand, and rising waters drowning low-lying communities on the other. Both scenarios will lead to water scarcity and disease, if not death, in some cases. It is not difficult to see how the right to water and food would be affected as a result of climate change.

D. Right to a Livelihood

The right to a livelihood is codified in Article 6 of the ICESCR, which recognizes the right of everyone to work,[77] while Article 7 refers to the universal right to the enjoyment of just and favorable working conditions.[78]

It is generally accepted that drought and flooding resulting from climate change will force people to abandon livelihoods such as fishing, farming, and agricultural or livestock businesses. This is likely to result in people abandoning their land, forcing them into poverty which, in turn, will lead to conflict over scarce natural resources and eventually migration.[79] This situation will be exacerbated for indigenous groups

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75. *See* U.N. Children's Fund, *Progress for Children: A Report Card on Water and Sanitation No. 5* at 4 (Sept. 2006), *available at* http://www.unicef.org/publications/files/Progress_for_Children_No._5_-_English.pdf.

76. UNDP, *supra* note 69, at 3.

77. ICESCR, *supra* note 61, art. 6.

78. *Id*. art 7.

79. For a discussion of migration and climate change, see Atapattu, *supra* note 8. S*ee generally* MOLLY CONISBEE & ANDREW SIMMS, ENVIRONMENTAL REFUGEES: THE CASE FOR RECOGNITION (New Economics Foundation 2003), *available at* http://www.neweconomics.org/gen/uploads/lpce0g55xjx5eq55mfjxbb5523102003180040.pdf; Suzette Brooks Masters, *Environmentally Induced Migration: Beyond a Culture of Reaction*, 14 GEO. IMMIGR. L.J. 855 (2000); Dana Zartner Falstrom, *Stemming the Flow of Environmental Displacement: Creating a Convention to Protect Persons and Preserve the Environment*, 2001 COLO. J. INT'L ENVTL. L. & POL'Y 2 (2001); Brooke Havard, Comment, *Seeking Protection: Recognition of Environmentally Displaced Persons Under International Human Rights Law*, 18 VILL. ENVTL. L.J. 65 (2007); David Keane, Note,

who depend on their land for survival. The Inuit case, discussed below, also highlights the link between climate change, cultural rights, and the increasing risk posed by climate change to indigenous peoples' survival and traditional practices.[80]

E. Right Not to be Displaced

Article 12 of the International Covenant on Civil and Political Rights recognizes the right of everyone to the freedom of movement and choice of residence.[81] Again, it is easy to envision how climate change will restrict the freedom of movement of people as well as their right to choose their place of residence. Warming temperatures, coupled with erratic weather patterns and rising sea levels that result in flooding, will severely restrict people's movement and force them to leave their homes in search of safer places to live. This will most often lead to displacement and migration within an affected country, but sometimes will create cross-border movement as well. The consequences of this displacement are readily apparent. Many poor countries can barely look after their own populations, let alone the millions of people that will be forced to flee rising sea levels and inundation of their homelands. It has been predicted that "environmental refugees" will cause the next wave of conflict in developing countries, particularly in sub-Saharan Africa.[82]

F. Other Rights

The list of rights discussed above is not an exhaustive enumeration of rights that will be affected by climate change. Others include the right to culture, the right to a healthy environment, and the right to

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The Environmental Causes and Consequences of Migration: A Search for the Meaning of "Environmental Refugees," 16 GEO. INT'L ENVTL. L. REV. 209 (2004); Tracey King, Note, *Environmental Displacement: Coordinating Efforts to Find Solutions*, 18 GEO. INT'L ENVTL. L. REV. 543 (2006); Stephen Castles, *Environmental Change and Forced Migration: Making Sense of the Debate* (U.N. Refugee Agency, Evaluation and Policy Analysis Unit, Working Paper No. 70, 2002), *available at* http://www3.hants.gov.uk/forced_migration.pdf; SEREN BOYD & RACHEL ROACH, TEARFUND, FEELING THE HEAT (2006), http://www.tearfund.org/webdocs/Website/News/Feeling%20the%20Heat%20Tearfund%20report.pdf; FIONA FLINTAN, ENVIRONMENTAL REFUGEES – A MISNOMER OR A REALITY?, A CONTRIBUTION TO THE WILTON PARK CONFERENCE REPORT ON ENVIRONMENTAL SECURITY AND CONFLICT PREVENTION (Mar. 2001), *available at* www.ucc.ie/famine/GCD/Paper%20for%20Wilton%20Park.doc.

80. *See* discussion *infra* Part IV.A.2.

81. ICCPR, *supra* note 45, art. 12.

82. *See supra* note 79.

development, to the extent that these rights are recognized under international law.

1. Right to a Healthy Environment

The right to a healthy environment is recognized in two regional human rights treaties,[83] and there is some debate as to whether such a right exists, or is only emerging, under general international law.[84] The African Commission on Human and People's Rights ("Commission") recognized the link between environmental degradation and human rights in the case of *The Social and Economic Rights Action Center and the Center for Economic and Social Rights* v. *Nigeria*.[85] The Commission held that the defendant company's disposal of oil into waterways, oil production, and disposal of toxic wastes into the environment and local waterways made Nigeria's Ogoniland a nightmarish place to live. The Commission held that the government's failure to take action against these environmental abuses amounted to a violation of the Ogoni people's rights to life, health, property, free disposal of natural resources, freedom from discrimination, and a healthy environment.[86] While the case did not involve the impact of climate change on indigenous communities, it is nonetheless important for its discussion on the link between environmental degradation and human rights.

The Commission, in holding that the Republic of Nigeria was in violation of Articles 2,[87] 4,[88] 14,[89] 16,[90] 18(1),[91] 21,[92] and 24[93] of the

83. *See* Organization of American States, Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights art. 11, Nov. 14, 1988, 28 I.L.M. 156 [hereinafter Protocol of San Salvador]; and Organization of African Unity, Banjul Charter on Human and Peoples' Rights art. 24, Jan. 19, 1981, 21 I.L.M. 58 [hereinafter Banjul Charter].

84. *See* HUMAN RIGHTS APPROACHES TO ENVIRONMENTAL PROTECTION (Alan E. Boyle & Michael R. Anderson eds., Oxford University Press 1996); Prudence E. Taylor, *From Environmental to Ecological Human Rights: A New Dynamic in International Law?*, 10 GEO. INT'L ENVTL. L. REV. 309 (1998); Atapattu, *supra* note 13. *See generally supra* note 7.

85. *See Soc. and Econ. Rights Action Ctr. and Ctr. for Econ. and Soc. Rights v. Nigeria*, Comm. No. 155/96, African Comm'n on Human and Peoples' Rights, *available at* http://www1.umn.edu/humanrts/africa/comcases/155-96.html (last visited Oct. 17, 2008) [hereinafter *The Nigeria Case*]. This section draws from Sumudu Atapattu, "Sustainable Development, Environmental Protection, and Human Rights: A Necessary Linkage?" Proceedings of the Canadian Council on International Law Annual Conference on *Fragmentation: Diversification and Expansion of International Law* (2006).

86. *See id*., *construed in* MARIE CLAIRE CORDONIER SEGGER & ASHFAQ KHALFAN, SUSTAINABLE DEVELOPMENT LAW: PRINCIPLES, PRACTICES, AND PROSPECTS at 208 (Oxford University Press 2004).

87. Banjul Charter, *supra* note 77, art. 2 (non-discrimination clause).

88. *Id*. art. 4 (right to life).

African Charter on Human and People's Rights, noted that "these rights recognize the importance of a clean and safe environment that is closely linked to economic and social rights in so far as the environment affects the quality of life and safety of the individual:"[94]

> The right to a general satisfactory environment, as guaranteed under Article 24 of the African Charter or the right to a healthy environment, as it is widely known, therefore imposes clear obligations upon a government. It requires the State to take reasonable and other measures to prevent pollution and ecological degradation, to promote conservation, and to secure an ecologically sustainable development and use of natural resources.[95]

While this case applies only regionally, the recognition that the right to a satisfactory environment imposes clear obligations on government is significant. These obligations range from taking reasonable measures to prevent pollution to promoting conservation to securing sustainable development. It is no longer possible for states to dismiss this obligation as empty and devoid of content.

From this general recognition of the link between environmental degradation and human rights, we now turn to a case that specifically deals with the impact of climate change on indigenous communities.

2. Right to Culture: Climate Change and Indigenous Communities

Article 15 of the ICESCR recognizes the right of everyone to take part in cultural life.[96] This has become particularly sensitive to some communities, such as the Inuit, whose culture is intrinsically linked to nature. Climate change is threatening Inuit cultural practices which, in turn, may lead to a violation of their right to life.

Because global warming has particular impacts on indigenous peoples, it was argued that the relationship between human rights and global warming needs to be evaluated in the context of indigenous rights:[97]

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89. *Id*. art. 14 (right to property).

90. *Id*. art. 16 (right to health).

91. *Id*. art. 18 (right to family life).

92. *Id*. art. 21 (right to dispose of natural resources).

93. *Id*. art. 24 (right to environment).

94. *The Nigeria Case*, *supra* note 79, ¶ 51.

95. *Id*., ¶ 52.

96. ICESCR, *supra* note 61, art. 15.

97. Martin Wagner, Managing Attorney, Earthjustice, Testimony before the Inter-American Commission on Human Rights (Mar. 1, 2007), *available at*

> Because indigenous peoples' traditional lands and natural resources are essential to their physical and cultural survival, the Commission and the Court have acknowledged that environmental damage—like that being caused by global warming—can interfere with the rights of indigenous peoples to life and to cultural integrity.[98]

One of the rights guaranteed under the American Declaration on the Rights and Duties of Man and the American Convention on Human Rights is the right to use and enjoy property.[99] In the context of indigenous communities, this right entitles these communities to use those lands to which they have historically enjoyed access for their traditional activities and livelihoods.[100] Climate change affects the enjoyment of the right to property in many ways—in some instances, the property may literally disappear. For example, the Inuit have lost sea ice due to melting and other peoples have lost land due to erosion and submersion. Moreover, the enjoyment of the right to property may be diminished as a result of increases in severe storms or the destruction of natural resources essential to the survival of indigenous communities.

In *Yanomami*, the Inter-American Commission on Human Rights ("Inter-American Commission") recognized that by allowing the construction of a highway through indigenous territory, the Brazilian government failed to protect the integrity of the land, thereby violating indigenous rights to life, liberty, and personal security.[101]

Testifying before the Inter-American Commission, Martin Wagner argued in the Inuit case that the realization of the right to life is necessarily related to and dependent upon one's physical environment.[102]

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http://www.earthjustice.org/news/press/007/global-warming-human-rights-gets-hearing-on-the-world-stage.html. *See also* Inuit Petition, *supra* note 50; Marguerite E. Middaugh, *Linking Global Warming to Inuit Human Rights*, 8 SAN DIEGO INT'L L.J. 179 (2006).

98. Martin Wagner, *supra* note 97 (quoting the case of Awas Tingni and Ecuador Report). *See also* Patrick Macklem & Ed Morgan, *Indigenous Rights in the Inter-American System: The Amicus Brief of the Assembly of First Nations in Awas Tingni v. Republic of Nicaragua*, 22 HUM. RTS. Q. 569 (2000).

99. *See* American Declaration on the Rights and Duties of Man, O.A.S. Res. XXX, Ninth International Conference of American States, art. XXIII (1948), *available at* http://www.escr-net.org/resources_more/resources_more_show.htm?doc_id=425903&parent_id=425906; American Convention on Human Rights art. 21, July 18, 1978, 1144 U.N.T.S. 123, *available at* http://www1.umn.edu/humanrts/oasinstr/zoas3con.htm.

100. *See* Maya Indigenous Communities of the Toledo District v. Belize, Case 12.053, Inter-Am. C.H.R., Report No. 40/04, OEA/Ser.L/V/II.122, doc. 5 rev. 1 (2004), *available at* http://www1.umn.edu/humanrts/cases/40-04.html.

101. *See* Yanomami Community v. Brazil, Case 7615, Inter-Am. C.H.R., Report No. 12/85, OEA/Ser.L/V/II.66, doc. 10 rev. 1 (1985), *available at* http://www.cidh.org/annualrep/84.85eng/Brazil7615.htm.

102. Martin Wagner, *supra* note 97.

The Inuit fall through the ice to their death more frequently because of the thinner ice in the Arctic caused by global climate change.

The petition also referred to the right of all peoples to subsistence, which is recognized in both international covenants as inherent to the right to life and to the right to enjoy the benefits of culture.[103] The latter is particularly relevant to indigenous populations. In the *Belize Maya* case, the Inter-American Commission noted that "the use and enjoyment of the land and its resources are integral components of the physical and cultural survival of the indigenous communities."[104] Climate change is destroying land and ecosystems that have been used for centuries by indigenous communities. Faced with a lack of subsistence, these communities may be forced to assimilate in order to survive. Forced assimilation directly contradicts the right to culture.

The Arctic region is particularly vulnerable to climate change, as its annual average temperate is increasing more than twice as fast as that in the rest of the world.[105] According to the Arctic Climate Impact Assessment:[106]

> The Arctic is extremely vulnerable to observed and projected climate change and its impacts. The Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social and economic changes, many of which have already begun.[107]

In addition to melting snow and ice, sea-level rise and changed weather patterns, changes in species habitat and forest loss due to drought and fires are wreaking havoc on people's lives. Humans are not the only species undergoing hardship, however. Marine mammals, coral reefs, and other sensitive ecosystems are all affected by climate change.[108] In short, it is hard to find a species that is not affected by climate change.

Additionally, some indigenous communities, such as those in the Andes, depend on the melting ice and snow for drinking water. The disappearance of the glaciers will cause severe water shortages for such communities. In the Arctic, where warming is evident in changes in sea

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103. *See* Yanomami Community, Inter-Am. C.H.R., Report No. 12/85.

104. Maya Indigenous Communities, Inter-Am. C.H.R., Report No. 40/04, ¶ 95.

105. Inuit Petition, *supra* note 50, at 2.

106. ARCTIC CLIMATE IMPACT ASSESSMENT, IMPACTS OF A WARMING CLIMATE (Cambridge University Press 2004), *available at* http://amap.no/acia/.

107. *Id.* at 10 (*quoted in* submissions by Sheila Watt-Cloutier to the Inter-American Commission on Human Rights Regarding Global Warming and Human Rights).

108. Kluger, *supra* note 20.

ice thickness and seasonal melting patterns, "some coastal Inuit communities are being completely uprooted, forced to move inland as their land literally disappears under their feet."[109]

The Inuit experience presents an example of the impact of climate change on indigenous culture. The effect of climate change on the Inuit people is summarized as follows:

> The environmental changes resulting from global warming have devastating effects on the Inuit, indigenous peoples inhabiting the Artic regions of northern and western Alaska, northern Canada, Greenland and Chukotka in the eastern Russian Federation. The ability of the Inuit to continue their unique, traditional culture depends on the snow and ice, which determines how the Inuit hunt, fish, travel and maintain homes. The Arctic ice cap normally shrinks each summer and expands each winter but dramatic shrinking that has recently been observed with the 2005 summer setting a record low at 20% below the average minimum ice extent measured between 1978 and 2000. Depletion of the sea ice, cause by increasing temperatures, reinforces the warming, as large stretches of dark water open up and the reflective ability of the bright white ice is lost.[110]

The Inuit have argued before the Inter-American Commission that they are facing extinction and are endangered. They pointed out that the international community is worried about the polar bears becoming extinct due to climate change, but scant attention has been paid to the Inuit community, which is facing extinction for the same reasons. The Inter-American Commission dismissed the application by the Inuit, but held a hearing on the issue—the Commission's main concern was that liability is tied to the common but differentiated responsibility principle.[111] If the Commission were to find the U.S. government liable under international law, it would have had to do so under the common but differentiated responsibility principle.[112] This poses particular problems for international law.

In another suit, a tiny Alaskan village sued several oil, power, and coal companies in February 2008 "claiming that the large amounts of greenhouse gases [the companies] emit contribute to global warming that

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109. *Id.*

110. Marguerite E. Middaugh, *Linking Global Warming to Inuit Human Rights*, 8 SAN DIEGO INT'L L.J. 179, 184 (2006).

111. This principle seeks to take account of the disparity between developing and developed countries both in terms of causing environmental problems and in their ability to respond to them. This principle is embodied in Principle 7 of the Rio Declaration. For a discussion of the principle, see ATAPATTU, *supra* note 31, at 379–436.

112. *See* discussion *infra* Part V.B.

threatens the community's existence."[113] The city of Kivalina and a federally recognized Indian tribe sued "Exxon Mobil Corporation, eight other oil companies, fourteen power companies and one coal company in a lawsuit filed in federal court in San Francisco."[114] The petitioners argued that their village was eroding into the Arctic Ocean due to global climate change, thereby threatening the community's existence, because of these companies' large emissions of greenhouse gases. In 2006, the U.S. Army Corps of Engineers concluded that the Kivalina area would soon become uninhabitable due to global warming and melting ice. Although plans were drawn to re-locate the community, these efforts have met delays.[115] It will be interesting to see how this lawsuit is viewed by the federal court.[116]

It is necessary, in this context, to discuss the relevant provisions of the UN Declaration on Indigenous Peoples ("Declaration") adopted by the UN General Assembly in 2007.[117] The Declaration embodies most rights in the International Bill of Human Rights, but also affirms certain rights that are specific to indigenous peoples. Article 11 of the Declaration affirms their right to culture and provides: "Indigenous peoples have the right to practice and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures."[118] Their participatory rights are also affirmed in the Declaration:

> Indigenous peoples have the right to participate in decision-making in matters which would affect their rights, through representatives chosen by themselves in accordance with their own procedures, as

113. *Eskimo Village Sues Over Global Warming*, ABC NEWS, Feb. 27, 2008, http://abcnews.go.com/TheLaw/GlobalWarming/story?id=4352802&page=1.

114. *Id. See also* Native City of Kivalina v. Exxonmobil Corp., No. C 08-01138 SBA, 2008 WL 2951677 (C.D. Cal. June 2, 2008) (order re scheduling and format for motions to dismiss).

115. Saqqara Aleister, *Kivalina: Washing Away History*, AM. CHRON., June 16, 2008, http://www.americanchronicle.com/articles/65079.

116. *See* Sara Aminzadeh, *A Moral Imperative: The Human Rights Implications of Climate Change*, 30 HASTINGS INT'L & COMP. L. REV. 231 (2007) (for a discussion of some of the cases relating to climate change). *See also* Eric A. Posner, *Climate Change and International Human Rights Litigation: A Critical Appraisal* (Olin Law & Econ. Working Paper No. 329, 2nd series, 2007), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=959748; Henry W. McGee, Jr., *Litigating Global Warming: Substantive Law in Search of a Forum*, 16 FORDHAM ENVTL. L. REV. 371 (2005).

117. Declaration on the Rights of Indigenous Peoples, G.A. Res. 61/295, U.N. Doc. A/RES/61/295 (Oct. 2, 2007).

118. *Id.* art. 11.

> well as to maintain and develop their own indigenous decision-making institutions.[119]

Furthermore, indigenous people have a right to the lands, territories and resources that they have traditionally owned, occupied, or otherwise used or acquired.[120] Article 29 provides that indigenous peoples have the right to the conservation and protection of the environment. Under Article 21, indigenous peoples have the right to maintain, control, protect, and develop their cultural heritage, traditional knowledge and traditional cultural expressions. Of course, being a soft law instrument, the document is not binding; however, it is a cause for concern that two countries with large indigenous populations—Canada and the United States—did not sign the Declaration. This will have implications if its provisions are to be embodied in a binding instrument in the future.

V. IMPLICATIONS FOR INTERNATIONAL LAW

As the above discussion illustrates, climate change poses a significant challenge to international law. International law must not only find a legal solution to the problem within existing structures of governance—which it has already sought to do rather unsuccessfully due to the non-cooperation of some significant contributors to the problem—but the very structures of international law may be in jeopardy. Never before has the international system encountered such a pervasive problem as global climate change. This phenomenon endangers not only the present generation, but also generations to come; it threatens species as well as entire ecosystems; and it has impacts on international trade, the world economy, and international peace and security. Never before has the international system been faced with a threat to the very existence of human beings on Earth. While it is true that the World Wars may have posed a similar threat to the very core of the international structure, the problems facing the international community today are worse in many respects—some of the predicted consequences are still invisible and will only materialize after the generation that caused them is gone, having neither experienced the consequences nor having been held accountable for their actions. From this point of view, the issue becomes one of equity. The debates on sustainable development and intergenerational equity assume a different light. The following section discusses the threat that climate change poses to international peace and security, the increase in conflict, and how international law should respond to the phenomenon of climate change. It will also briefly discuss the common

119. *Id.* art. 18.

120. *Id.* art. 26.

but differentiated responsibility principle and its implications for liability because the Inuit case revolved around that issue.

A. Increased Conflict and the Implications for International Peace and Security

While environmental stress has rarely been the sole cause of conflicts in and between states, the intrinsic link between access to resources—particularly water—and conflict is increasingly recognized. Global climate change will exacerbate this problem. Faced with increased temperatures, erosion, desertification, deforestation, flooding, rising sea levels, forest fires, loss of species, and increased incidence of disease, environmental stress may well become the main cause of conflict in the coming years.

While wars and conflicts have forced many people to abandon their homes and flee to relatively safe areas, we are now faced with a situation where people may flee their homes for environmental reasons. People who do so have been termed "environmental refugees," and it is estimated that in 1984–1985 some ten million Africans fled their homes due to reasons connected with environmental degradation.[121] Many of these refugees moved across national boundaries thereby increasing tension in the receiving countries. Most receiving countries can barely cope with their own problems and when more people seek access to quickly dwindling resources, conflicts are bound to increase.

The World Commission on Environment and Development ("WCED") described the relationship between environmental degradation and conflict as follows:

> As unsustainable forms of development push individual countries up against environmental limits, major differences in environmental endowment among countries, or variations in stocks of usable land and raw materials, could precipitate and exacerbate international tension and conflict. And competition for use of the global commons, such as ocean fisheries and Antarctica, or for use of more localized common resources in fixed supply, such as rivers and coastal waters, could escalate to the level of international conflict and so threaten international peace and security.[122]

If one also considers the inherent injustices in developing countries, prevailing extreme socioeconomic inequality, and corruption and

121. *Our Common Future*, *supra* note 35, at 291. While there was no one "environmental crisis" that triggered this movement, environmental degradation in general coupled with many other factors caused people to move.

122. *Id.* at 292–93.

poverty, the situation becomes bleak indeed. The WCED recognized the link between global warming and conflict as follows:

> Environmental threats to security are now beginning to emerge on a global scale. The most worrisome of these stem from the possible consequences of global warming. . . Any such climatic change would quite probably be unequal in its effects, disrupting agricultural systems in areas that provide a large proportion of the world's cereal harvests and perhaps triggering mass population movements in areas where hunger is already endemic. Sea levels may rise during the first half of the next century enough to radically change the boundaries between coastal nations and to change the shapes and strategic importance of international waterways—effects both likely to increase international tension. The climatic and sea-level change are also likely to disrupt the breeding grounds of economically important fish species. Slowing, or adapting to, global warming is becoming an essential task to reduce the risks of conflict.[123]

The issue of climate change and security was discussed for the first time in the UN Security Council in 2007. The delegate from the United Kingdom proposed the debate, which sought to examine the relationship between energy, security, and climate. While some felt that the Security Council is not the proper forum to discuss this matter, others welcomed the debate on the ground that climate change has the potential to affect international peace and security.[124] The British Foreign Secretary noted that climate change was a security issue, not just a matter of national security but rather regarding "collective security in a fragile and increasingly interdependent world."[125] Calling for a long-term global response, the UN Secretary General said that climate change has not only serious environmental and socioeconomic implications, but also implications for peace and security.[126] The awarding of the Nobel Peace

123. *Id*. at 294.

124. *See* Press Release, Security Council, Security Council Holds First-Ever Debate on Impact of Climate Change on Peace, Security, Hearing Over 50 Speakers, U.N. Doc. SC/9000 (April 17, 2007), *available at* http://www.un.org/News/Press/docs/2007/sc9000.doc.htm. *See also* CHRISTOPHER PENNY, GREENING THE SECURITY COUNCIL: CLIMATE CHANGE AS AN EMERGING 'THREAT TO INTERNATIONAL PEACE AND SECURITY,' (2005), http://www.gechs.org/downloads/holmen/Penny.pdf; Alexandra Knight, *Global Environmental Threats: Can the Security Council Protect our Earth?*, 80 NYU L. REV. 1549 (2005); High Representative & Eur. Commission, *Paper from the High Representative and the Eur. Commission to the Eur. Council: Climate Change and International Security*, S113/08 (Mar. 14, 2008), *available at* http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/reports/99387.pdf.

125. Security Council, *supra* note 124, at 1.

126. *Id. See also* PENNY, *supra* note 124.

Prize jointly to the IPCC and former U.S. Vice President Al Gore also highlighted the link between international peace and climate change.

B. Other Challenges to International Law

The main question facing the international community is what legal regime should be developed for the post-2012 period when the present obligations under the Kyoto Protocol lapse. The 13th Conference of Parties ("COP") held in Bali in December 2007 provided the forum to discuss post-2012 obligations. For the first time, developing countries agreed to:

> Enhanced national/international action on mitigation of climate change, including . . . nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner.[127]

Looking beyond 2012, the IPCC warns that despite the current mitigation policies and sustainable development practices, global greenhouse gas emissions will continue to rise in the next few decades.[128] It further warns that anthropogenic warming and sea level rise would continue for *centuries* due to the time scales involved with weather processes, even if greenhouse gas concentrations are stabilized today. The IPCC points out that more extensive adaptation measures than those currently practiced will be necessary to reduce vulnerability to climate change, regardless of the mitigation methods adopted.

The IPCC report notes that although a wide array of adaptation options are available, more extensive adaptation measures are necessary to reduce vulnerability to climate change. While it is true that societies have long managed to deal with weather and climate-related events,

> [a]dditional adaptation measures will be required to reduce the adverse impacts of projected climate change and variability, regardless of the scale of mitigation undertaken over the next two to three decades. Moreover, vulnerability to climate change can be exacerbated by other stresses. These arise from, for example, current climate hazards, poverty and unequal access to resources, food insecurity, trends in economic globalisation, conflict and incidence of diseases such as HIV/AIDS.[129]

127. *See Bali Action Plan*, *supra* note 41, ¶ 1.

128. *See IPCC 4th Report*, *supra* note 3.

129. *Id.*

The UNDP's annual publication, the Human Development Report, devoted its 2007/08 report to global climate change. This report also recognized the importance of a two-pronged strategy of adaptation and mitigation particularly in the context of poverty and equity:

> Adaptation priorities must also be addressed. For too long, climate change adaptation has been treated as a peripheral concern, rather than as a core part of the international poverty reduction agenda. Mitigation is an imperative because it will define prospects for avoiding dangerous climate change in the future. But the world's poor cannot be left to sink or swim with their own resources while rich countries protect their citizens behind climate-defence [sic] fortifications. *Social justice and respect of human rights demand stronger international commitment to adaptation.*[130]

The most recent document to endorse adaptation is the Bali Action Plan, adopted in December 2007.[131] The Conference of Parties called for enhanced action on adaptation. Some of its adaptation strategies include vulnerability assessments, integration of adaptation actions into sectoral and national planning, providing incentives for the implementation of adaptation actions, risk management and risk reduction strategies—including risk-sharing and transfer mechanisms such as insurance—disaster reduction strategies, and economic diversification.[132] The Bali Action Plan further requires parties to consider the "urgent and immediate needs of developing countries" when adopting these strategies, "especially the least-developed states and small island developing states, as well as countries in Africa affected by drought, desertification and floods."[133]

Another challenge for international law is devising and adopting a legal framework for those who might be forced to migrate as a result of climate change. While these "climate refugees"[134] have no legal protection under existing international law,[135] there seems to be a general consensus that large groups of persons will be displaced as a result of climate change putting them in "a vulnerable situation" deserving

130. UNDP, *Human Development Report 2007/2008 Fighting Climate Change: Human Solidarity in a Divided World Summary*, at 13, *available at* http://hdr.undp.org/en/media/HDR_20072008_Summary_English.pdf (emphasis added).

131. *See Bali Action Plan*, *supra* note 41.

132. *Id.* ¶ 1.

133. *Id.*

134. FLINTAN, *supra* note 79. There is no consensus as to the term "climate refugees." Many names have been proposed including "environmental refugees," "environmentally displaced persons" and "climate refugees."

135. *See* Atapattu, *supra* note 8.

protection.[136] While actual numbers of environmentally displaced persons are not available, some contend that it could be around fifty million by 2010;[137] others have put this figure at twenty-five million.[138] Whatever the correct number is, there is no doubt that millions of people will be displaced as a result of climate change. It is thus imperative that the international community adopt a suitable legal framework to cover environmentally displaced persons before the problem actually occurs.[139]

The Inuit case, discussed above, raises another challenge for international law: dealing with the issue of liability for damage caused by past greenhouse gas emissions.[140] If the Inter-American Commission were to find the United States responsible under international law, it would have had to do so under the common but differentiated responsibility principle.[141] In other words, liability would arise for the portion of climate change that the United States caused. Although we know that the United States accounts for twenty percent of global greenhouse gas emissions,[142] for the purposes of state responsibility, one must prove that the United States was responsible for the damage *caused to the Inuit*—i.e., it was the emission of greenhouse gases by the United States that caused the environmental damage to the Arctic which, in turn, resulted in the violation of the protected rights of the Inuit people. While under current state responsibility principles it may not be possible to hold one state out of 200 liable for causing a global environmental problem,

136. Aurelie Lopez, *The Protection of Environmentally-Displaced Persons in International Law*, 37 ENVTL. L. 365, 375–76 (2007).

137. David Adam, *50m Environmental Refugees by End of Decade, UN Warns*, THE GUARDIAN, Oct. 12, 2005, http://www.guardian.co.uk/environment/2005/oct/12/naturaldisasters.climatechange1.

138. Organization for Security and Cooperation in Europe, 13th Economic Forum, Prague, May 23–27, 2005, *Environmental Refugees: An Emergent Security Issue* at 1 (contribution by Norman Myers), *available at* http://www.osce.org/documents/eea/2005/05/14488_en.pdf.

139. *See* WHO, *International Migration, Health & Human Rights*, Health & Human Rights Publication Series, Issue No. 4 (Dec. 2003).

140. This section is drawn from the author's paper titled *Climate Change, Equity and Differentiated Responsibilities: Does the Present Climate Regime Favor Developing Countries?*, presented at the IUCN conference on Climate Law and Developing Countries, September 25–27, 2008, University of Ottawa, Canada (being prepared for publication under the title "Climate Change, Differentiated Responsibilities and State Responsibility: Devising Novel Strategies for Damage Caused by Climate Change").

141. The common but differentiated responsibility principle is embodied in Principle 7 of the Rio Declaration of Environment and Development and seeks to take into consideration the disparity between developing countries and developed countries in designing environmental obligations in relation to global environmental problems. *See generally* ATAPATTU, *supra* note 31, ch. 5.

142. DAVID HUNTER, JAMES SALZMAN & DURWOOD SAELKE, INTERNATIONAL ENVIRONMENTAL LAW AND POLICY, 663 (FOUNDATION PRESS, 2007, 3rd ed).

the question arises whether it is equitable to let people suffer as a result of an issue that they neither contributed to nor profited from. In devising a liability regime for climate change, should the international community be looking at some of the innovative principles of liability that were developed at the national level such as market share liability principle,[143] risk contribution theory,[144] or the national market share theory?[145] The international community has generally shied away from adopting liability regimes, preferring to embrace a preventive approach particularly in relation to global environmental problems. While this, no doubt, is the preferable approach, we cannot ignore the fact that due to past practices, damage can take place and we cannot allow victims to bear such damage alone. A liability regime would thus complement a preventive approach. In order to provide such a liability regime for global climate change, international lawyers will have to address difficult questions relating to causation and allocation of liability based on emission rates.[146]

VI. CONCLUSION

Climate change undoubtedly poses a profound challenge to international law and has the ability to undermine all protected rights—rights that the international community took years to consolidate, not just for the present generation, but for future generations as well. Indigenous communities, whose cultural practices and lifestyle are intrinsically linked to nature, seem particularly vulnerable to the adverse effects of climate change. The time is now ripe—though some may argue that it is already too late—for the international community to take a holistic approach to climate change given its far-reaching implications for human beings and the environment for generations to come.

Hopefully the compromises made at the 2007 Bali Conference will be followed and the international community, developed and developing countries alike, will accept the need to reduce greenhouse gas emissions. Developing countries must accept binding targets, and developed countries must provide financial assistance and technology transfer in order to enable developing countries to fulfill these obligations. The legal

143. *See, e.g.*, *Sindell v. Abbott Laboratories*, 607 P.2d 924, 937 (Cal. 1980) (holding that DES manufacturers may be held liable for miscarriages based on their market share). *See also, e.g.*, Robert F. Daley, Comment, *A Suggested Proposal to Apportion Liability in Lead Pigment Cases*, 36 DUQ. L. REV. 79 (1997).

144. *See, e.g.*, *Collins v. Eli Lilly Co.*, 342 NW.2d. 37, 49 (Wis. 1984).

145. *See, e.g.*, *Martin v. Abbott Laboratories*, 689 P 2d 368, 383 (Wash. 1984).

146. *See generally* Randall S. Abate, *Climate Change, the United States, and the Impacts of Arctic Melting: A Case Study in the Need for Enforceable International Environmental Human Rights*, 26 STAN. ENVTL. L.J. 3 (2007).

regime adopted in relation to ozone depletion could serve as a useful model in this regard. In the final analysis, however, global climate change is a challenge for the entire international community, not just for developed countries alone.

It seems pertinent to end this discussion with a quotation from Sheila Watt-Cloutier, the former chair of the Inuit Circumpolar Conference, who stresses the importance of reframing our discussion on climate change to make it more human-focused:

> I have attended three COPs. People rush from meeting to meeting arguing about all sorts of narrow technical points. The bigger picture, the cultural picture, the human picture is being lost. Climate change is not about bureaucrats scurrying around. It is about families, parents, children, and the lives we lead in our communities in the broader environment. We have to regain this perspective if climate change is to be stopped.
>
> Inuit understand these connections because we remain a people of the land, ice, and snow. That is why, for us, climate change is an issue of our right to exist as an indigenous people. How can we stand up for ourselves and help others do the same?[147]

147. Sheila Watt-Cloutier, Chair, Inuit Circumpolar Conference, Remarks at the 11th Conference of Parties to the UNFCCC (Dec. 7, 2005), *quoted in* Osofsky, *supra* note 7, at 697.

Notes & Comments

Environmental Protection for the New Northwest Passage

Matthew L. Hoppe*

ABSTRACT

Recently, the melting of sea ice in the Northwest Passage—a shortcut waterway across the top of North America in the Arctic—has opened up new possibilities for shipping and resource development in that region. At the same time, this opening has left the region vulnerable to potential environmental damage that will almost certainly result from increased human presence, presenting new challenges for environmental protection. The Arctic region has become a place where countries and corporations have begun to compete over sovereignty, rights of shipping access, and natural resources. In the case of the Northwest Passage, Canada has expressed a claim of sovereignty, which is disputed by the United States. The current international environmental law pertaining to the Arctic region is insufficient to address the environmental challenges that will arise, and the task of creating a more effective international legal regime appears difficult. In contrast, Canadian environmental law is more effective, as it is tailored closely to the unique characteristics of the Arctic region and includes enforcement provisions. The best short-term solution to the immediate need for added environmental protection is a bilateral agreement between the United States and Canada in which the

* J.D. Candidate, University of Colorado Law School 2009. The author would like to give special thanks to Margrit Lent Parker for her indispensable help and guidance in developing this Note. He also acknowledges the *Journal*'s editorial staff for their many helpful and needed edits and comments. Finally, the author is especially thankful for the love and support of his parents, family, and Jordana Ellway.

United States recognizes Canada's claim to and regulatory authority over the Northwest Passage.

I. INTRODUCTION

This Note discusses protecting the Arctic environment in light of a dramatic increase in the melting of sea ice there. The melting has led to the imminent availability of the Northwest Passage as a trade and resource development corridor. The Arctic region has a particularly sensitive and unique ecological system and is susceptible to a wide variety of environmental problems. The colder temperatures and weaker sunlight in the region make the environmental concerns especially problematic because of the decreased ability of the environment to respond to pollution and disruption. Climate change and warming in the region have led to the vast melting of ice in areas that have been historically inaccessible. In particular, the fabled Northwest Passage, a short route across the top of North America, will now be accessible for long periods of the year. In 2007, the Northwest Passage was opened to maritime traffic for the first time in recorded history.[1] This route from Europe to Asia is 7,000 kilometers shorter than going through the Panama Canal, saving about two weeks in transit time.[2]

As a result, the Arctic region and waterways adjacent to Canada will see increased human contact as the region is looked to as a favorable navigation route and a lucrative location for resource extraction. The world's nations and corporations are anxious to commence shipping through the Passage and start exploring for natural resources. The United States Geological Survey ("USGS") has estimated that one-quarter of the world's undiscovered petroleum reserves lie in the Arctic region.[3] According to the USGS, the region's "virgin territory, and natural resources [are] worth hundreds of billions of dollars."[4] Frequent headlines highlight the Arctic's renewed importance and include descriptions of attempts by nations such as Russia to make territorial claims in the region.[5]

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1. *See* Ken McGoogan, *Sailing Into Open Waters*, THE GLOBE AND MAIL, Sept. 29, 2007, http://www.theglobeandmail.com/servlet/story/LAC.20070929.PASSAGE29/TPStory/Environment (last visited Aug. 8, 2008).

2. Michael Byers, *The Need to Defend Our New Northwest Passage*, THE TYEE, Jan. 30, 2006, http://thetyee.ca/Views/2006/01/30/DefendNorthwestPassage/ (last visited Aug. 8, 2008).

3. Clifford Krauss et al., *As Polar Ice Turns to Water, Dreams of Treasure Abound*, N.Y. TIMES, Oct. 10, 2005, at A1.

4. *Id.*

5. *See, e.g.*, Diane Francis, *The Cold War in the North Pole*, FINANCIAL POST, Nov.

The thawing of the Northwest Passage presents immediate environmental concerns that were not present in the past. Prior to the melting, scholars insisted that protecting the Arctic required addressing a problem originating outside the region: the long-range transport of hazardous compounds to the Arctic region.[6] While this remains an important concern, the newer concerns must be addressed within the region itself. In the 1990s, the Arctic nations established a loose international regime for the region's environmental protection. The regime is currently composed of the Arctic Council, which is a soft-law voluntary agreement between the eight Arctic states.[7] The Council employs the principles set forth in the Arctic Environmental Protection Strategy ("AEPS"), established five years prior.[8] However, Canada asserts sovereign control over the Passage and has domestic environmental legislation aimed at Arctic preservation. The most pertinent Canadian law specifically relating to the Canadian Arctic is the Arctic Waters Pollution Prevention Act ("AWPPA"), a broad environmental statute tailored to preventing environmental damage there.[9]

The protection of the Arctic environment thus depends a great deal on whether Canadian authority, international authority, or both is enforced in the region. While Canadian laws arguably provide more effective protection, the Canadian jurisdiction hinges on whether the Northwest Passage is a part of internal Canadian waters or is an international strait. An international strait joins two expanses of high seas and is used for international navigation.[10] Such waterways are open with few restrictions on international shipping. Disagreement between Canada and the United States over how to designate the Passage has driven the conflict over the Canadian sovereignty claim to the Northwest Passage. The United States, a historical advocate for the designation of international straits worldwide, is opposed to and has obstructed Canada's attempts to assert control over the Northwest Passage as part of Canadian internal waters. Accelerated melting in the region has renewed

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12, 2007, http://communities.canada.com/financialpost/blogs/francis/archive/2007/11/09/the-cold-war-in-the-north-pole.aspx (last visited Aug. 8, 2008).

6. David VanderZwaag, *International Law and Arctic Marine Conservation and Protection: A Slushy Shifting Landscape*, 9 GEO. INT'L ENVTL. L. REV. 303, 342 (1997).

7. Joint Communique and Declaration on the Establishment of the Arctic Council, September 19, 1996, 35 I.L.M. 1382 (1996) [hereinafter Arctic Council].

8. Arctic Environmental Protection Strategy, June 14, 1991, 30 I.L.M. 1624 [hereinafter AEPS].

9. Arctic Waters Pollution Prevention Act, R.S.C. 1985, c. A-12 [hereinafter AWPPA].

10. *See* Byers, *supra* note 2. *See also* Bing Bing Jia, THE REGIME OF STRAITS IN INTERNATIONAL LAW (1998), for a lengthy discussion of international straits.

urgency for settling the sovereignty issue, not only for determining passage rights and how resources will be developed, but to ensure that effective authority exists for protecting the environment.

Canada's success in establishing its sovereignty claims over the Northwest Passage would best serve the goal of environmental protection of the Passage. As a legal matter, Canada might be able to assert its laws over the Passage regardless of the success of its sovereignty claim. However, Canada would be in a better position to assert jurisdiction if it did have a valid territorial claim.[11] The cooperation of the United States in achieving this outcome is of critical importance since it has impeded both the perfection of the Canadian claim to the Northwest Passage, as well as the creation of an international hard-law treaty for environmental protection.

This Note argues that the best short-term solution to the immediate need for added environmental protection is a bilateral agreement between the United States and Canada in which the United States recognizes both Canada's claim to and regulatory authority over the Northwest Passage. There is a strong policy argument for why the United States should accede to Canada's claims. Canada and the United States have many aligned security interests and are generally on friendly terms.[12] The preservation of the Arctic environment is—or should be—important to the United States. Additionally, American concerns that Canada might obstruct free American passage through the Arctic could be placated by an arrangement with Canada allowing the United States unfettered passage through Canadian Arctic waters in exchange for American compliance with Canadian laws and regulations.[13]

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11. See *e.g.* Canada: Statement Concerning Arctic Sovereignty, 24 I.L.M 1723 (1985) [hereinafter Canadian Sovereignty Statement], which states:

> the Arctic is not only a part of Canada. It is part of Canada's greatness. The policy of this government is to preserve that greatness undiminished . . . . The exercise of functional jurisdiction in Arctic waters is essential to Canadian interests . . . . Only full sovereignty protects the full range of Canada's interests . . . it is vital even to Canada's nationhood.

12. *See e.g.* Directorate of Continental Materiel Cooperation website, http://www.dnd.ca/admmat/dgiip/dcmc_e.asp (last visited Aug. 8, 2008) (listing bilateral agreements between the United States and Canada, including the Defence Production Sharing Agreement (1956), the Defence Development Sharing Arrangements (1963), and the MOU concerning Procurement of Defense Supplies (1996). "These agreements cover such areas as research and development, test and evaluation, air defence, communications, logistics, maritime operations, navigation, search and rescue and meteorology").

13. See Canadian Sovereignty Statement, *supra* note 11, which states:

> The policy of this government is to offer its cooperation to its friends and allies, and to seek their cooperation in return . . . . We are prepared to explore with the United States all means of cooperation that might promote the respective

First, this Note examines the environmental problems facing the Arctic. This examination includes: (1) the history of the region; (2) the current and potential implications of increased ship traffic through the Northwest Passage; and (3) a consideration of the region's pre-existing environmental difficulties. A brief discussion of Canada's claim to the Northwest Passage follows. The Note then discusses the regimes currently available to protect the Arctic environment and argues that the Canadian regime is the preferable means of protection. The analysis of various regimes first considers the environmental law pertaining to the region. It then discusses Canadian law aimed at protecting the Arctic. Following this, the Note lays out three possible courses of action: (1) leaving the uncertain system as it is; (2) working towards the development of an international hard-law treaty; or (3) allowing Canada full authority to enforce its regime in the region. Next, the Note argues that the third option is preferable. This Note concludes by looking at one potential route to accomplishing the outcome of Canadian authority: a bilateral agreement between the United States and Canada.

II. ENVIRONMENTAL PROBLEMS FACING THE ARCTIC DUE TO THE OPENING OF THE NORTHWEST PASSAGE

Since 1960, melting has reduced the amount of sea ice in the Arctic by thirty-two percent.[14] The present rate of shrinkage is 70,000 square kilometers per year.[15] It is estimated that the passage will be ice-free, first during the summer months and then year-round, sometime in the next twenty-five to fifty years.[16] This timeframe might be shortened in light of recent events, however, as the summer of 2007 saw record-breaking areas of ice melting.[17] An area twice the size of the United Kingdom melted in a single week in September of that year.[18] British researchers discovered that the Arctic icecap is shrinking even during the winter months, leading them to conclude that the summer icecap could completely vanish within ten years.[19] During the winter following the

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interests of both countries . . . any cooperation with the United States . . . shall be on the basis of full respect for Canada's sovereignty.

14. *Northwest Passage: The Arctic Grail*, CBC NEWS IN DEPTH, Aug. 8, 2006, http://www.cbc.ca/news/background/northwest-passage/ (last visited July 21, 2008) [hereinafter *Arctic Grail*].

15. *Id*.

16. *Id*.

17. *Loss of Arctic Ice leaves experts stunned*, GUARDIAN.CO.UK, Sept. 4, 2007, *available at* http://www.guardian.co.uk/environment/2007/sep/04/climatechange.

18. *Id*.

19. *Arctic icecap melting even in winter*, THE TIMES OF INDIA, Oct. 27, 2008,

record summer melting in 2007, sea ice thickness decreased by an additional nineteen percent.[20]

The results of this melting are historically significant. Places where ice regularly stranded ships in the past are now open. Historically, ships that attempted voyages through the Northwest Passage found their journeys ill-fated.[21] Roald Amundsen first traveled the full route of the Passage in 1903 in a twenty-one-foot boat.[22] At points in his journey, Amundsen had to wait months for ice to melt so that he could pass.[23] Although passages became relatively more frequent and viable as technology and navigation improved, they remained rare. For example, it took Canada's Royal Canadian Mounted Police schooner *St. Roch* two years from 1940 to 1942 to navigate the Passage from east to west and back again.[24] With the Passage ice-free, the journey is significantly easier than the alternative Panama Canal route.[25] In response to the prospect of melting and increased access to a shorter shipping passage, corporations around the world have invested $4.5 billion in ships capable of navigating the remaining ice.[26]

Yet, for now, free-floating ice keeps the passage dangerous.[27] This is a concern because a major potential use of the Northwest Passage is tankers delivering oil from Alaskan and Canadian fields to refineries on the eastern coast of the United States. Oil tankers passing through the icy and often narrow waters of the Northwest Passage heighten the possibility of oil spills and ecological catastrophe. As the *Exxon Valdez* oil spill has shown, cleanup in Arctic-like environments is extremely difficult, and the lack of sunlight inhibits the natural degradation of

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available at http://timesofindia.indiatimes.com/Global_Warming/Arctic_icecap_melting_even_in_winter/articleshow/3646919.cms.

20. *Id*.; s*ee also* Paul Eccleston, *Arctic ice thickness drops by up to 19 per cent*, TELEGRAPH.CO.UK, Oct. 28, 2008, http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2008/10/28/eaice128.xml (last visited Nov. 9, 2008).

21. For example, consider the ill-fated voyages of John Franklin (where cannibalism occurred, voyage of 1845-1848), John and James Clark Ross (had to abandon original ship when it became trapped in ice and walk over 300 miles to find supplies, spending in total four winters in the Arctic, voyage of 1829-1833), and Edward Parry (three failed attempts to discover the Passage, between 1819-1825).

22. For a brief biography of Roald Amundsen, *see Alone on the Ice* (PBS documentary film, 1999) and the associated website on Roald Amundsen, http://www.pbs.org/wgbh/amex/ice/peopleevents/pandeAMEX87.html.

23. *Id*.

24. For general specifications and history of the *St. Roch*, see the RCMPV *ST. ROCH* website, Historic Naval Ships Association, http://hnsa.org/ships/stroch.htm.

25. As discussed *supra* Section I, the route is two weeks shorter than the Panama route.

26. *Arctic Grail*, *supra* note 14.

27. *Id.*

pollutants like oil.[28] Necessarily, a key ingredient of a legal regime protecting the Arctic environment should limit oil shipping to certain times of the year when it is most safe, or to special ships that are less likely to be breached. For example, the AEPS addresses this concern when discussing oil pollution, stating that the occurrence of oil spills "will depend on the level of activity in the Arctic, the technical standards of the activity and the preventative measures taken."[29] Moreover, protections are needed because increasing worldwide oil prices will incentivize actors to take the risks associated with oil development in the Arctic, with a corresponding increase in regional oil-related activity.

There are additional threats to the environment as a result of increased human contact and traffic. For example, the AEPS highlights noise pollution as a threat to the Arctic region.[30] It notes that the underwater environment in the Arctic is unusually quiet because of the presence of ice. The increased use of the Passage by shipping will disrupt the natural quietness of the region. Thus, the AEPS notes that "noise from human activities may cause short-term or long-term behavioral reactions and temporary displacement of various marine mammals."[31] Noise pollution may be unavoidable if intensive shipping is allowed in the Arctic. When dealing with noise pollution problems caused by increased contact with the region, monitoring and controlling ship traffic could be critical in avoiding environmental damage.

The Arctic also faces several other environmental problems beyond those stemming from increased human contact and activity. These problems originate from human sources beyond the region, and are imported into the region by sea currents, wind, or other natural forces. For example, persistent organic pollutants ("POPs") and heavy metals are found in high concentrations in the Arctic, especially in the marine food chain.[32] POPs are substances like pesticides, industrial compounds, and combustion by-products.[33] Heavy metals—like lead, mercury, and cadmium—have also been found in wildlife. Another concern is radioactivity, as Russia has been suspected of illegally dumping waste in the Arctic.[34] Nuclear weapons testing and the Chernobyl accident have

28. Richard J. Ansson. *The North American Agreement on Environmental Protection and the Arctic Council Agreement: Will These Multinational Agreements Adequately Protect the Environment?*, 29 CAL. W. INT'L L.J. 101, 120 (1998).

29. AEPS, *supra* note 8, § 3.2.

30. *Id*. § 3.4 at 1640.

31. *Id*. § 3.4 at 1641.

32. VanderZwaag, *supra* note 6.

33. State of Knowledge Report of the UN ECE Task Force on Persistent Organic Pollutants for the Convention on Long-Range Transboundary Air Pollution, Jun. 4, 1994, 18 I.L.M. 1442 (1994).

34. Ansson, *supra* note 28, at 114.

contributed to radioactive contamination in the region as well.[35] The AEPS mentions another problem: acid produced from combustion has been transported to the region and is affecting the quality of soils and harming vegetation.[36] International law is the only real means to solve these long-range transport pollution problems. As the origins of the pollutants are global, these problems are within the realm of a myriad of international environmental laws. The AEPS deals with these kinds of pollutants by calling on the eight Arctic signatory countries to comply with existing international law on the matter.[37]

The unique characteristics of the Arctic exacerbate these environmental problems. For example, the low temperatures slow the decomposition of pollutants, vegetative regeneration is a slow process because of the shortened growing season, and animals typically are found in high concentrations and are thus prone to catastrophes. Moreover, because of the centrality of the marine environment in the overall ecosystem of the Arctic, any kind of environmental disruption in the water is especially damaging. Additionally, severe weather and the presence of ice make cleanup efforts more difficult than in other regions.[38]

III. SOVEREIGNTY & STRAITS: DOES CANADA HAVE A CLAIM TO THE NORTHWEST PASSAGE?

Whether Canada can assert jurisdiction over the waters that comprise the Northwest Passage will be a determinative factor in enacting and enforcing necessary environmental protections. Canadian environmentalists have been urging Canada to be more assertive in staking a claim in the Arctic. Ensuring that nonconsensual passages do not occur and establishing a firm Canadian presence in the region are essential to the Canadian claim over the Passage. To that end, Canada has committed C$5.3 billion over five years for an increased presence, including three heavy-duty armed icebreakers, a network of underwater

35. AEPS, *supra* note 8, § 3.5.

36. *Id*. § 3.6.

37. *See, e.g*., *id.* §4.1 for Persistent Organic Contaminants (refers to the UN ECE Convention on Long-Range Transboundary Air Pollution, 18 I.L.M. 1442 (1994), *supra* note 33).

38. Melissa A. Verhaag, Note, *It is Not Too Late: The Need for a Comprehensive International Treaty to Protect the Arctic Environment*, 15 GEO INT'L ENVTL. L REV. 555, 559 (2003).

sensors, aircraft flyovers, and unmanned drones.[39] However, Canada does not currently have an all-season icebreaker.[40]

Canada's positive claim to the parts of the Arctic region proximate to it, including the Northwest Passage, dates back to the 1909 assertion by a Canadian senator that Canada would draw a series of straight lines from its eastern- and western-most points to the North Pole and lay claim to the area in between those lines. However, recent developments show that Canada's claim remains disputed. In 1969, the *SS Manhattan*, an American oil supertanker owned by Exxon, journeyed through the Arctic.[41] Canada escorted the *Manhattan* with coast guard vessels, implying tacit permission for the passage.[42] Still, this passage stirred up popular unrest in Canada about the status of the Northwest Passage.[43] The *Manhattan*'s owners sent the tanker through the Passage again in 1970, demonstrating that use of the Passage was increasingly viable for American corporations wishing to transport oil from Alaska to the eastern coast of the United States.[44] In 1970, reacting to the *Manhattan* voyage, Canada extended, at least by definition, its territorial sea from three miles to twelve miles in an attempt to assert its domestic laws on foreign vessels journeying through narrow points in the Northwest Passage.[45] At the same time, Canada enacted AWPPA and withdrew from the International Court of Justice's ("ICJ") jurisdiction with respect to any matter pertaining to AWPPA.[46] At the time of AWPPA's initial

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39. *Arctic Grail*, *supra* note 14.

40. Byers, *supra* note 2 (noting that China, Britain, South Africa, and South Korea currently own or are building such vessels).

41. Donald R. Rothwell, *The Canadian-U.S. Northwest Passage Dispute: A Reassessment*, 26 CORNELL INT'L L.J. 331, 337 (1993).

42. *Id*.

43. *Id*.

44. *Id*. at 339.

45. The narrowest point of the passage is twenty-four miles across.

46. Rothwell, *supra* note 41, at 340. For general information regarding compulsory ICJ jurisdiction, see the International Court of Justice website, Declarations Recognizing the Jurisdiction of the Court as Compulsory, http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=3 (last visited Jan. 17, 2009), which explains:

> The States parties to the Statute of the Court may "at any time declare that they recognize as compulsory ipso facto and without special agreement, in relation to any other State accepting the same obligation, the jurisdiction of the Court" (Art 36, para. 2 of the Statute). Each State which has recognized the compulsory jurisdiction of the Court has in principle the right to bring any one or more other State which has accepted the same obligation before the Court by filing an application instituting proceedings with the Court, and, conversely, it has undertaken to appear before the Court should proceedings be instituted against it by one or more such other States;

Statute of the International Court of Justice art. 36, June 26, 1945, 59 Stat. 1055, 3

passage, Canadian Prime Minister Pierre Trudeau remarked, "International law that now stands does not sufficiently protect countries on the pollution aspect of international waters. And it is important for Canada to take forward steps in this area to help international law develop."[47]

The United States disapproved of the actions taken by Canada. It argued that the Canadian actions were not founded in international law, that such actions would not be accepted by the United States, and that the United States' right to freedom of the seas was being infringed. Canada escaped an American legal challenge to its actions only because it had backed out of compulsory ICJ jurisdiction.[48]

While the United States' disagreement with the Canadian position was still brewing, the United States Coast Guard icebreaker *Polar Sea* made the transit through the Northwest Passage in 1985. In 1986, Canada reacted by proclaiming "straight baselines"[49] from various Canadian islands in the Arctic, essentially making the claim that the Northwest Passage was entirely within Canadian internal waters.[50] Canada also revised AWPPA and passed it in its current form.[51] The United States, despite objecting to the changes, nevertheless agreed to meet with Canada to discuss the issues. A 1988 meeting led to an agreement between the United States and Canada.[52] The two countries agreed that the aftermath of the *Polar Sea's* transit left nothing settled as to the status of the Northwest Passage.[53] The countries did agree, however, that the United States would not travel through Canadian claimed waters without the consent of Canada.[54] It is noteworthy that the formal agreement

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Bevans 1153.

47. Canadian Prime Minister's Remarks on the Proposed Legislation, May 1970, 9 I.L.M. 600 (1970) [hereinafter Prime Minister 1970 Remarks].

48. Rothwell, *supra* note 41, at 340.

49. See *e.g.* Andrea Charron, *The Northwest Passage in Context*, THE CANADIAN MILITARY JOURNAL, 3 (2005), 3 *available at* http://www.journal.forces.gc.ca/engraph/Vol6/no4/PDF/06-North3_e.pdf for a definition of straight baselines:

> the straight baseline method allows a country with offshore islands and/or very jagged coastlines to calculate its territorial seas from straight lines drawn from a point on the coast to the islands, or from island to island. One then "connects the dots" literally, and the water behind the lines is designated internal water, while waters away from the line and toward open waters are considered territorial seas (internal footnote omitted).

50. Rothwell, *supra* note 41, at 331-32.

51. Revision of AWPPA discussed *infra* at Sec. IV.C.

52. Canada-United States: Agreement on Arctic Cooperation and Exchange of Notes Concerning Transit of Northwest Passage, Jan. 11, 1988, 28 I.L.M. 141 (1988) [hereinafter 1988 Can.-U.S. Agreement].

53. *Arctic Grail*, *supra* note 14.

54. 1988 Can-U.S. Agreement, *supra* note 52, at 143 cl. 3.

reached was limited to icebreakers, like the *Polar Sea*, and is inapplicable to other kinds of shipping.[55]

Developments in international law have also shaped the discussion about the character of the Passage. A 1951 decision of the ICJ in the *Anglo-Norwegian Fisheries Cases* made "straight baselines" a legally accepted means of determining the extent of state control along fragmented coastlines.[56] As mentioned above, Canada adopted this approach after the 1985 journey of the *Polar Sea*, linking the outer headlands of the archipelago to define its territory.[57] Under this definition, Canada would be able to legally exert sovereignty over the waters of the Northwest Passage.

However, in 1982, the United Nations Convention on the Law of the Sea ("UNCLOS") was adopted.[58] UNCLOS is the central treaty in international maritime law. The treaty governs many issues relating to the world's oceans, including "navigational rights, territorial sea limits, economic jurisdiction, legal status of resources on the seabed . . . , passage of ships through narrow straits, conservation and management of living marine resources, [and] protection of the marine environment."[59] One problem under UNCLOS is that even if a country extends baselines, previously existing rights of passage are not extinguished.[60] As a legal matter, Canada's claim could turn on whether or not the Northwest Passage attained international strait status prior to 1986, the year Canada declared the baselines.[61] If it was not an international strait at that time, Canada has a legally permissible claim to the route as an internal waterway.[62]

In examining this debate, some scholars argue that the Northwest Passage should be considered an international strait because of the history of the Passage prior to the extension of baselines.[63] To be an

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55. *Id*. cl. 4.

56. *Fisheries Cases* (U.K. v. Nor.), 1951 I.C.J. 116 (Dec. 18).

57. Byers, *supra* note 2.

58. U. N. Convention on the Law of the Sea, Dec. 10, 1982, 21 I.L.M. 1261 (1982) [hereinafter UNCLOS].

59. *See* Andrew King, Note, *Thawing a Frozen Treaty: Protecting United States Interests in the Arctic with a Congressional-Executive Agreement on the Law of the Sea*, 34 HASTINGS CONST. L.Q. 329, 332 (2007) (citing U. N. Division for Ocean Affairs and the Law of the Sea, The United Nations Convention on the Law of the Sea: A Historical Perspective (1998), *available at* http://www.un.org/Depts/los/convention_agreements/convention_historical _perspective.htm).

60. Paul Andrew Kettunen, *The Status of the Northwest Passage Under International Law*, 1990 DET. C.L. REV. 929, 970-71 (1990).

61. *See id*. at 987-89.

62. Rothwell, *supra* note 41, at 360.

63. *See* Kettunen, *supra* note 60, at 978-79.

international strait under the *Corfu Channel* case, a two-part test must be satisfied.[64] First, it must be possible to navigate the waterway as a "single strait" connecting areas of the high seas and economic zones, and second, the straight must actually be used for international navigation.[65] In arguing that the Northwest Passage is an international strait, it is asserted that the geography of the Passage meets the first part of the test while the second part is satisfied by the limited number of transits through the Passage, mostly by governmental vessels. The second part of the test is more difficult to satisfy because there have been so few transits through the Passage. To overcome this difficulty, scholars have resorted to concluding that a special "polar test" should apply to the Northwest Passage.[66] According to this argument, the standard for the required amount of transit through a strait should be lower in polar regions because such regions have both ice hazards and adverse polar weather conditions.[67] Suffice it to say, academic debates aside, there is no legal certainty to either position at this time.

Beyond the discussion about ownership of the waterway under Article 76 of UNCLOS, exclusive economic zones of a country can extend into the sea if there is a natural prolongation of its continental shelf beyond 200 miles.[68] If a country is able to exercise sovereign rights over seabed through Article 76, Article 77 then provides that the country can explore and exploit natural resources in that area.[69] Accordingly, even if Canada's ownership claim fails, it should still be able to exert exclusive jurisdiction over resource extraction within the relevant areas.

IV. IMPLEMENTING CANADA'S ENVIRONMENTAL REGIME IS PREFERABLE TO ATTEMPTING TO FORGE AN INTERNATIONAL TREATY

An unimpeded Canadian environmental regime is currently the most effective way to assure environmental protection in the Arctic. Even though UNCLOS devotes a section—Article 234—to ice-covered waters (allowing coastal states to enforce vessel-source pollution control laws),

64. *See* The Corfu Channel Case (U.K. & N. Ir. v. Alb.), 1949 I.C.J. 4 (Apr. 9).

65. *Id*. at 977-78.

66. Rothwell, *supra* note 41, at 357.

67. This view has attained a level of recognition in at least one judicial decision. *See, e.g.*, *id.*, citing *Legal Status of Eastern Greenland* (Nor. v. Den.), 1933 P.C.I.J. (Ser. A/B) No. 53, at 22 (Apr. 5), *available at* http://www.worldcourts.com/pcij/eng/decisions/1933.04.05_greenland/.

68. UNCLOS, *supra* note 58, art. 76.

69. *Id*. art. 77.

there remain difficulties in any assumption that Canada's laws would apply to the entire Northwest Passage. This is because it is difficult to assign enforcement boundaries in the Northwest Passage, which is fraught with the dispute over Canadian sovereignty. An example of a vessel-source pollution control law is, of course, the Canadian environmental statute AWPPA.[70] Therefore, although Article 234 essentially clears the path under current international environmental law for countries, like Canada, to act to protect the Arctic near their own coasts, the limits of this article have not been defined. In addition, if the Northwest Passage is no longer ice-covered water, then this section might not apply. Finally, there is added uncertainty because the United States has not ratified UNCLOS and as a non-party would not be subject to Canadian regulation.

It may be possible to craft a binding international "addition" to UNCLOS that recognizes the right of states, such as Canada, to exert domestic laws over places like the Northwest Passage in their entirety. However, no such law currently exists and many proposals for international environmental regimes envision stripping countries of their sovereignty claims. There is little doubt that Canada, as well as most of the other Arctic nations, would refuse to go along with such a plan.

In AWPPA, Canada has enacted an environmental law aimed specifically at protecting the Arctic and, in particular, the kind of problems that will be caused by opening the Northwest Passage. Since this law and related regulations are already in place and, for reasons outlined below, are superior to the loose collection of soft-law international regimes, it is the best solution to protecting the Arctic in the face of impending environmental challenges.

A. Existing International "Hard-Law" Protection for the Arctic Environment

Presently, the only hard-law treaty for environmental protection in the Arctic is the 1973 Agreement on the Conservation of Polar Bears.[71] Under this treaty, five of the Arctic states have mandatory obligations to protect the polar bear population.[72] Some international treaties governing pollution are also applicable to this region because the Arctic Ocean is covered and the laws applying to all oceans apply there.[73] Examples

70. *See infra* Sec. IV.C.

71. VanderZwaag, *supra* note 6.

72. Agreement on the Conservation of Polar Bears, Nov. 15, 1973, 13 I.L.M. 13 (United States, Norway, Denmark, Canada, USSR).

73. Ansson, *supra* note 28, at 117.

include the 1973 Convention for the Prevention of Pollution from Ships and its 1978 Protocol,[74] the 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matters,[75] and the 1990 International Convention on Oil Pollution Preparedness, Response, and Co-Operation.[76] There are also several other hard-law treaties that apply to oil spills around the world, including any in the Northwest Passage.[77]

The Prevention of Marine Pollution treaty was enacted to protect the "sea," which is defined as all marine waters other than the internal waters of states.[78] The contracting parties agreed to "promote" measures to protect the marine environment against pollution from sources such as oil, radioactive pollutants, and wastes associated with the development of offshore resources.[79] The agreement, however, focuses mainly on dumping and not on accidental spills.[80] It also does not specifically address the Arctic, where special conditions make promoting measures to protect the marine environment an unusually difficult task. In any event, while dumping is a possible consequence of increased human activity in the area, it seems that accidental spills are a more likely concern.

There are, however, some soft-law agreements that show that the Arctic states are interested in the problem of Arctic pollution. The AEPS[81] and the Arctic Council[82] are the principle agreements pertaining specifically to the Arctic. Yet these soft-law agreements have failed to do much besides gather information about environmental problems and increase dialogue between the states. While communication is an

74. Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, Feb. 16, 1978, 17 I.L.M. 546; International Convention for the Prevention of Pollution from Ships, Nov. 2, 1973, 12 I.L.M. 1319. *But see* Ansson, *supra* note 20, at n. 125 (pointing out that Canada has not ratified this set of treaties).

75. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Nov. 13, 1972, 11 I.L.M. 1294 [hereinafter Convention on Marine Pollution].

76. International Convention on Oil Pollution Preparedness, Response, and Co-Operation, Nov. 30, 1990, 30 I.L.M. 733.

77. *See, e.g.*, UNCLOS, *supra* note 50; Convention for the Prevention of Pollution from Land-Based Sources, Feb. 21, 1974, 13 I.L.M. 352 (1974); Intergovernmental Conference on the Convention on the Convention on the Dumping of Wastes at Sea: Final Documents, Nov. 13, 1972, 11 I.L.M. 1291; International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, Dec. 18, 1971, 11 I.L.M. 284; International Convention on Civil Liability for Oil Pollution Damage, Nov. 29, 1969, 9 I.L.M. 45; International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, Nov. 29, 1969, 9 I.L.M. 25.

78. Convention on Marine Pollution, *supra* note 75, art. III.3.

79. *Id*. art. XII.

80. *Id*. art. I.

81. AEPS, *supra* note 8.

82. Arctic Council, *supra* note 7.

important first step, more is required to adequately protect the region. In light of the increased traffic in the Arctic, the time for discussion and studying must give way to action to prevent irreparable damage.

B. The Arctic Environmental Protection Strategy & the Arctic Council

The eight Arctic countries—Canada, Denmark, Finland, Iceland, Norway, Sweden, the Soviet Union, and the United States—met three times between 1989 and 1991 to develop the AEPS.[83] The AEPS, issued on June 14, 1991, was designed to meet the objectives of protecting the Arctic ecosystem, natural resources, the cultures of indigenous peoples; and eliminating pollution in the region. The plan identified the various problems and priorities that the countries agreed needed to be addressed. The AEPS indentified six main types of pollutants in the Arctic: persistent organic contaminants, oil pollution, heavy metals, noise, radioactivity, and acidification. Implementation of the AEPS was to be achieved through national legislation on the part of the party states on a voluntary basis, thus giving it "soft-law" status.[84] Some commentators believe that the United States is to blame for the soft-law status of the AEPS because of its reluctance to participate in any new multilateral organizations or to commit to any international financial agreements.[85] Under AEPS, the eight nations agreed to meet regularly on a ministerial level, to involve indigenous peoples, and to establish working groups. These working groups have studied the specific environmental problems in the Arctic and potential remedies.[86]

The most important of these working groups is the Arctic Monitoring and Assessment Program ("AMAP"), formed under Section 6 of the AEPS.[87] AMAP's current objective is "providing reliable and sufficient information on the status of, and threats to, the Arctic environment, and providing scientific advice on actions to be taken in order to support Arctic governments in their efforts to take remedial and

83. AEPS, *supra* note 8.

84. Under soft law treaties, there is no legally binding force and the treaty is no more than a non-binding agreement between the signatory countries.

85. David Vanderzwaag, Rob Huebert, & Stacey Ferrara, *The Arctic Environmental Protection Strategy, Arctic Council and Multilateral Environmental Initiatives: Tinkering While the Arctic Marine Environment Totters*, 30 DENV. J. INT'L L. & POL'Y 131, 144-45 (2002).

86. *Id*. at 146.

87. *See* Arctic Monitoring and Assessment Program website, http://www.amap.no/ [hereinafter AMAP] (last visited Aug. 5, 2008). *See also* AEPS, *supra* note 8, § 6.

preventive actions relating to contaminants."[88] Thus, AMAP was designed to study the levels of pollutants and assess their effects on the environment. It was implemented through the creation of a small task force established by the Norwegian government.[89] AMAP epitomizes the study-the-problem focus of the soft-law regime currently governing the Arctic. While its work is important, working groups like AMAP have no tools to solve the problems they are studying.

The AEPS was revised by the formation of the Arctic Council in September 1996.[90] The Arctic Council is similar to the AEPS regime and incorporates many of its features. There are three modifications, however.[91] First, sustainable development is a new emphasis under the Council. A new task group, the Sustainable Development and Utilization Initiative, was created, indicating a shift away from purely environmental concerns towards studying ways to develop the region in concert with protecting the environment.[92] Second, the Council gave indigenous peoples a more prominent role as they were made permanent Council participants, though they are without a vote. The third modification is that lower governmental agencies from the participating parties became more involved in regional meetings, while the original AEPS structure brought only ministers to the table.[93]

The Arctic Council, based on the principles of the AEPS, recognizes the special needs of the region. In Section 8.1 of the AEPS, the countries agree to take early cooperative action on emergency prevention, preparedness, and response in the Arctic. The countries are to review existing mechanisms and thereafter convene a meeting to consider and recommend a new system of cooperation. The AEPS goes on to suggest a variety of courses of action the countries could take, although notably they are mostly research and information exchanges about various initiatives for emergency response in the countries.[94] This is a laudable section of AEPS because it encourages the participant countries to address the problem of emergency response together by exchanging methods. However, it provides no specific mechanism for any kind of emergency response. It also does not enable any sort of task force or set of enforcement officers to carry out an emergency response.

88. *See* AEPS, *supra* note 8. *See also* AMAP website, s*upra* note 87.
89. *See* AMAP website, *supra* note 87.
90. Arctic Council, *supra* note 7.
91. VanderZwaag, *supra* note 6, at 338.
92. Arctic Council, *supra* note 7.
93. *Id*.
94. AEPS, *supra* note 8, § 8.1.

C. Canada's Environmental Regime Protecting the Arctic

In addition to its comprehensive national environmental regime, Canada has enacted a law—the Arctic Waters Pollution Prevention Act—directed particularly at the Arctic region. Other Canadian environmental statutes may apply to the region as well.

AWPPA was first enacted in 1970.[95] It imposed environmental regulations on shipping within 100 miles of Canada's Arctic coast.[96] At the time of its passage, AWPPA ran contrary to international law. But with the enactment of UNCLOS in 1982, AWPPA was embraced under international law since UNCLOS authorized coastal states to enact laws prohibiting maritime pollution within 200 miles of places where ice creates navigational hazards.[97] It should be kept in mind, however, that AWPPA could be applied unilaterally if the 1986 baseline extension is accepted, as Canada would then gain sovereignty over the Northwest Passage under the *Anglo-Norwegian Fisheries* case and UNCLOS.[98]

The Canadian Parliament passed amendments to AWPPA in 1985 in response to the voyage of the *Polar Sea*.[99] Parliament noted in the 1985 preamble to AWPPA the inevitability of natural resource extraction in Arctic areas and the increased incidence of transportation through the Canadian Arctic.[100] The purpose of the legislation was to ensure that navigation and resource development in the Canadian Arctic occurred with regard to the welfare of the Inuit, the primary indigenous group in the eastern portions of the Canadian Arctic, and the preservation of the environment.[101]

The main prohibition of AWPPA is in Section 4(1). Under that section, "no person or ship shall deposit or permit the deposit of waste of any type in the arctic waters or in any place on the mainland or islands of the Canadian arctic under any conditions where the waste or any other waste that results from the deposit of the waste may enter arctic waters."[102] Violators are subject to civil and criminal liability.[103] If Section 4(1) is violated, those developing natural resources in the Arctic region, those carrying out any undertaking on land or water, the owner of any ship navigating in arctic waters, and the owners of any cargo of such

95. AWPPA, *supra* note 9.
96. *Id*.
97. UNCLOS, *supra* note 58, art. 234.
98. *See supra* Section III.
99. AEPS, *supra* note 8. *See also* Rothwell, *supra* note 41, at 344.
100. AWPPA, *supra* note 9.
101. *Id*.
102. AWPPA, *supra* note 9, § 4(1).
103. *Id*.

ships are jointly and severally liable for damages in the amount determined by regulations under Section 9 of the Act.[104] Additionally, AWPPA provides that the polluter must indemnify the government for actions taken to remedy or repair the conditions that result from a deposit of waste.[105] This is a strict liability regime; fault or negligence need not be shown.[106] The Act also provides for criminal penalties.[107] Violators of Section 4(1) can be fined $5,000 per person and $100,000 per ship. A separate offense occurs for each day the violation continues, making a large fine quite possible.

AWPPA embodies what is called the "polluter-pay" principle, which is a common feature firmly entrenched in Canadian environmental law. The purpose of the principle is to encourage sustainable and responsible development by assigning polluters the responsibility for cleaning up pollution. By imposing the costs of contamination on the polluter, the principle incentivizes the protection of ecosystems as a part of doing business.[108]

AWPPA also encompasses a long list of technical regulations that have been promulgated under its authority.[109] These regulations specify ship construction formulas, zones of operations set out by location and dates, and enforcement procedures. The details of these regulations are at the heart of AWPPA's effectiveness because they carefully consider conditions in a region with special navigation concerns. Additionally, Canadian law enforcement is now enforcing AWPPA by aerial surveillance and is overflying commercial ships operating in Arctic waters looking for spills and violations.[110]

The first prosecution under AWPPA came nineteen years after its passage in the case *Regina v. Le Chene No. 1*.[111] The defendant in the case spilled fuel into a tidal stream near Hall Beach, Northwest Territory

104. *Id.* § 6(1).

105. *Id.* § 6(3).

106. *Id.* § 7(1).

107. *Id.* § 18.

108. *Imperial Oil Ltd. v. Attorney Gen. of Québec*, 2 S.C.R. 624, 641-42 (Can. 2003).

109. *See* Transport Canada, Arctic Shipping Pollution Prevention Regulations, *available at* http://www.tc.gc.ca/acts-regulations/GENERAL/A/awppa/regulations/001/awppa001/awppa001.html.

110. CNW Group, *Canada's New Government Enhances Aerial Surveillance to Detect Illegal Discharges from Ships in Canada's Arctic Waters*, Aug. 1, 2006, http://www.newswire.ca/en/releases/archive/August2006/01/c2763.html (last visited July 21, 2008).

111. *Regina v. Le Chene No. 1*, [1987] N.W.T.R. 209, 2 C.E.L.R. (N.S.) 273, (N.W. Terr. Ct.).

and pled guilty to a violation of Section 4(1) of AWPPA.[112] However, because of the direction of the tidal stream, no pollution reached Hall Beach and the fuel dispersed out to sea.[113] The court had to decide whether it was proper to impose the sentence given that no practical environmental damage resulted from the defendant's conduct.[114] In analyzing the case, the Northwest Territories Territorial Court looked to similar offenses that had been prosecuted under the Ocean Dumping Control Act, the Fisheries Act, the Northern Inland Waters Act, and other territorial acts affecting environmental matters.[115] The court held that "imposing meaningful penalties for the failure to provide . . . the highest standards of care for the purity of the air, land and water," encourages deterrence and, accordingly, a fine had to be assessed in the case.[116]

Because of these provisions and the court's decision in *Le Chene*, AWPPA has become an effective tool for preventing pollution in the Northwest Passage. Because the most risky use of the Passage will be by oil tankers, AWPPA's incorporation of the strict liability, polluter-pays principle means that oil tanker operators will be forced to internalize the costs of their passages. Further, *Le Chene* demonstrates that Canadian courts will impose penalties in a way that deters tankers from polluting. The potential penalties imposed on oil tanker operators could be very high because of the risks associated with floating sea ice and the extreme amount of damage a large-scale oil spill could cause in the Arctic region. To avoid high penalties in the unique Arctic setting, AWPPA incentivizes tanker operators to build and operate strong-walled ships capable of withstanding collisions with floating ice.

AWPPA also creates "pollution prevention officers" ("PPOs") with powers to enforce the Act.[117] Section 15(1) lists the powers of the PPOs. PPOs have a statutory warrant to enter any premises where the officer has reasonable grounds to believe that wastes may be or have been deposited, or where waste may enter the Arctic Ocean.[118] PPOs can examine the waste and take samples.[119] PPOs may compel any person in the area to produce for inspection any documents or papers concerning any matter relevant to the Act.[120] The only exception is that PPOs may

112. *Id.* at 1, 3.
113. *Id.* at 15.
114. *Id.* at 16.
115. *Id.* at 2.
116. *Id.* at 21.
117. AWPPA, *supra* note 9, § 14(1).
118. *Id.* § 15(1)(a-b).
119. *Id.* § 15(1)(b).
120. *Id.* § 15(1)(c).

not invade the privacy of a dwelling place.[121] With regard to ships, PPOs can board any ship and conduct inspections to determine if the ship complies with standards set under Section 12.[122] PPOs can order the ship to proceed outside the zone if it fails to comply with the standards or "*if the officer is satisfied, by reason of weather, visibility, ice or sea conditions*" that passage would be unsafe.[123] A PPO officer can, in times of emergency, commandeer vessels to respond to an environmental accident and assist with immediate cleanup operations.[124] The Act criminalizes failures to comply with PPO orders.[125] Thus, the statute implicitly recognizes that the Arctic, with its harsh conditions and high risk of irreparable harm, requires flexibility and quick responses.

AWPPA is effective because it has a readily available enforcement mechanism. By creating officers tasked with policing the Arctic and giving those officers wide latitude to enforce regulations and manage first-response cleanup, AWPPA furthers the goal of protecting the environment. When compared to the loose international regime, which provides no such enforcement mechanisms, the Canadian approach stands in stark contrast. The Canadian PPOs do not need to go before a court to obtain a warrant. Their powers are appropriate to police an area like the Arctic. Moreover, international efforts are rarely flexible and quick. Indeed, it has taken many years for the international community to form the Arctic Council, which is a mere study group on environmental problems and does little to effect an actual environmental policy aimed at preventing and remediating pollution in the Arctic.

V. WHAT SHOULD BE DONE NOW?

There appear to be three general courses of possible action at this point. It may be possible to leave the current international soft-law regime in place and hope that environmental protection develops with time. Though potentially difficult, it may also be possible for the current international structure to evolve into a protection regime with teeth. Finally, it is possible that Canada will succeed in establishing a claim of sovereignty over the Northwest Passage and will be able to enforce its environmental laws therein.

121. *Id.* § 15(3).
122. *Id.* § 15(4)(a).
123. *Id.* § 15(4)(b)(iii) (emphasis added).
124. *Id.* § 15(4)(c)(ii).
125. *Id.* §§ 17, 19(a).

A. Leaving the Current System in Place

As discussed above, the current international regime under the Arctic Council and AMAP calls for studying and monitoring the environmental conditions in the Arctic and contemplating possible protection mechanisms. However, because this structure is soft-law, it is not binding on individual countries and cannot compel them to police the region and enforce these contemplated protection mechanisms. Therefore, if confronted with an environmental catastrophe, the Arctic Council system would be relatively powerless to respond. This soft-law regime cannot effectively prevent environmental catastrophes nor enforce environmental regulations without an enforcement mechanism or the presence of officers operating in the Arctic.

Under current international law, Canada's AWPPA might be applicable within the Northwest Passage, or at least parts of it. Although Canada has succeeded in prosecuting a Canadian polluter under AWPPA, the real test of Canadian jurisdiction will come if it attempts to enforce the law against a non-Canadian polluter. When Canada passed AWPPA, it withdrew its acceptance of compulsory jurisdiction in the ICJ in order to avoid a legal dispute that could have led to an adverse decision regarding Canadian sovereignty in the Arctic.[126] However, in 1985 the Canadian government reinstated acceptance of compulsory jurisdiction.[127] The ICJ thus would decide a test case where Canada attempts to enforce AWPPA against a foreign vessel, with a significant issue being whether Canada has jurisdiction. Such a case could decide whether Canada's claim of Arctic sovereignty will succeed, despite Canada's insistence that a negative outcome would not be determinative of its assertion of Arctic sovereignty.[128]

It is troublesome, therefore, to assume that AWPPA and other Canadian environmental laws would fill the gaps left by the loose international regime. As Canada's jurisdiction in the region is untested, Canada would be less than enthusiastic about enforcing its law when it could mean that it would lose its ongoing struggle to attain sovereignty in the Northwest Passage by an adverse ICJ decision.

126. Rothwell, *supra* note 41, at 340.

127. *Id.* at 344.

128. *See, e.g.*, Prime Minister 1970 Remarks, *supra* note 47 (stating AWPPA is "not an assertion of sovereignty, but an assertion of determination to control certain aspects of what is happening there").

B. A Hard-Law Environmental Treaty for the Arctic?

Instead of living with the current uncertainties, the Arctic states, led by the United States and Canada, could work towards developing a hard-law treaty to protect the Arctic environment. Such a treaty would include enforcement mechanisms, not unlike the treaties concerning Antarctica. Many scholars have argued that a hard-law treaty protecting the Arctic can be developed in a similar fashion to the Antarctica treaties.[129] The Antarctic Treaty has been in effect since 1961.[130] In that treaty, the signatory countries agreed that none would attempt to make territorial claims on the continent. The 1961 treaty did not, however, address environmental problems until the Protocol on Environmental Protection to the Antarctic Treaty was added in 1991.[131] Further, there are several other side treaties that, combined with the Antarctic Treaty, comprise what is considered one of the best international environmental regimes in the world.[132]

In order for an international hard-law, enforceable regime in the Arctic to be created along the lines of the Antarctic Treaty, the eight Arctic states would have to give up their sovereignty claims over the region. This likely will prove extremely difficult or even impossible. The Arctic is significantly different in character from Antarctica. The Northwest Passage and the Arctic are strategically important,[133] resource rich, and offer a potentially lucrative shortcut for international navigation. In addition, all of the Arctic states are vying for territorial claims over different parts of the Arctic region due to their proximity and interest in developing the resources and navigation of the region. Antarctica, while perhaps rich in resources, is not territorially linked to powers like the United States, Russia, and Canada, and it does not have the potential to become an important trade route.[134] Thus, unlike

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129. Antarctic Treaty, June 23, 1959, 12 U.S.T. 794 [hereinafter Antarctic Treaty of 1959]; and the Protocol on Environmental Protection to the Antarctic Treaty, Oct. 4, 1991, 30 I.L.M. 1455, 1461 (1991) [hereinafter Antarctica Protocol].

130. Antarctic Treaty of 1959, *supra* note 129.

131. Antarctica Protocol, *supra* note 129, at 1461.

132. Verhaag, *supra* note 38, at 574.

133. See, *e.g.*, Kettenun, *supra* note 60, at 940-41, which explains:

> the shortest distance between the two super powers [the United States and the Soviet Union] is across the Arctic Circle [and] further strategic considerations led to American-Canadian cooperation in the development of the North American Aerospace Defence Command (NORAD), a long range bomber interceptor system.

Kettunen also notes that "the Soviet Union has historically understood the strategic attributes of the region and its arctic sector is heavily concentrated with naval and air force bases."

134. The distance between Moscow and the North Pole is 2,378 miles, whereas the

international environmental agreements pertaining to Antarctica, much more is at stake here. The Northwest Passage, being a navigation conduit and a potential source of vast natural resources, means that states will value access to the Arctic much more than to Antarctica. Concerns about access and navigation likely will override environmental concerns where a conflict arises.

In light of this, any treaty must be designed to balance the interests of access and protection towards a goal of sustainable development, and could expand on various other environmental protection treaties that are generally applicable around the world. If the United States does not wish to support the Canadian territorial claim over the waters of the Northwest Passage, then it should lead the Arctic states to develop and ratify hard-law treaties protecting the Arctic environment.

Some commentators believe that an international treaty modeled after the sovereignty provisions of the Antarctica treaties is the best solution to the American-Canadian dispute over the Northwest Passage.[135] The underlying view here is that Canada's sovereignty would be recognized over the resources, land areas, and even the strait itself. However, Canada would be forced to permit international navigation in the Passage under such a treaty. Thus, it hardly would seem like "sovereignty" in the normal sense. Canada would be reluctant to commit to a full-scale policing effort if it had to give up its sovereignty claims in this way and subject the area to international jurisdiction.

Perhaps the most that can reasonably be expected is the development of multilateral regional agreements under the auspices of the Arctic Council. Such agreements would have to, as a necessary precondition, respect the sovereignty of the Arctic states over their claimed territories, including Canada's claims. It may be possible for the United States and Canada to work on a regional agreement about the status of the Arctic that would allow effective environmental protection law to develop. The Barents Euro-Arctic Region treaty ("BEAR Declaration") signed by the European Arctic states exemplifies such a regional agreement.[136] Signed in 1993, the BEAR Declaration's signatory countries were Finland, Norway, Russia, and Sweden. The BEAR Declaration was designed with sustainable development of the

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distance from Moscow to the South Pole is 10,120 miles. *See* Distance from Moscow calculator, http://argun.tripod.com/dis1mosc.htm (last visited July 21, 2008). Note that Moscow is by no means the closest part of Russia to the North Pole, but this comparison is illustrative of the relative proximities.

135. Rothwell, *supra* note 41, at 368.

136. U.N. Environmental Programme, The Kirkenes Declaration from the Conference of Foreign Ministers on Co-operation in the Barents Euro-Arctic Region, Jan. 11, 1993, http://www.unep.org/dewa/giwa/areas/kirkenes.htm (last visited July 21, 2008).

Arctic in mind, rather than environmental protection objectives. It was motivated by region-specific concerns about the Arctic.[137] The United States and Canada, similarly motivated by regional concerns, could develop an agreement to protect the environment in the North American Arctic. Indeed, it would be an appropriate step under AEPS, and would complement the BEAR Declaration. However, this would likely be a long, difficult process complicated by the involvement of third-party countries. Moreover, the BEAR Declaration, while more effective than AEPS alone, is not a purely hard-law regime.

D. Canadian Success in Claiming the Northwest Passage

Canadian sovereignty in the Northwest Passage is easier to accomplish than an international treaty because the chief obstacle to the Canadian claim has been the United States. The United States has repeatedly acted to disrupt the Canadian claim to Northwest Passage. It is likely that if the United States were to accede to Canada's claims, the claims would succeed. A bilateral agreement between the United States and Canada would only require bringing two parties to the table, rather than many. Canada and the United States arguably have closer interests than the myriad of other Arctic countries. Thus, this option largely avoids the difficulties inherent in pursuing the creation of an international, or even regional, hard-law treaty system.

If Canada were to gain sovereignty over the Northwest Passage, it could extend its environmental laws to protect the region's environment. Canada already has a strong environmental statute in AWPPA that provides effective prevention principles to protect the Arctic against potential environmental catastrophes caused by shipping mishaps or dumping. Canada would likely be less hesitant to enforce this law against an international polluter if its exclusive claim was perfected and it did not face the prospect of the Northwest Passage being declared an international strait. In comparison to the uncertainties posed by leaving the current system in place and the difficulties in bringing the international community together to develop a hard-law environmental treaty, this option provides certainty and ease because a specific statute already exists.

137. Verhaag, *supra* note 38, at 569.

VI. HELPING CANADA ACHIEVE SOVEREIGNTY OVER THE NORTHWEST PASSAGE: A BILATERAL AGREEMENT WHERE THE UNITED STATES BACKS CANADA'S CLAIM

The United States and Canada should strike a bargain that would further both of their interests, while at the same time protecting the fragile Arctic environment. The United States has blocked Canadian claims to the Arctic in part because it wants to keep the Northwest Passage open as a shipping route from Alaska to the East Coast. Enhancements in navigation and ice-breaking technology have strengthened this American position,[138] making this a significant bilateral legal dispute between the United States and Canada.[139] However, the United States should work towards ending its dispute with Canada over the Northwest Passage. The Arctic region and the Northwest Passage are a "significant part of the Canadian national psyche."[140] Canada is unlikely to yield in its claims over the area. If Canada is willing to grant the United States a right of passage in exchange for an agreement to back Canada's claim over the region, the United States should back down from its dogmatic view that the Northwest Passage must be considered an international strait.

Current American policy seems to be at least somewhat receptive to this notion. The United States Department of State notes that "as the world's pre-eminent naval power, the United States has a national security interest in the ability to freely navigate and overfly the oceans as essential preconditions for projecting military power" and "ensuring the free flow of commercial navigation is likewise a basic concern for the United States as a major trading power, whose economic growth and employment is inextricably linked with a robust and growing export sector,"[141] indicating the United States' preference for international straits. However, the State Department, perhaps recognizing its own hypocrisy, goes on to state, "as a coastal nation, for example, we naturally tend to seek maximum control over the waters off our shores. Equally, as a major maritime power, we often view such efforts on the part of others as unwarranted limitations on legitimate rights of navigation."[142] The State Department also notes that the oceans policy of

138. Rothwell, *supra* note 41, at 332.

139. *Id.*

140. *Id.* at 331.

141. U.S. Dep't. of State, *Oceans*, http://www.state.gov/g/oes/ocns/ (last visited Jan. 2, 2009).

142. *Id.*

the United States must be seen through an international lens that takes into consideration the fact that "marine ecosystems and ocean currents, which transport pollutants and otherwise affect environmental interests, extend across maritime boundaries and jurisdictional limits" and that "achievement of oceans policy objectives thus requires international cooperation at the bilateral, regional, and global level."[143]

The State Department's Arctic policy is summarized by two very brief documents found on its website. One of these documents is a speech given by Evan T. Bloom, the Deputy Director for Polar and Scientific Affairs entitled "The Arctic."[144] In this speech, Bloom outlines, in a special section entitled "The Bilateral Dimension," the important relationship between the United States and Canada with regard to Arctic policy, noting that "the United States has exceptionally good cooperation with Canada on a tremendous range of issues."[145] Bloom also discusses American security interests in the Arctic, including an interest in "carrying out military exercises in the region, and moving ships and aircraft freely under customary international law rights."[146] He mentions the Northwest Passage briefly, noting that environmental protection of the Northwest Passage in the face of increased activity is an interest shared by the United States and Canada.[147]

The second document is entitled "U.S. Arctic Policy."[148] This document defines six objectives as the focus of American Arctic policy.[149] These goals are protecting the environment, promoting sustainable resource development, meeting security needs, strengthening cooperation among the eight Arctic states, involving indigenous people of the Arctic in decisions, and enhancing scientific monitoring of environmental issues.[150] The Policy goes on to discuss AEPS and the Arctic Council, its working groups, and American participation in such efforts.[151] Neither of these two documents mentions issues of Canadian sovereignty in the Northwest Passage.

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143. *Id.*

144. Evan T. Bloom, Remarks to the Conference on the United States, Climate Change and the Arctic Renewed American Interest in a Changing North, University of Quebec at the Montreal Science Centre, Canada, April 19, 2007, *available at* http://www.state.gov/g/oes/rls/rm/2007/85350.htm.

145. *Id.*

146. *Id.*

147. *Id.*

148. U.S. Dep't of State., *U.S. Arctic Policy*, http://www.state.gov/g/oes/ocns/arc (last visited Jan. 2, 2009).

149. *Id.*

150. *Id.*

151. *Id.*

Thus, it appears that American policy is not necessarily contrary to Canadian goals, but it also may not be entirely favorable towards them in light of the overriding American concern with being the "world's pre-eminent naval power." The United States' official policy statements avoid giving any concession to Canadian interests beyond noting a general agreement with Canada's goals of protecting the environment. Therefore, although the proposed bilateral agreement would actually satisfy American goals in a functional respect because naval passage would be secured, some may oppose it on ideological grounds based on a fear that losing one supposed international strait may be seen as a defeat to American power. Moreover, Canada has already authorized one American Coast Guard vessel to pass through its waters exempt from strict AWPPA regulations and likely will prove willing to do so in the future.[152]

Another factor affecting American policy is security. Professor Michael Byers of the University of British Columbia argues that an "international shipping route along Canada's third coast could facilitate the entry of drugs, guns, illegal immigrants and perhaps even terrorists . . . as well as providing an alternative route for illicit shipments of weapons of mass destruction or missile components by rogue states."[153] Indeed, these are important concerns for the United States, which shares an open border with its northern neighbor. Canadian environmental, immigration, customs, and criminal laws are better equipped to police the Northwest Passage than are the international community's loose legal regimes. Thus, the United States should support Canadian jurisdiction in part because Canada and the United States share a common security interest in the Northwest Passage.

As far as physical management of the Northwest Passage goes, it is noteworthy that the American ice-breaker *Polar Star* is now inoperable and docked in Seattle awaiting overdue repairs that will take at least a year.[154] Its sister ship, the *Polar Sea*, is operable, but remains in Seattle undergoing maintenance.[155] Thus, the United States is presently ill-equipped to exercise any kind of substantial presence in the Arctic.[156]

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152. *Order Exempting the United States Coast Guard Icebreaker "HEALY" from the Application of the Arctic Shipping Pollution Prevention Regulations*, CANADA GAZETTE, July 2, 2003, *available at* http://canadagazette.gc.ca/partII/2003/20030702/html/sor247-e.html.

153. Byers, *supra* note 2.

154. *Coast Guard gets $30M to overhaul icebreaker*, NAVYTIMES, Oct. 17, 2008, *available at* http://www.navytimes.com/news/2008/10/cg_polarstar_101608w/.

155. For information regarding the current status of the *Polar Sea*, see the United States Coast Guard website, http://www.uscg.mil/pacarea/cgcPolarSea/updates.asp (last visited Oct. 28, 2008).

156. Krauss, *supra* note 3.

Canada is in a much better position for monitoring the Passage and ensuring environmental protection. One commentator agrees, arguing that Canada's superior position in the management of the Northwest Passage is backed by its geographic proximity and experience with navigating the area.[157]

It should be noted that there could be another way the United States could simultaneously recognize Canada's claims, achieve the goal of protecting the Arctic, and protect American interests. The United States could simply ratify UNCLOS, which would allow Canada to enforce AWPPA over American ships, at least in some circumstances. This action might also lend legitimacy to enforcement actions against other foreign-flagged ships were the United States to allow enforcement against its ships. Such a step could feasibly improve environmental protection in the Arctic with less hassle. The United States has not yet ratified UNCLOS. Ratification has been blocked by Republican Senators, led by Senator James M. Inhofe of Oklahoma, on the grounds that it would infringe on American sovereignty.[158] UNCLOS enjoys wide support in the United States aside from the Senate Republicans opposed to it.[159] One scholar believes that the use of a Congressional-Executive agreement[160] is one way to get around the Senate Republicans and allow the United States to enter into UNCLOS.[161]

VII. CONCLUSION

On September 15, 2007, the European Space Agency reported that the Northwest Passage was free of ice and that sea ice in the Arctic was at its lowest level since satellite measurements began in the 1970s.[162] With the opening of new ice-free channels comes the opening of new shipping lanes, new incentives to develop resources, and new risks to the Arctic environment. The status of the Passage must be settled in order to protect the environment.

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157. Mark Jarashow, Michael B. Runnels, & Tait Svenson, Note, *UNCLOS and the Arctic: The Path of Least Resistance*, 30 FORDHAM INT'L L.J. 1587, 1650-51 (2007).

158. Krauss, *supra* note 3.

159. *See* King, *supra* note 59, at 336-37.

160. A Congressional-Executive Agreement is an international agreement entered into by the President that is then ratified by a majority of both the House and Senate. This type of treaty-making is considered by some to be constitutionally suspect, but has been used for agreements such as NAFTA.

161. King, *supra* note 59, at 351-52.

162. *Arctic Sea Route Opens*, Reuters, Sept. 15, 2007, http://www.enn.com/ecosystems/article/23070/.

The best way to advance environmental protection now is to allow Canada to exert sovereignty and its environmental law over its portion of the region. To achieve this end, the United States can play a large role by endorsing Canadian sovereignty. The preferable solution is a bilateral treaty between the United States and Canada addressing the Northwest Passage. Canada and the United States could reach an agreement whereby the United States is given an unfettered right of passage through the strait while other foreign-flagged ships would be required to obtain consent from the Canadian government. This could potentially serve both Canadian and American policy objectives, as well as international environmental objectives.

This option avoids the potential struggles and drawn out process of trying to enact a binding multilateral or international treaty. Obstacles to such a treaty include difficulties with trying to get Arctic states to cede their claims over the Arctic—something that seems impossible given the amount of wealth that stands to be gained from the region's opening.

Canadian control is preferable because monitoring and controlling shipping traffic is not a task that can be easily performed by the international community. Unlike the current loose international regime under the Arctic Council, the Canadian statute pertaining directly to the Arctic, AWPPA, is an effectively crafted instrument for protecting the environment against the risks associated with increased human traffic. AWPPA includes comprehensive monitoring and enforcement provisions. Moreover, it embodies the important polluter-pays principle, which will incentivize tanker operators to build ships capable of safely navigating the Passage and to conduct navigation in a cautious manner. The United States should recognize that Canada's environmental regime is the best way to protect the Arctic's fragile ecosystem. It can do this by entering into a bilateral agreement with Canada.

A Hybrid Marine Protection System as a Model for the Marine Conservation Efforts of the United States

Jessica D'Ardenne*

ABSTRACT

Marine environments are in a precarious position due to extensive and extended exploitation. Worldwide conservation efforts are necessary to reverse the damage and preserve this valuable natural resource. The United States is currently developing a national marine protection system for our shorelines. In its development and implementation, the United States should integrate marine reserves—areas in which human disturbance is forbidden—into the system. Marine reserves have been scientifically proven to rejuvenate previously exploited areas of the marine environment. In spite of these positive impacts, marine reserves may be seen as politically extreme measures. For these reasons, although marine reserves should form an integral part of the national marine protection system, they should be integrated with less extreme conservative tools, such as marine protection areas in which some human disturbance is permitted.

I. INTRODUCTION

Marine environments are in a dire state due to overfishing, development, water pollution, and other activities.[1] Due to these

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problems, marine conservation efforts are becoming a higher priority for many conservationists, scientists, and government officials worldwide.[2] Marine conservation efforts have taken many forms ranging from marine protection areas ("MPAs") that have minimal restrictions to "marine reserves" that have numerous restrictions. Coherent systems that include both MPAs and marine reserves are also being developed throughout the world in an effort to leverage the benefits of each. For the purposes of this Note, the term marine reserve will refer to an area in which no fishing or any other human disturbance is permitted. In contrast, a MPA is a regulated area that allows some human disturbance, such as fishing. Under these definitions, all marine reserves are MPAs, albeit a type with enhanced protections; however, not all MPAs are marine reserves.

New Zealand is the world leader in the development of marine reserves and is currently making efforts to create a national system of marine reserves. In response to the growing concern over the state of the oceans, the United States is also attempting to develop a national system. The United States' national system would leverage existing protected areas and systems that are operated by states, municipalities, and tribal organizations. It is currently in the planning phase.

This Note will advocate for the implementation of a marine planning system that includes marine reserves, as well as MPAs in which fishing and other activities are permitted. The system will be referred to as a hybrid marine protection system. This Note will demonstrate that a hybrid marine protection system is a reasonable alternative to the New Zealand marine reserve model. The hybrid model advocated in this Note somewhat mirrors the marine protection system established in central California as a result of the enactment of its Marine Life Protection Act ("MLPA"). While it may be politically impractical to establish a system comprised completely, or even primarily, of marine reserves, as is a goal in New Zealand, a system that emphasizes the strategic placement of marine reserves within a system of MPAs could be just as effective, as is described below. As will be shown, marine reserves are highly effective in conservation efforts and have many beneficial effects. Due to these benefits, marine reserves are indispensable in a marine planning system and should be emphasized in the United States' national system.

Part II will employ case studies to describe the world's overfishing problem, discuss why overfishing is occurring, and offer potential solutions. Part III will address marine reserves. It will provide a detailed definition of a marine reserve and describe their positive effects on

1. *See* CAL. FISH & GAME CODE § 2851(c) (2008).

2. *See* Joint Ocean Commission Initiative, http://www.jointoceancommission.org/ (last visited Sept. 10, 2008).

marine environments. Additionally, Part III will acknowledge the limitations of this conservation tool, including difficulties encountered in making scientific predictions about the effects of marine reserves and the associated political problems in the approval and implementation of marine reserves. Part IV will discuss the United States' attempt to address the current state of our oceans through the development of a national system. Finally, Part V will advocate that the United States adopt a hybrid system similar to that of California.

II. THE PROBLEM

The fishing industry has caused a decline in our ocean's fish populations of up to eighty or ninety percent.[3] There is some disagreement among marine biologists about this number; however, all agree that there are too many fishing boats pursuing too few fish.[4] Overfishing is aggravated by four factors: (1) the negligent management of fisheries and the similarly careless enforcement of laws and regulations; (2) the power of new fishing technologies; (3) the often overzealous and exploitive nature of the network of international companies participating in the fishing trade; and (4) consumer apathy about the exploitive fishing practices that are supplying fish for consumption.[5]

The international problem of overfishing can be illustrated by examining the current state of the giant bluefin tuna. Giant bluefin tuna are highly coveted due to their fat-layered belly meat, which is considered the finest sushi.[6] Due to this demand, even a small school of 200 giant bluefin tuna is worth more than half a million dollars in Japan.[7] Case studies of the overfishing of this species and other species demonstrate the four aggravating factors identified above.[8]

First, the fishing of the giant bluefin tuna illustrates the negligent management of fisheries and the lax enforcement of laws and regulations. To meet the demand of sushi markets, the giant bluefin tuna is fished from the Mediterranean Sea at a rate that is four times higher than what is sustainable.[9] For example, the annual legal take of giant

3. Fen Montaigne, *Still Waters*, NAT'L GEOGRAPHIC, Apr. 2007, at 42.
4. *Id.*
5. *Id.*
6. *Id.*
7. *Id.* at 43.
8. *Id.* at 42.
9. *Id.* at 44.

bluefin tuna, as established by the International Commission for the Conservation of Atlantic Tuna ("ICCAT"), is 32,000 tons for the Ecolofish fleet,[10] a small commercial fishing company.[11] However, according to the ICCAT, the group tasked with managing giant bluefin tuna populations, the actual take of that fleet is likely closer to 50,000 or 60,000 tons. If fishing continues at these rates, the giant bluefin tuna stocks will collapse.[12] The difficulties of detecting violations and of subsequent enforcement are caused in part by tuna ranching.[13] In this practice, giant bluefin tuna are captured in nets at sea and transferred into cages to be fattened offshore.[14] The fish are then killed and flash-frozen on Japanese ships.[15] Because the fish are transferred directly to the Japanese ships at sea, much of the catch can be hidden from the ICCAT.[16]

The success of the "Give Swordfish a Break" campaign further illustrates the impact of the first factor by showing a species' positive response to a change from lax law enforcement to effective and active enforcement.[17] This campaign, which will be examined below in greater detail, targeted the nearly wiped out North Atlantic swordfish.[18] It was spearheaded by the Natural Resources Defense Council and SeaWeb in 1998 and had two main objectives: namely, the establishment of international quota restrictions on the species and bringing an end to the fishing of swordfish in nursery areas within the waters of the United States.[19] These objectives were achieved in 1999 and 2000, respectively.[20] A few years later, in late 2002, a study conducted by the ICCAT found that the North Atlantic swordfish populations had increased in number to ninety-four percent of the level that was considered healthy.[21]

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10. *Id.* at 46.
11. *Id.* at 43.
12. *Id.*
13. *See id.* at 47.
14. *Id*.
15. *Id*.
16. *Id.*
17. Natural Resources Defense Council, *North Atlantic Swordfish*: *Successful NRDC Campaign Proves Conservation Works; North Atlantic Swordfish Population Turns Corner to Recovery*, http://www.nrdc.org/wildlife/fish/nswordbr.asp (last visited Sept. 10, 2008).
18. *Id.*
19. *Id.*
20. *Id.*
21. *Id.*

The second aggravating factor—the power of new fishing technologies—increases the potential to overfish our oceans because the ability to detect fish has improved. For example, bluefin tuna are easily seen from above with the aid of airplanes.[22] This method of spotting the giant bluefish tuna is possible because these fish procreate by rising to the surface of the water where the females emit eggs, and the males emit sperm.[23] This event can be seen from miles away by planes that then notify the fishing boats in the area.[24] Additionally, fishing vessels often are outfitted with global positioning systems and echo sounders, making detection of fish in the vicinity inevitable.[25] Among other innovations, powerful motors have replaced less effective sails, boats have increased in size, nets have become stronger due to the use of new materials, and vessels are able to stay at sea longer because the catches can be refrigerated aboard the ships.[26]

The third factor causing overfishing is the overzealous nature of the fishing industry, which results in the overexploitation of the ocean's resources.[27] Many of the technological advances facilitate this overzealousness. For example, according to the WWF, the global conservation organization, "Today's huge industrial fishing fleets set thousands of kilometers of strong, invisible nets each day—some large enough to hold [twelve] jumbo jets—as well as thousands of kilomet[ers] of longlines with tens of thousands of hooks."[28]

The movement of commercial fleets in their fishing expeditions also demonstrates the overzealous nature of the fishing industry. After essentially extinguishing the fish stock in one area, the fleets move elsewhere in pursuit of a new supply.[29] This trend can be seen in West Africa where international fishing boats have joined local fishermen and are exploiting the marine resources, depleting the local people's main source of protein.[30]

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22. Montaigne, *supra* note 3, at 43.

23. *Id*.

24. *Id.*

25. *Id.* at 55.

26. WWF, *Fishing Problems: Bigger Nets, Faster Boats*, http://www.panda.org/about_wwf/what_we_do/marine/problems/problems_fishing/boats/ (last visited Sept. 10, 2008).

27. Montaigne, *supra* note 3, at 42.

28. WWF, *supra* note 26.

29. Montaigne, *supra* note 3, at 42.

30. *Id.*

This trend was also seen in the case of the giant bluefin tuna.[31] By the mid-1990s, the southern bluefin tuna had been overfished to the extent that the species had decreased to a mere six to twelve percent of its original population.[32] Following this exploitation, and in order to meet the demand of the Japanese sushi market, the giant bluefin tuna fishing industry turned to the stocks of the Mediterranean Sea.[33]

This practice of fishing foreign waters is often aggravated by Fisheries Partnership Agreements between developed and developing nations.[34] Typically, a country has a designated Exclusive Economic Zone ("EEZ"), which is an area that extends 200 miles off the country's coasts.[35] EEZs, initially established in the 1970s, were partly created to protect a country's fishery resources from the exploitation of foreign fishing fleets.[36] Now these protections have been weakened because many countries have agreements permitting foreign nations to fish within their EEZs in exchange for a minimal fee.[37] Often fleets fishing in foreign waters are not watched closely for illegal fishing practices.[38] Commenting on the fishing agreement between the European Union and Guinea Bissau, a fisherman from Guinea Bissau stated that the agreement "has no sense or benefit because the industrial fishing boats don't leave us any chance of survival. They fish right up to the coast without being stopped and the government doesn't have the means to control their activities."[39]

Finally, the overfishing problem is aggravated due to consumer apathy about the current practices of the fishing industry.[40] Addressing this final factor is necessary to implement many changes needed to solve the overfishing problems.[41] Many experts agree that the crux of the overfishing problem is the current human perception that creatures of the sea are commodities that exist solely for human use and exploitation.[42] In contrast to this current view, many experts advocate that marine life must

31. *Id.* at 47.

32. *Id*.

33. *Id.*

34. WWF, *Fishing problems: Unfair Fisheries Partnership Agreements*, http://www.panda.org/about_wwf/what_we_do/marine/problems/problems_fishing/access_agreements/ (last visited Sept. 10, 2008).

35. *Id*.

36. *Id*.

37. *Id*.

38. *Id*.

39. *Id.*

40. Montaigne, *supra* note 3, at 42.

41. *See id*. at 51.

42. *Id*.

be respected in the same way that terrestrial wildlife is respected—marine life must be revered as living things that deserve protection.[43] The sea must be viewed as an ecosystem and not simply a supplier for the demands of consumption.[44] Informational campaigns should target consumers and retailers in an effort to educate these groups about the current problem.[45] Additionally, these campaigns could promote the purchase of sustainably caught fish.[46] Informational and educational efforts of this nature were part of the "Give Swordfish a Break" campaign, which marked the first large scale effort to mobilize consumers around the conservation of fish.[47] The campaign started with endorsements from twenty-seven chefs, and this number quickly increased by 700 chefs from restaurants across the United States.[48] When endorsing the "Give Swordfish a Break Pledge," each of the chefs promised not to serve North Atlantic swordfish in their restaurants.[49] Additionally, many businesses, ranging from cruise lines to grocery stores, followed suit.[50] One restaurateur from New York noted that the restaurant industry and seafood consumers all have a vested interest in participating in conservation efforts to ensure a stable future seafood supply.[51]

One conservation solution, the subject of this Note, directly combats all four aggravating factors—the creation of MPAs, including marine reserves, around the world.[52] This Note advocates that the United States should continue its current efforts to create a national system of MPAs and ultimately should establish a hybrid system that leverages the benefits of MPAs and marine reserves. Concededly, marine reserves, while beneficial, have their limitations as will be discussed below.

43. *Id*.
44. *Id*.
45. *Id*.
46. *Id.*
47. Natural Resources Defense Council, *supra* note 17.
48. *Id*.
49. *Id*.
50. *Id*.
51. *Id.*
52. Montaigne, *supra* note 3, at 51.

III. MARINE RESERVES

A. Dr. Bill Ballantine and the Development of the Marine Reserve

1. The Concept of a Marine Reserve

Goat Island, one of the world's first marine reserves, was established in New Zealand in 1977.[53] Its creation followed twelve years of campaigning, which was spearheaded by Dr. Bill Ballantine, the director of the University of Auckland Marine Laboratory.[54] New Zealand now has thirty-one marine reserves, which cover almost eight percent of the nation's coastal waters.[55] However, ninety-nine percent of that area consists of only two reserves, each of which is 100 miles away from the mainland of New Zealand.[56]

Ballantine continues to advocate for the establishment of marine reserves both in New Zealand and across the globe.[57] According to him, a marine reserve must follow five strict rules to be successful: (1) no fishing; (2) no removal of anything; (3) no human disturbance; (4) people must be encouraged to learn from the reserve, within the limits enumerated above; and (5) the above listed rules must be permanent.[58]

From New Zealand's experience with marine reserves, it is evident that this method of conservation provides ample benefits to various areas including science, education, conservation, health, recreation, tourism, planning, management, fisheries, and ecosystem support. Even though there are many utilitarian benefits, Ballantine argues that these should all be secondary goals and that the main purpose of marine reserves should be to permit the ocean to return to an undisturbed state, thus allowing ecosystems to restore themselves.[59] No matter what one's view on this matter, it is undeniable that marine reserves provide many benefits.

53. Kennedy Warne, *Blue Haven*, NAT'L GEOGRAPHIC, Apr. 2007, at 74–75.

54. *Id.* at 74.

55. *Id.* at 80.

56. *Id.*

57. *See* W. J. Ballantine and T. J. Langlois, *Marine Reserves: The Need for Systems*, http://www.marine-reserves.org.nz/papers/EMBSpaperJan07.pdf (last visited Oct. 20, 2008).

58. Dr. W. J. Ballantine, *Marine Reserves in New Zealand: The Development of the Concept and the Principles*, at 7, http://www.marine-reserves.org.nz/papers/concept.pdf [hereinafter *Marine Reserves the Concept*].

59. Warne, *supra* note 53, at 81.

Therefore, they should be included as a fundamental aspect in all marine planning programs.

However, marine reserves are rarely established through current marine planning and management efforts, whereas non-reserve MPAs are commonly created through these practices.[60] One reason for this difference is that unlike marine planning, marine reserves are uncomplicated in operation and simply allow ecosystems to restore themselves and biodiversity to rebuild itself,[61] thus bringing back and preserving the ocean's intrinsic life and natural processes.[62] Furthermore, MPAs and marine reserves are often established for different reasons; while MPAs reactively protect critical habitats, including spawning sites and nursery grounds, marine reserves proactively protect all species of a marine ecosystem.[63]

2. The Need for a System of Marine Reserves

While individual marine reserves are an important step in the conservation of marine habitats and have many positive effects, Ballantine argues that a system that combines individual marine reserves is necessary to optimize the benefits of these conservation tools.[64] He identifies five principles for a successful marine reserve system, including: (1) representation; (2) replication; (3) network design; (4) ample size in order to be self-sustaining; and (5) maximum diversity for the arrangements.[65] First, each region must be represented, and within each region, each major ecosystem must be represented.[66] Second, to satisfy the replication principle, each of the ecosystems should be protected by more than one reserve within a region.[67] Third, due to the mobile nature of marine life, especially during reproductive cycles, the network of reserves should be designed to protect species at all stages of life.[68] Fourth, the system must be large enough to sustain all natural

60. *Marine Reserves the Concept*, *supra* note 58, at 5.

61. Warne, *supra* note 53, at 81.

62. *Marine Reserves the Concept*, *supra* note 58, at 1.

63. Stephen R. Palumbi, *Marine Reserves and Ocean Neighborhoods: The Spatial Scale of Marine Populations and Their Management*, 29 ANN. REV. OF ENV'T AND RESOURCES 31 (2004).

64. *Marine Reserves the Concept*, *supra* note 58, at 17.

65. *Id.* at 17–18.

66. *Id.* at 17.

67. *Id.*

68. *Id.* at 18.

processes of the marine life.[69] Finally, the system should ensure variety and diversity in terms of size and arrangement of the reserves.[70]

Chamois Andersen, the Principal of Natural Resource Communications, who is currently working on the development of California's marine protection network, agrees that a system of protected areas is necessary to have a healthy ecosystem.[71] This is because species need to be able to migrate freely during their natural life cycles; a properly devised system must account for these patterns in order to provide protection to each species along the various points in its migration.[72]

Contrary to Ballantine's promotion of a system of marine reserves, some advocate that a network of MPAs that includes marine reserves strategically located to maximize replenishing power is a better solution than solely having non-marine reserve MPAs or solely having marine reserves.[73] Furthermore, this hybrid system could be designed to meet each of Ballantine's five principles for a successful system.[74] One example of this hybrid model is found on the California coast, which includes twenty-nine areas located along the central coast, roughly half of which ban all fishing.[75] The successes of California's marine protection efforts are discussed further below.

3. The Political Problems Associated with Marine Reserves

The idea of a marine reserve is radical to many people.[76] Therefore, many of the marine environment's stakeholders and many political figures are resistant to this conservation tool.[77] Evidence of this political resistance is seen in Ballantine's efforts in New Zealand where he

69. *Id.*

70. *Marine Reserve the Concept*, *supra* note 58, at 19.

71. Telephone Interview with Chamois Andersen, Principal of Natural Resource Communications (Jan. 24, 2008) [hereinafter Interview with Chamois Andersen].

72. *Id.*

73. *See* Warne, *supra* note 53, at 81.

74. *Marine Reserves the Concept*, *supra* note 58, at 17–18 (including: (1) representation; (2) replication; (3) network design; (4) ample size to be self-sustaining; and (5) maximum diversity for the arrangements).

75. Warne, *supra* note 53, at 81.

76. *See id*. at 74.

77. *See id*; Dr. W. J. Ballatine, Oral Submission to Select Committee on Marine Reserves Bill, http://www.marine-reserves.org.nz/papers/oralsubtoselectcom.pdf (last visited Oct. 20, 2008) [hereinafter Oral Submission]; Dr. W. J. Ballantine, Speech for Oceans Day on Aug. 6, 2002, http://www.marine-reserves.org.nz/papers/speechtopm2002.pdf (last visited Oct. 20, 2008) [hereinafter Speech].

labored for six years to get the first Marine Reserves Act passed[78] in 1971.[79] It took an additional six years for the first marine reserve to be implemented[80] at Goat Island[81] near the University of Auckland's Leigh Marine Laboratory.[82] In an oral submission to a Select Committee of Parliament considering a bill to replace New Zealand's 1971 Marine Reserves Act, Ballantine admitted that establishing marine reserves is a political issue because it pertains to the management of large areas of public domain.[83] Ballantine is currently advocating for a national system of marine reserves instead of scattered individual marine reserves.[84] He points out that other governments, having learned from New Zealand's experience with marine reserves, have consequently adopted reserve systems, and he urges New Zealand to do the same.[85] One of the reserve systems he was referring to was that of the Channel Islands in California.[86] While the network at the Channel Islands is not strictly comprised of marine reserves—specifically, two out of the twelve areas are less protected than reserves[87]—this hybrid network is a possible compromise. While a system such as that of the Channel Islands recognizes the importance of marine reserves, its hybrid composition, and consequent varying levels of protection, may be more palatable to opponents of the more severe restrictions that are characteristic of marine reserves.

B. Scientific Support Advocating Marine Reserves

1. Effects of Marine Reserves

There are four scientifically quantifiable ways that marine reserves affect species. They lead to: (1) recovery of previously exploited species; (2) declines in populations of prey and competitors; (3) transformations

78. Oral Submission, *supra* note 77, at 1.

79. Bill Ballantine, http://www.marine-reserves.org.nz/pages/ballintine.html (last visited Sept. 10, 2008).

80. Oral Submission, *supra* note 77, at 1.

81. Warne, *supra* note 53, at 74.

82. Bill Ballantine, *supra* note 79.

83. Oral Submission, *supra* note 77, at 1.

84. *Id.* at 2.

85. *Id.*

86. *Id.*

87. Interview with Chamois Andersen, *supra* note 71.

of habitats due to tri-level trophic cascades; and (4) increases in diversity and changes in faunal distribution.[88]

With respect to promoting recovery of previously exploited species, marine reserves generally lead to increases in biomass and population density of species that would be heavily fished without the protection of the reserves.[89] Fish biomass has been found to increase anywhere from 100 percent to 800 percent.[90] One study conducted on populations of snapper and rock lobster in three reserves in northeastern New Zealand demonstrated an increase in the abundance and biomass of both species following the establishment of the marine reserves.[91] Legal-sized snappers (snappers that are large enough to be legally harvested) were found to be fourteen times more abundant inside the marine reserves than outside.[92] Likewise, legal-sized rock lobsters were approximately 3.7 times more abundant within the marine reserves than outside the reserves.[93] These striking changes are, at least partially, due to the reserve's protection from fishing.[94] The fact that the only species that do not benefit from reserves are those that are not heavily exploited in their ordinarily unprotected environments supports the theory that the reserves' protection from fishing contributes to the differences in biomass and population density that is found inside reserves.[95]

The increase in biomass and population density can also partially be explained by the causal relationship between the two characteristics—specifically, a larger fish size leads to an increase in biomass and an exponential increase in reproductive capacity, the latter of which leads to an increase in population density.[96] For instance, one 62 centimeter long red snapper produces the same number of eggs as 212 red snappers that

88. Timothy J. Langlois & William J. Ballantine, *Marine Ecological Research in New Zealand: Developing Predictive Models Through the Study of No-Take Marine Reserves*, 19 CONSERVATION BIOLOGY 1763, 1765 (Dec. 2005) [hereinafter *Developing Predictive Models*] (citing N.T. Shears & R.C. Babcock, *Indirect Effects of Marine Reserves Protection on New Zealand's Rocky Coastal Marine Communities*, *in* SCIENCE INTERNAL SERIES 192, (Department of Conservation, Wellington, New Zealand, 2004)).

89. Palumbi, *supra* note 63, at 33.

90. *Id.*

91. *Developing Predictive Models*, *supra* note 88, at 1766.

92. *Id.*(citing T.J. Willis, R.B. Millar, & R.C. Babcock, *Protection of Exploited Fish in Temperate Regions: High Density and Biomass of Snapper Pagrus Auratus (Sparidae) in Northern New Zealand Marine Reserves*, 35 J. APPLIED ECOLOGY 214 (2003)).

93. *Id*. (citing S. Kelly, D. Scott, A.B. MacDiarmid, & R.C. Babcock, *Spiny Lobster, Jasus edwardsii, Recovery in New Zealand Marine Reserves*, 92 BIOLOGICAL CONSERVATION 359 (2000)).

94. Palumbi, *supra* note 63, at 33-34.

95. *Id.* at 34-35.

96. *See id.* at 35.

are 41 centimeters in length.[97] This trend of increased biomass and population density has been seen in the marine reserve at Edmunds Underwater Park in Puget Sound, where a ling cod produces twenty times more eggs per hectare than a fish of the same species found outside the reserve.[98]

The second and third effects of marine reserves—the promotion of a decline in populations of prey and competitors and changes in habitats due to tri-level trophic cascades—also interact with one another.[99] A trophic level is a hierarchical stratum that includes organisms that are all at the same position in the food chain.[100] A trophic level cascade describes the ripple effect that occurs when a predator reduces the number of its prey that are in a lower trophic level than the predator.[101] In turn, this reduction of prey lessens the predation pressures on the next lower trophic level, thus leading to increases in the numbers of the organisms in the third trophic level.[102] It has been found that species in different trophic groups respond to reserves differently,[103] which is thought to be attributable to trophic cascades.[104] Specifically, while a minimal response is seen in omnivores and detritivores, a stronger response is seen in species that consume algae, invertebrates, or plankton.[105] The strongest response, nearly doubling in number across twenty studies, is seen in predatory fish.[106]

The marine reserve at Goat Island provides a good example of this relationship between decline in prey and changes to tri-level trophic cascades. There, after fishing of snapper and rock lobster was halted, scientists observed a shift from a sea urchin dominated environment to a more diverse one, thick with kelp and mixed macroalgal stands.[107] This change can be explained by the cessation of the overfishing of snapper and rock lobsters. When these species, which are the main predators of

97. *Id.*

98. *Id.* at 36.

99. *See id.* at 35.

100. Merriam-Webster Online Dictionary, *trophic level*, http://www.merriam-webster.com/dictionary/trophic%20level (last visited Feb. 7, 2008).

101. *See* Stephen R. Carpenter, James F. Kitchell, & James R. Hodgson, *Cascading Trophic Interactions and Lake Productivity*, 35 BIOSCIENCE 636, 636 (Nov. 1985).

102. *See id*.

103. Palumbi, *supra* note 63, at 35.

104. *See Developing Predictive Models*, *supra* note 88, at 1766.

105. Palumbi, *supra* note 63, at 35.

106. *Id.*

107. *Developing Predictive Models*, *supra* note 88, at 1766 (citing R.C. Babcock et al., *Changes in Community Structure in Temperate Marine Reserves*, 189 MARINE ECOLOGY PROGRESS SERIES 125 (1999)).

the sea urchin (rock lobsters alone being responsible for at least forty-five percent of sea urchin mortality),[108] were overfished, the sea urchin population exploded and devoured the kelp and sea weed.[109] When fishing in Goat Bay ended, an almost immediate change was observed.[110] The ratio of predators to prey rebalanced as the populations of snapper and rock lobsters increased and the number of sea urchins dropped.[111] Studies showed the chance of predation of sea urchins is seven times higher inside the reserve than outside the reserve.[112] Trophic cascade trends, such as the one at Goat Island, are likely accentuated because predatory fish are frequently fishing targets.[113] Thus, when fishing ends, predatory fish flourish,[114] and the ratio of predators to prey rebalances.

The fourth and final effect is an increase in biodiversity in marine reserves.[115] This was observed in the reserves in northeastern New Zealand and is thought to be a result of the decrease in the population of grazing urchins.[116] In turn, the decrease in sea urchins led to an increase of algal distributions, which are associated with faunal diversity and productivity.[117]

2. Successful Conservation Efforts at California's Channel Islands

In addition to serving as a model for establishing a hybrid marine protection system, California has provided optimistic scientific data

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108. *Id.* (citing N.T. Shears & R.C. Babcock, *Marine Reserves Demonstrate Top-down Control of Community Structure on Temperate Reefs*, 132 OECOLOGIA 131 (2002)).

109. Warne, *supra* note 53, at 74.

110. *Id.*

111. *Id.*

112. *Developing Predictive Models*, *supra* note 88, at 1766 (citing N.T Shears & R.C. Babcock, *Marine Reserves Demonstrate Top-down Control of Community Structure on Temperate Reefs*, 132 OECOLOGIA 131 (2002)).

113. Palumbi, *supra* note 63, at 35.

114. *Id.*

115. *Developing Predictive Models*, *supra* note 88, at 1766.

116. *Id.*(citing R.B. Taylor, *Density, Biomass and Productivity of Animals in Four Subtidal Rocky Reef Habitats: The Importance of Small Mobile Invertebrates*, 172 MARINE ECOLOGY PROCESS SERIES 37 (1998) and N.T. Shears & R.C. Babcock, *Continuing Trophic Cascade Effects After 25 Years of No-take Marine Reserve Protection*, 246 MARINE ECOLOGY PROGRESS SERIES 1 (2003)).

117. *Id.* (citing R.B. Taylor, *Density, Biomass and Productivity of Animals in Four Subtidal Rocky Reef Habitats: The Importance of Small Mobile Invertebrates*, 172 MARINE ECOLOGY PROCESS SERIES 37 (1998) and N.T. Shears & R.C. Babcock, *Continuing Trophic Cascade Effects After 25 Years of No-take Marine Reserve Protection*, 246 MARINE ECOLOGY PROGRESS SERIES 1 (2003)).

about the benefits of this type of system as a conservation tool.[118] The Channel Islands off the coast of California are home to twelve MPAs, ten of which are marine reserves.[119] After the network was established in April 2003, the California Department of Fish and Game formed a group of marine experts to develop monitoring objectives for the system.[120] This group has collected data over the last five years by monitoring changes in the marine environment and in human activities in and around the protected areas.[121] The data demonstrates a dramatic increase in the size of individual fish, as well as an increase in the total abundance of many species.[122] According to Dr. Jenn Caselle, a research scientist with the University of California, Santa Barbara, "This increase in the average size can have important ecological effects because larger fish produce exponentially more young than smaller fish."[123] Specifically, these changes were seen in kelp, bass, and California sheephead.[124] The data also shows an increase in size and abundance of California's spiny lobster.[125] Additionally, using a remotely-operated vehicle as a research tool, the experts determined that eight to twelve of the finfish species that were monitored also exhibited an increase in density within the protected areas.[126] Even though many species have already exhibited a profound growth in a short period of time, it was unexpected that these changes in species population and individual size would occur so rapidly.[127] Researchers anticipate that most other species will take longer to demonstrate a response to the protection of the reserves.[128] For example, researchers hypothesize that slow-growing rockfishes will not exhibit a significant response for another ten to fifteen years.[129]

Changes in human interactions with the marine environment after the establishment of the marine reserves were also studied.[130] Because many of the species in the protected areas of the Channel Islands are

118. *See* Interview with Chamois Andersen, *supra* note 71.

119. *Id.*

120. California Department of Fish and Game, *Scientists to Discuss First Five Years of Monitoring the Channel Islands Marine Protected Areas*, Feb. 5, 2008, http://www.dfg.ca.gov/news/news08/08012.html (last visited Oct. 17, 2008).

121. *Id.*

122. Interview with Chamois Andersen, *supra* note 71.

123. California Department of Fish and Game, *supra* note 120.

124. *Id.*

125. *Id.*

126. *Id.*

127. *Id.*

128. *Id.*

129. *Id.*

130. Interview with Chamois Andersen, *supra* note 71.

popular commercial and sport fishing targets,[131] it might seem logical that restrictions on fishing these species in the ten Channel Islands reserves would negatively impact the fishing industry in this area; however, this has not been the case.[132] This paradoxical result is likely partially due to spillover of the species from the protected areas into the unprotected areas, which is caused by the increase in population in the protected areas.[133]

3. Unique Responses to Marine Reserves

It is important to note that marine habitats in different bioregions may respond differently to the implementation of marine reserves.[134] This is illustrated in studies conducted in the Poor Knights Marine Reserve.[135] This reserve is located near the coastal islands of New Zealand, which are characterized by warmer waters caused by the East Auckland Current.[136] The one degree higher water temperatures attract tropical marine life ranging from whale sharks to coral shrimps.[137] Merely four years after the implementation of the reserve, the snapper population increased by 7.4 times.[138] Even more dramatic, the total snapper biomass increased by 808 percent.[139] These large increases are especially surprising because a lag time is expected before biomasses and populations increase when populations were previously subjected to high fishing pressure.[140] In contrast, no increase in the population of rock lobsters has been observed.[141] Scientists believe that the significant

131. *See id*.; *see* California Department of Fish and Game, *supra* note 120.

132. Interview with Chamois Andersen, *supra* note 71.

133. *Id.*

134. *See Developing Predictive Models*, *supra* note 88, at 1765 (citing N.T. Shears & R.C. Babcock, *Indirect Effects of Marine Reserves Protection on New Zealand's Rocky Coastal Marine Communities*, 192 SCIENCE INTERNAL SERIES 1, Department of Conservation, Wellington, New Zealand, (2004)).

135. *See id.* at 1767.

136. *Id.* (citing M.P. Francis, C.J. Worthington, P. Saul, & K. D. Clements, *New and Rare Tropical and Subtropical Fishes From Northern New Zealand*, 33 N.Z. J. MARINE & FRESHWATER RES. 71 (1999)).

137. Warne, *supra* note 53, at 78.

138. *Developing Predictive Models*, *supra* note 88, at 1767 (citing C.M. Denny, T.J. Willis, & R.C. Babcock, *Rapid Recolonisation of Snapper Pagrus auratus: Sparidae Within an Offshore Island Marine Reserve After Implementation of No-take Status*, 272 MARINE ECOLOGY PROGRESS SERIES 183 (2004)).

139. *Id.*

140. *Id.* (citing N. V. C. Polunin & C. M. Roberts, *Greater Biomass and Value of Target Coral-Reef Fishes in Two Small Carribbean Marine Reserves*, 100 MARINE ECOLOGY PROGRESS SERIES 167 (1993)).

141. *Id.* (citing J.D. Booth, E. Bradford, and J. Renwick, *Jasus edwardii puerulus*

changes in the snapper population and the lack of change in the rock lobster population are attributable to the effects of the East Auckland Current.[142] The changes observed in this particular reserve illustrate that the marine life in each reserve will respond uniquely and unpredictably.[143]

4. Problems with Predicting Reactions to Marine Reserves and Factors to Consider in Planning

According to Dr. Timothy J. Langlois and Ballantine, accurate and detailed predictions of changes due to the protection of a marine reserve are essentially impossible to make because of the complex trophic interactions and population dynamics of each reserve.[144] They suggest that the changes produced by marine reserves are affected by numerous factors including: (1) the region and habitat; (2) the size and shape of the area;[145] (3) the spatial arrangement of the area;[146] (4) novel forms of behavior due to new population structures;[147] and (5) the total size of the reserve area.[148] This prediction difficulty was also acknowledged in California's MLPA, which declared that because there is no undisturbed baseline area, the impacts of human activity on the marine environment and the necessary protective measures to forestall any such impacts are difficult to understand.[149] In other words, there is no pristine area against which changes can be measured.

Settlement Levels Examined in Relation to the Ocean Environment and to Subsequent Juvenile and Recruit Abundance, New Zealand Fisheries Assessment Report 2000/34. at 48 (2000)).

142. *Id.* (citing C.M. Denny, T.J. Willis, & R.C. Babcock, *Rapid Recolonisation of Snapper Pagrus auratus: Sparidae Within an Offshore Island Marine Reserve After Implementation of No-take Status*, 272 Marine Ecology Progress Series 183 (2004) and S. M. Chiswell, *Circulation Within the Wairarapa Eddy, New Zealand*, 37 N.Z. J. MARINE & FRESHWATER RES.691 (2003)).

143. See *id.*

144. *Id.* at 1768.

145. *Id.* (citing J. E. Neigel, *Species-Area Relationships and Marine Conservation*, 13 ECOLOGICAL APPLICATIONS 138 (2003)).

146. *Id.* (citing C.M. Denny, T.J. Willis, & R.C. Babcock, *Rapid Recolonisation of Snapper Pagrus auratus: Sparidae Within an Offshore Island Marine Reserve After Implementation of No-take Status*, 272 MARINE ECOLOGY PROGRESS SERIES 183 (2004)).

147. *Id.* (citing D. Parsons & D. Egli, *Fish Movement in a Temperate Marine Reserve: New Insights Through Application of Acoustic Tracking*, 39 MARINE TECH. SOC'YJ. 15 (2005)).

148. *Id.*

149. CAL. FISH & GAME CODE § 2851(e).

Despite the inability to make scientific predictions about a reserve's effects on a previously fished area, there is scientific data that offers guidance about how to establish an optimal marine protection system. First, according to marine conservationist and Stanford University Professor Dr. Stephen R. Palumbi, the size of the neighborhood—defined as the "area centered on a set of parents that is large enough to retain most of the offspring of those parents"[150]—must be considered in evaluating the appropriate size of the marine reserve.[151] Mathematical models of marine reserves show that the reserve should be more than twice the size of the neighborhood of a species to promote the optimal increase in population.[152]

Additionally, movement patterns play a role in determining whether a marine reserve can protect a species and thus lead to an increase in population.[153] Specifically, the amount of time that a given species spends within the area of the reserve is correlated to the rate of decline in fishing-related mortality.[154] For a highly mobile fish that travels in and out of the reserve area, the decline in mortality is directly correlated to the total fraction of the marine ecosystem that is protected.[155] For instance, the Florida Keys National Marine Sanctuary includes a reserve that is only about one percent of the size of the entire sanctuary.[156] Here, highly mobile fish will not be protected by this relatively small reserve.[157]

However, movement patterns cannot be looked at in isolation to determine the effects a reserve will have on a particular species; these patterns must be looked at in conjunction with a factor called recruitment.[158] Recruitment refers to the addition of new juveniles to the species at a rate higher than the rate at which adults exit the reserve area—i.e., more additions than subtractions.[159] The interaction between movement patterns and recruitment is demonstrated by comparing the effects of protection on different species that have low mobility but varying levels of recruitment. First, species with low mobility and high

150. Palumbi, *supra* note 63, at 32.
151. *Id.* at 37.
152. *Id.*
153. *Id.*
154. *Id.*
155. *Id.*
156. *Id.*
157. *Id.*
158. *Id.* at 38.
159. *Id.*

recruitment will typically increase in population within reserves.[160] In contrast, the opposite result will be seen in species with low adult movement and poor recruitment.[161] In the latter scenario, exit rates will be low, but there will not be an increase in population because, with low recruitment, juveniles are added at a rate lower than the rate of exit.[162] A possible example of this interaction of movement and recruitment is seen in the fisheries in Jamaica where extreme fishing exploitation has left few adults to provide recruits, causing a slow recovery in the fish population.[163] In contrast, highly mobile species may nonetheless react positively to reserves if their recruitment is high enough to counteract the mortality caused from movement into and out of the protection of the reserve.[164]

Due to the interaction of the many factors that affect the changes produced by a marine reserve, reliable predictive models about their effects will not be possible until there is a representative range of reserves.[165] This underscores Ballantine's advocacy for representation of regions and ecosystems in a marine reserve network. Furthermore, the lack of reliable predictive models makes goal setting and progress measurement of traditional marine planning difficult. This difficulty supports Ballantine's advocacy for having only one goal in the implementation of marine reserves—to minimize human disturbance.[166] With minimal human disturbance, marine environments will be able to recover to a more natural state.[167] While this goal would not be strictly enforced in all areas within a hybrid marine protection system, it would be present in the marine reserves and, to some degree, in the areas with less stringent protections.

160. *Id.* at 37–38.

161. *Id.* at 38.

162. *Id.*

163. *Id.*

164. *Id.*

165. *Developing Predictive Models*, *supra* note 88, at 1768 (citing A. J. Underwood, M. G. Chapman, & S. D. Connell, *Observations in Ecology: You Can't Make Progress on Processes Without Understanding the Patterns*, 250 J. EXPERIMENTAL MARINE BIOLOGY & ECOLOGY 97 (2000)).

166. *See id.* at 1769.

167. *Id.*

IV. THE RESPONSE OF THE UNITED STATES

A. Executive Order 13158 on Marine Protected Areas

On May 26, 2000, President Bill Clinton issued Executive Order 13158.[168] The Order charges the Department of Commerce ("DOC") and the Department of the Interior ("DOI") with protecting existing MPAs and establishing a national system of MPAs.[169] The DOC and DOI must:

> (a) strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded MPAs; (b) develop a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources; and (c) avoid causing harm to MPAs through federally conducted, approved, or funded activities.[170]

In essence, the intent of the Executive Order is to define what qualifies as an MPA, determine which marine conservation areas in the United States meet those qualifications, establish a national system of MPAs that leverages those pre-existing marine conservation areas, identify gaps in protection within the system, and, finally, work to address those gaps.[171]

B. An Overview of the Process for Developing the National System

In pursuit of these goals, the DOC is instructed to establish a Marine Protected Area Federal Advisory Committee ("MPA FAC"), which will consist of non-federal scientists, resource managers, and other interested parties.[172] The MPA FAC will provide expert advice and recommendations regarding the implementation of the national

168. Exec. Order No. 13,158, 65 Fed. Reg. 34,909 (May 26, 2000) [hereinafter Exec. Order].

169. *Id*. at 34,909–34,910.

170. *Id.* § 1.

171. Telephone Interview with Mark Hixon, Ph.D, Chair, Marine Protected Areas Federal Advisory Committee and Professor, Department of Zoology, Oregon State University, Feb. 22, 2008 [hereinafter Interview with Dr. Mark Hixon] (includes subsequent follow up correspondence and additional interviews with Dr. Mark Hixon) (correspondence on file with author).

172. Exec. Order, *supra* note 168, at 34,909–10.

system.[173] Additionally, in the creation of the national system of MPAs, the DOC and DOI shall consult with other federal agencies, as well as state, territorial, and tribal authorities involved with establishing and maintaining MPAs.[174] Furthermore, the DOC's National Oceanic and Atmospheric Administration must establish a Marine Protected Area Center ("MPA Center") that will carry out, in cooperation with the DOI, the Order's mission of establishing a national system of MPAs.[175]

A July 2008 interview with Dr. Mark Hixon, the Chair of the MPA FAC and a Professor of Marine Conservation Biology at Oregon State University, reveals recent developments in the effort to establish a national system. The MPA Center previously developed an inventory of over 1,800 MPAs from an initial inventory of marine managed areas ("MMAs").[176] MMAs are "[a] broad set of natural and cultural resource areas in the marine and Great Lakes environment under a spectrum of place-based management."[177] The criteria for MMAs are more inclusive than those for MPAs.[178] The initial pool of MMAs was narrowed by filtering the conservation areas based on explicit standards designed to identify bona-fide MPAs.[179] In the next step, MPAs from the MPA inventory will be nominated to be part of the national system based on four criteria.[180] These selection criteria include that the MPA must: (1) "[m]eet the definitional criteria of an MPA, including each of its key terms—area, marine environment, reserved, lasting, and protection;" (2) "[s]upport at least one priority goal and conservation objective of the national system;" and (3) "[h]ave a management plan."[181] There is a fourth criterion for cultural sites, which is that they "must conform to

173. *Id.* at 34,910.

174. *Id.* at 34,909–10.

175. *Id.* at 34,910.

176. National Marine Protected Areas Center, *Marine Protected Areas Inventory*, http://www.mpa.gov/helpful_resources/inventory.html (last visited Sept. 1, 2008).

177. MARINE PROTECTED AREAS FED. ADVISORY COMM., PROTECTING AMERICA'S MARINE ENVIRONMENT: A REPORT OF THE MARINE PROTECTED AREAS FEDERAL ADVISORY COMMITTEE ON ESTABLISHING AND MANAGING A NATIONAL SYSTEM OF MARINE PROTECTED AREAS, at 26 (June 2005), http://mpa.gov/mpafac/mpafac_history.html (last visited Oct. 20, 2008).

178. *Id.*

179. Interview with Dr. Mark Hixon, *supra* note 171. *See also* National Marine Protected Areas Center, *Marine Protected Areas Inventory*, http://www.mpa.gov/helpful_resources/inventory.html.

180. National Marine Protected Areas Center, REVISED DRAFT FRAMEWORK FOR DEVELOPING THE NATIONAL SYSTEM OF MARINE PROTECTED AREAS, 13 May 2008, http://mpa.gov/pdf/national-system/revise_draft_frmwk_0308.pdf (last visited Oct. 20, 2008).

181. *Id.*

criteria for the National Register of Historic Places" ("NRHP").[182] The priority objectives and general goals referred to in the second criterion will be described below. After this process is completed, the MPA Center and the MPA FAC expect that several hundred MPAs will be invited to join the initial national system.[183]

After creation of the initial national system, the next step will be to conduct a gap analysis of the MPAs to determine where additional protections are needed.[184] While still in the planning phases, this stage will likely include an analysis of the MPAs that will examine the size, quantity, spacing, connectivity, and comprehensiveness of protection.[185] After the gaps are identified, there will be efforts to address them and create a comprehensive and efficient national system of MPAs.[186] At the gap-filling stage, if not already established, the United States should work toward a hybrid system that emphasizes significant reliance on marine reserves.

Unfortunately, progress has been slow. For example, the MPA Center was established in 2001,[187] but two years passed before the MPA FAC was established in 2003.[188] In spite of the slow advancement, there have been notable developments during the Bush administration—specifically the adoption of Clinton's Executive Order 13158 and the establishment of the Northwestern Hawaiian Islands Marine National Monument on June 15, 2006.[189] Despite the limited attention and resources from the federal government, progress continues through the efforts of advocates of the national system.[190] Moreover, states continue to work independently on their own coastal waters as demonstrated by the California system.[191]

182. *Id.*

183. Interview with Dr. Mark Hixon, *supra* note 171.

184. *Id.*

185. *Id.*

186. *Id.*

187. *Id.*

188. National Marine Protected Areas Center, *MPA Federal Advisory Committee History*, http://mpa.gov/mpafac/mpafac_history.html (last visited Sept. 25, 2008).

189. Interview with Dr. Mark Hixon, *supra* note 171; Press Release, The White House, President Bush Establishes Northwestern Hawaiian Islands National Monument (June 15, 2006), http://www.whitehouse.gov/news/releases/2006/06/20060615-6.html (last visited Oct. 20, 2008).

190. Interview with Dr. Mark Hixon, *supra* note 171.

191. *Id.*

C. Goals for the National System and Supporting Objectives

The three comprehensive themes that form the foundation of the development and implementation of the national system are that it integrates the nation's: (1) Natural Heritage; (2) Cultural Heritage; and (3) Sustainable Production.[192] Natural heritage is defined as the "nation's biological communities, habitats, ecosystems, and processes, and the ecological services, uses, and values they provide to this and future generations."[193] Cultural heritage includes the "cultural resources that reflect the nation's maritime history and traditional cultural connections to the sea, as well as the uses and values they provide to this and future generations."[194] Finally, sustainable production pertains to "the renewable living resources and their habitats, including, but not limited to, spawning, mating, and nursery grounds, and areas established to minimize incidental by-catch of species, that are important to the nation's social, economic, and cultural well-being."[195]

On April 26, 2007, the MPA FAC adopted priority objectives that support these goals.[196] These specific objectives and their associated priority levels provide valuable insight into what the United States values in its future national system and, furthermore, what the national system will ultimately look like. In addition, as previously stated, the prioritized objectives will be used when identifying which MMAs will qualify as MPAs that will be invited to be included in the initial national system.[197]

First, Natural Heritage objectives include three high priority objectives: (1) "critical habitat of threatened or endangered species;" (2) "reproduction areas and nursery grounds;" and (3) "biogenic habitat."[198] Additionally, this goal is supported by three mid-level priority objectives: (1) "key areas for migratory species;" (2) "areas of high species and/or habitat diversity;" and (3) "unique or rare habitats and associated communities." Finally, there are three lower-level objectives

192. National Marine Protected Areas Center, *Draft Framework for Developing the National System of Marine Protected Areas*, at 4, July 2006, http://mpa.gov/pdf/national-system/final-framework-draft.pdf (last visited Oct. 20, 2008) [hereinafter *Draft Framework*].

193. *Id.*

194. *Id.*

195. *Id.*

196. MPA Federal Advisory Committee, *Toward a National System of Marine Protected Areas Recommendations from 2006-2007*, Feb. 2008, http://mpa.gov/pdf/fac/fac_recmd_06_07.pdf (last visited Oct. 20, 2008).

197. *Id.* at 12.

198. *Id.* at 9.

under Natural Heritage: (1) "link areas important to life histories (e.g., spawning areas and nursery habitats);" (2) "ecologically important geologic features, as well as enduring and recurring oceanographic features;" and (3) "areas that provide compatible opportunities for education and research."[199]

Next, three high priority objectives also support Cultural Heritage. These include: (1) "Cultural and Historic Resources Listed on the [NRHP];" (2) "Cultural and Historic Resources determined eligible for the NRHP or listed on a State Register;" and (3) "Cultural sites that are paramount to a culture's identity and/or survival." In addition, there are two mid-level priority objectives: (1) "Cultural and Historic sites that may be threatened" and (2) "Cultural and Historic sites that can be utilized for heritage tourism." Finally, Cultural Heritage is supported by one lower-level priority consideration: "Cultural and Historic sites that are under-represented."[200]

Lastly, the goal of Sustainable Production is supported by six objectives. Two are high priority objectives: (1) "reproduction areas (including areas of high larval production) and nursery grounds" and (2) "areas important for the conservation of natural age and sex structure of important harvestable species."[201] Next, there are two mid-level priority objectives: (1) "foraging grounds" and (2) reduction of "bycatch in areas where bycatch has a substantial impact on sustainable fisheries."[202] Finally, there are two lower-level priority objectives: (1) "areas that provide compatible opportunities for education and research" and (2) "areas that conserve or restore high priority fishing grounds."[203]

While the United States' national system is still in its planning phase, and we do not know what the system will ultimately look like, it is important that the nation recognize the benefits of marine reserves even during planning. Presently, the United States is considering MPAs with a variety of levels of protection for inclusion in the national system. If it combines this potential diversity with recognition of the value of marine reserves, optimistically, the result will be a hybrid system similar to that of California.

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199. *Id.*

200. *Id.*

201. *Id.*

202. *Id.* Bycatch refers to the unintentional catching of non-target species in nets and hooks. WWF, *Smarter fishing gear: making fishing gear more selective*, http://www.panda.org/about_wwf/what_we_do/marine/problems/bycatch/bycatch_solutions/fishing_gear/ (last visited Feb. 23, 2008).

203. MPA Federal Advisory Committee, *supra* note 196, at 9.

V. A MODEL FOR A HYBRID CONSERVATION SYSTEM: CALIFORNIA'S MLPA

A. California's MLPA

The California legislature enacted the MLPA, which became effective January 1, 2000.[204] This Act established California's marine protection network in recognition of the fact that its marine biological diversity is a fundamental natural resource and is important for public health and well-being, ecological health, and the economic health of industries that are dependent on the marine environments.[205]

The MLPA initiative includes an effort to create a more cohesive network and, in some cases, to integrate the independent marine managed areas (marine managed areas were renamed MPAs with the MLPA).[206] California has had marine parks off its coast for several decades.[207] However, historically, these marine parks were managed by several different agencies and had no consistent management plans or regulations.[208] The MLPA endeavors to produce an integrated system with defined purposes and effective management and enforcement procedures that will be based on scientific guidelines.[209] Specifically, the statute aims to "modify the existing collection of MPAs to ensure that they are designed and managed according to clear, conservation-based goals and guidelines that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves."[210]

Historically, marine reserves have not been emphasized in California's protection efforts. At the time California's MLPA was enacted, only fourteen of the 220,000 square miles—a mere 0.006 percent of California's coastal waters—were protected as marine reserves.[211] However, through the MLPA, California also recognizes the importance of marine reserves:

> Marine life reserves are an essential element of an MPA system because they protect habitat and ecosystems, conserve

204. CAL. FISH & GAME CODE § 2851.
205. *Id.* § 2851(b).
206. Interview with Chamois Andersen, *supra* note 71.
207. *Id.*
208. *Id.*
209. *See* CAL. FISH & GAME CODE § 2851.
210. *Id.* § 2851(h).
211. *Id.* § 2851(g).

> biological diversity, provide a sanctuary for fish and other sea life, enhance recreational and educational opportunities, provide a reference point against which scientists can measure changes elsewhere in the marine environment, and may help rebuild depleted fisheries.[212]

For the purposes of this Act, a marine life reserve is defined as:

> a marine protected area in which all extractive activities, including the taking of marine species, and, at the discretion of the commission and within the authority of the commission, other activities that upset the natural ecological functions of the area, are prohibited. While, to the extent feasible, the area shall be open to the public for managed enjoyment and study, the area shall be maintained to the extent practicable in an undisturbed and unpolluted state.[213]

Through the MPLA, California's ultimate goal is to establish a network that covers its entire 1,100-mile coastline.[214] In April of 2007, the California Fish and Game Commission adopted twenty-nine MPAs that span the central coast between Santa Barbara and Santa Cruz.[215] This central coast series went into effect in September of 2007 and is managed under the MLPA Program by the California Department of Fish and Game.[216] At the time of this Note's publication, California is planning to undertake the development of a system off the north central coast, followed by the southern region, the northern region, and concluding with the San Francisco Bay area.[217] Governor Arnold Schwarzenegger aims to complete the state's entire network by the year 2010.[218]

California is the first state to take on such a complex and vast initiative of covering its coasts with a network of MPAs.[219] Recognizing its leadership, Oregon and Washington are looking to California's processes for guidance in establishing MPA networks on their respective coasts.[220] Additionally, the United States should look at California's efforts for guidance in establishing the national system.

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212. *Id.* § 2851(f).
213. *Id.* § 2852(d).
214. Interview with Chamois Andersen, *supra* note 71.
215. *Id.*
216. *Id.*
217. *Id.*
218. *Id.*
219. *Id.*
220. *Id.*

B. California's System as a Model for the United States

The California system's emphasis on marine reserves should be emulated. It is the position of this Note that during the planning, selection and invitation, and ultimately, the gap-filling phases of the creation of the national system, a similar focus on marine reserves should be taken. Currently, less than one percent of the total managed area of the United States consists of marine reserves.[221] As California has, the United States should acknowledge the importance of marine reserves and the current inadequacy of the proportion of marine conservation areas that are designated as marine reserves. Furthermore, like California, the United States should increase the area of the marine environment that is dedicated to marine reserves. Ballantine suggests that in order to reap the full benefits of marine reserves, a minimum of ten percent—and up to fifty percent—of the entire ocean should be dedicated to marine reserves.[222] While this may not be a feasible target percentage for the United States at this point, it underscores the inadequacy of the current one percent of all conservation areas—not even one percent of the marine environment as a whole—that is dedicated to marine reserves.

An emphasis on marine reserves would better enable the United States to achieve its conservation goals. As was illustrated above by the findings in the reserves of New Zealand, the Channel Islands of California, and other areas, marine reserves are highly effective in conservation, protection, and rejuvenation of the marine environment. Admittedly, it would be difficult to implement many large marine reserves due to their stringent restrictions. However, their obvious benefits would make a marine protection system that includes marine reserves, strategically interspersed among other protected areas, a better vehicle to achieve conservation goals than a system without marine reserves.

VI. CONCLUSION

Our oceans are currently in a desperate situation and are in need of international conservation efforts. The ocean's problems are caused by overfishing and exploitation, marine and coastal development, pollution, and a lack of programs that encourage marine recovery and rejuvenation.

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221. *Draft Framework*, *supra* note 192, at iv.

222. No-Take Marine Reserves, *What are "No-Take" Marine Reserves?*, http://www.marine-reserves.org.nz/pages/marine.html (last visited June 15, 2008).

The creation of MPAs and marine reserves would address these problems.

The United States has begun to place a higher priority on marine conservation efforts, beginning with President Clinton's Executive Order 13158 and continuing in the current effort to create a national system of MPAs. It is critical that the United States continues to prioritize marine conservation by persisting in its planning efforts for the creation of a national system. Additionally, during planning and the subsequent evaluation of the initial national system and consequent gap filling efforts, the United States should acknowledge the inescapable benefits of marine reserves. Marine reserves have been highly successful in New Zealand and California and have many scientifically proven benefits, such as increasing biomass and population density and permitting marine environments to recover to their natural balance of species.

While it would likely be impractical to implement a system that consists primarily of marine reserves—because of political difficulties like those experienced in New Zealand—it is critical that marine reserves form an integral part of the marine conservation system. The system that exists in central California and is expected to spread to cover the state's entire coastline is a reasonable alternative to Ballantine's New Zealand model. The California hybrid model emphasizes the use of marine reserves while integrating this indispensable conservation tool within a system that also includes less restrictive marine planning areas. The United States should continue its conservation efforts to implement a national system of MPAs and ultimately produce a hybrid system comparable to that of California.