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Panama and the Specter of Climate Change

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Panama and the Specter of Climate Change

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I. INTRODUCTION

Human-induced climate change is a reality, even as we endeavor to discern its particularities, and the pace and course of its ultimate consequences.¹ It is a profound global problem that is the subject of broad-based international treaties² and the charge of international scientific and political intergovernmental and nongovernmental organizations.³ Yet, while global warming will have consequences that are shared by most members of the global community, it will have diverse, local and quite specific implications for particular regions, nations and peoples.⁴ Hence, as the world grows warmer, we must also ponder how a changing climate will affect various segments of the international community. This includes assessing the degree to which nations and peoples have or continue to contribute to the impending crisis, the wide-ranging local and national capacities to react and respond and, for low and middle income nations, how it coincides with their assessments and plans for industrialization and modernization.

This is a complex query, for the victims of climate change are

1. For the Fourth Assessment Reports by the Intergovernmental Panel on Climate Change ("IPCC"), see SUSAN SOLOMON ET AL., WORKING GROUP I REPORT ON THE PHYSICAL SCIENCE BASIS (Kansri Boonpragob et al. eds., Cambridge University Press 2007) [hereinafter IPCC WORKING GROUP I REPORT]; MARTIN PARRY ET AL., WORKING GROUP II REPORT ON IMPACTS, ADAPTATION, AND VULNERABILITY (Wolfgang Cramer & Daniel Murdiyarso eds., Cambridge University Press 2007) [hereinafter IPCC WORKING GROUP II REPORT]; TERRY BARKER ET AL., WORKING GROUP III REPORT ON MITIGATION OF CLIMATE CHANGE (Mukiri wa Githendu ed., Cambridge University Press 2007) [hereinafter IPCC WORKING GROUP III REPORT]. All Fourth Assessment Reports by the IPCC are available at <http://www.ipcc.ch> (follow Publications and Data hyperlink; then follow Assessment Reports hyperlink).

2. See, e.g., United Nations Framework Convention on Climate Change, May 9, 1992, 31 I.L.M. 849 (entered into force Mar. 21, 1994), available at http://unfccc.int/not_assigned/b/items/1417.php [hereinafter FCCC]; Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22 (entered into force Feb. 16, 2005), available at http://unfccc.int/not_assigned/b/items/1417.php [hereinafter Kyoto Protocol].

3. The most prominent is the IPCC, a scientific intergovernmental organization founded by the World Meteorological Organization ("WMO") and the United Nations Environmental Programme ("UNEP"). IPCC, IPCC – Intergovernmental Panel on Climate Change, <http://www.ipcc.ch/organization/organization.htm> (last visited Oct. 11, 2009). The IPCC's role is to provide objective information about climate change, assessing the latest scientific, technical and socio-economic literature produced worldwide to gain an understanding of the hazard of human-induced climate change, its observed and projected impacts and possibilities of adaptation and mitigation. *Id.* The IPCC is open to all governments that are members of the WMO or the UNEP. *Id.*

4. IPCC, *Summary for Policy Makers*, in IPCC WORKING GROUP I REPORT, *supra* note 1.

not necessarily coterminous with its unwitting architects.⁵ The perpetrators of this crisis⁶ are the peoples and nations of the industrialized North whose carbon emissions are responsible for most of the damage unfolding upon our fragile planet,⁷ even as large, rapidly industrializing nations race to join this unenviable club.⁸ With respect to already industrialized nations, the objective is to persuade them to undertake effective legal commitments that will prevent, and hopefully reverse, further damage. Similarly, it is hoped that developing nations will eventually follow suit and reconcile saving our climate with their goal of rapid industrialization.⁹ The effects of global warming will be asymmetrical even among Northern Tier industrialized nations, although these states will undoubtedly be better able to confront and adapt to whatever consequences may unfold.¹⁰ Those who will bear the brunt of the most egregious effects of a warmer planet, are the nations and peoples of the Global South. These small, impoverished and especially vulnerable nations are relatively powerless

5. See R.T. Pierrehumbert, *Climate Change: A Catastrophe in Slow Motion*, 6 CHI. J. INT'L L. 573 (2006).

6. For the author's views on the injustice of the causes versus the effects of global warming, see generally Ruth Gordon, *Climate Change and the Poorest Nations: Further Reflections on Global Inequality*, 78 U. COLO. L. REV. 1559 (2007) [hereinafter *Climate Change and the Poorest Nations*].

7. See, e.g., Barber B. Conable, *Development and the Environment: A Global Balance*, 5 AM. U. J. INT'L L. & POL'Y 235, 243-44 (1990); Alan Manne & Richard Richels, *The Berlin Mandate: the Costs of Meeting Post-2000 Targets and Timetables*, 24 ENERGY POL'Y 205 (1996); Christine Moran Sinclair, *Global Warming or Not: The Global Climate is Changing and the United States Should Too*, 28 GA. J. INT'L & COMP. L. 555 (2000); Sammy Zahran et al., *Ecological Development and Global Climate Change: A Cross-National Study of Kyoto Protocol Ratification*, 20 SOC. & NATURAL RES. 37 (2007); Richard Schmalensee, *The Lessons of Kyoto*, 2002 MIT SLOAN MGMT. REV. 96.

8. See, e.g., Zhou Dadi, *Environmental Considerations in the Economic Development of China*, 9 ARIZ. J. INT'L & COMP. L. 221 (1992); Steven Ferrey, *Why Electricity Matters, Developing Nations Matter, and Asia Matters Most of All*, 15 N.Y.U. ENVTL. L.J. 113, 146-49 (2007); Deborah E. Cooper, Note, *The Kyoto Protocol and China: Global Warming's Sleeping Giant*, 11 GEO. INT'L ENVTL. L. REV. 401, 405 (1999); Elisabeth Rosenthal, *Booming China Leads the World in Emissions of Carbon Dioxide, a Study Finds*, N.Y. TIMES, June 14, 2008, at A5.

9. See, e.g., Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 S. CAL. L. REV. 905; Sinclair, *supra* note 7; Cooper, *supra* note 8; Dadi, *supra* note 8, at 225-28; Rosenthal, *supra* note 8.

10. For example, the Netherlands confronts catastrophe, while the United States faces varying consequences due to its diverse geography. See, e.g., M. VanKoningsveld et al., *Living with Sea-Level Rise and Climate Change: A Case Study of the Netherlands*, 24 J. OF COASTAL RESEARCH 367 (2008); Martin Beniston et al., *Future Extreme Events in European Climate: an Exploration of Regional Climate Model Projections*, 81 CLIMATIC CHANGE 71 (2007).

actors within this conundrum.¹¹ Some, such as small island nations and the indigenous nations of the Arctic region, may cease to exist as their habitats disappear along with their cultures, civilizations and entire way of life.¹² These nations also lack the resources to deal with storms, rising sea levels, unpredictable weather patterns and other impending calamities from climate change.¹³ Such effects will undoubtedly affect these nations' positions and development strategies, always their central focus in the international sphere. Yet, despite their best efforts, these nations have been unable to slow global warming or to play roles in the solutions offered in its wake.¹⁴

Neither segment of the international community is the focus of this paper, however. Instead, my intention is to explore one of the nations at the midpoint of these two boundaries – Panama, a middle income Central American nation that is a member of an emergent and increasingly influential Second World.¹⁵ With the exception of China, and perhaps India,¹⁶ middle income nations have not been a major focus of climate change studies, despite their importance in halting the output of greenhouse gas (“GHG”) emissions and maintaining necessary sinks to capture the emis-

11. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1560.

12. See Dan McDougall, *The World's First Environmental Refugees*, THE ECOLOGIST, Jan. 30, 2009, available at http://www.theecologist.org/investigations/climate_change/269582/the_worlds_first_environmental_refugees.html; see also *Climate Change and the Poorest Nations*, *supra* note 6, at 1573-75.

13. *Climate Change and the Poorest Nations*, *supra* note 6, at 1589-05.

14. *Climate Change and the Poorest Nations*, *supra* note 6, at 1600-05.

15. A variety of terms are used in this paper in an attempt to characterize and differentiate between the varied groups of nations found in the international community. The terms Third World, Southern Tier and Global South are employed to distinguish low and middle income nations from high income industrialized, Organization for Economic Co-operation and Development (“OECD”) nations, which are characterized as the Global North, Northern Tier or simply industrialized. Third World also designates the largely colored world of the Global South, as well as those who formerly sought political autonomy during the Cold War from the warring western First World and the communist Second World. Ruth Gordon, *Katrina, Race, Refugees, and Images of the Third World*, in HURRICANE KATRINA: AMERICA'S UNNATURAL DISASTER 226, 238-42 (Jeremy I. Levitt & Matthew C. Whitaker eds., University of Nebraska Press 2009). Second World indicates the growing group of middle-income nations that are not yet part of the OECD, but are also not at the bottom of the international economic and political hierarchy. The complexities of these terms are beyond the scope of this paper, as the emergence of this middle group, largely populated by people of color is a work in progress. For further reflections on such terms as developing, underdeveloped and Third World, see generally Ruth Gordon, *Deconstructing Development*, 22 WIS. INT'L L.J. 1 (2004). [hereinafter *Deconstructing Development*].

16. See, e.g., Dadi, *supra* note 8, at 222-30; Rosenthal, *supra* note 8.

sions being ejected.¹⁷

Like other middle income nations, Panama is not one of the major sources of the processes that have led to a warmer climate,¹⁸ although it is seeking, and is well on the way to becoming a modern industrial state.¹⁹ Unlike poor nations which have been marginalized within climate change discourse, impending industrialization makes middle income nations significant in discussions regarding the causes and responses to the mounting climate catastrophe.²⁰ Middle income nations possess varying capacities to contribute to and deal with the problem, and are also able to attract and assume climate change mitigation undertakings, such as Clean Development Mechanism ("CDM") projects.²¹ Moreover, as is the case with their poorer, more powerless neighbors, dealing with climate change will undoubtedly affect their industrialization strategies and policies.

In some respects, Panama is typical of nations in the Central American region. For example, it boasts rainforests, which as sinks are crucial parts of the Earth's ecological mosaic combating climate change. It also has indigenous populations that depend on ecosystems threatened by a quickly warming climate, and face

17. See, e.g., Rogelio Gonzalez Garcia et al., *Climate Change and Environmental Policies in Mexico*, 9 ARIZ. J. INT'L & COMP. L. 217 (1992). However, many other Second World nations have not been studied.

18. It is often noted that China is about to surpass the United States as the largest emitter of global greenhouse gases. Rosenthal, *supra* note 8. Of course, China is also the major manufacturing nation in the world, while the U.S. is a declining industrial power that specializes in services as part of the post-industrial world. See Vandenberg, *supra* note 9, at 917-28.

19. See World Bank – Panama Country Brief, <http://go.worldbank.org/40JQNGAWO0> (last visited Jan. 12, 2010) (noting that Panama has experienced an economic boom in recent years).

20. This author has explored the plight of nations on the periphery in some depth. See, e.g., *Climate Change and the Poorest Nations*, *supra* note 6.

21. See Kyoto Protocol, *supra* note 2, at art. 12. The Clean Development Mechanism ("CDM"), as defined in Article 12 of the Protocol, allows a country with an emission reduction or emission limitation commitment under the Kyoto Protocol, an Annex B Party, to implement an emission reduction project in developing countries. *Id.* Such projects can earn saleable certified emission reduction ("CER") credits, each equivalent to one ton of CO₂, which can be counted towards meeting Kyoto targets. MEINHARD DOELLE, FROM HOT AIR TO ACTION? CLIMATE CHANGE, COMPLIANCE AND THE FUTURE OF INTERNATIONAL ENVIRONMENTAL LAW 30-33 (Thomson Carswell 2005) (discussing projects involved with CRE trading); FCCC, *Clean Development Mechanism*, http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php (last visited Jan. 12, 2010). There are a total of 1,108 CDMs worldwide; 714 (64.44%) are in Asia and the Pacific, 361 (32.56%) are in Latin America and the Caribbean, 25 (2.26%) are in Africa, and 8 (.72%) are elsewhere. FCCC, *CDM Registration*, <http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByRegionPieChart.html> (last visited Jan. 12, 2010).

projects intended to combat global warming that may destroy both their lands and way of life.²² Indeed, these communities may be forced to “develop” in a manner that was neither contemplated nor desired.²³ Thus, Panama represents the customary case, to the extent we can speak of customary cases,²⁴ of a nation somewhere in the range of intermediate states within climate change deliberations.

Then again, perhaps on some level, there are no customary cases in climate change discourse, as geography and capacity unquestionably influence the level of potential injury. Panama’s location and geography have profoundly influenced its politics, economy and history, possibly making Panama, by some measures, one of the most atypical nations in the world.²⁵ Located on the isthmus that connects the North and South American continents and, at its narrowest point separating the Atlantic and Pacific Oceans by only fifty miles, it is where the United States eventually decided to construct the Panama Canal.²⁶ Completed in 1914, the process leading to this achievement reeked of colonialism, racism and domination;²⁷ indeed, the canal was central to Panama’s “liberation” and resulted in a broad swath of its territory essentially under U.S. control for almost 100 years.²⁸ Still, the Panama Canal and its surrounding ecosystem, taken together, is a technological and ecological wonder of the modern world.²⁹ At the turn of the twenty-first century, the Panama Canal became a Panamanian possession, fundamental to its economy and plans to step boldly into the industrialized world.³⁰ In this quest, the

22. See *infra* notes 203-09 and accompanying text.

23. See *infra* notes 203-09 and accompanying text.

24. Since each nation can be differentiated by size, location, geography and capacity, there may be no such thing as a customary case.

25. Of course each nation is unique, given the many cultures, ethnicities and economies found across the international spectrum and that each particular piece of land is distinctive and thus possesses its own particular geography and climate. When these factors are added together, the distinctiveness of each nation is apparent.

26. Panama – Britannica Online Encyclopedia (2009), <http://www.britannica.com/eb/article-41028> (last visited Jan. 12, 2010).

27. See *infra* notes 245-71 and accompanying text.

28. See *infra* notes 257-80 and accompanying text.

29. The Canal Zone has a complex ecosystem that not only facilitates shipping through the Canal, but supplies drinking water to the nearby cities of Panama and Colon. Jennifer L. O’Hara, *Introduction: The Panama Canal Watershed Area*, in PROTECTING WATERSHED AREAS: CASE OF THE PANAMA CANAL 1 (Mark Ashton et al. eds., Food Products Press 1999). It takes 1.8 billion gallons of water a day to facilitate passage through the gravity fed locks. *Id.* at 2.

30. For a thorough history of the Panama Canal, see generally Panama Canal Authority Technical Resources Center and Corporate Communications Division, A

Canal is being expanded, at great expense, to facilitate larger and additional ships.³¹ But climate change may alter this strategy, for the prospect of Arctic melting presents the reality of an alternative route between the Atlantic and Pacific.³² Thus, a course of action meant to generate significant additional revenues to Panama may instead be less productive due to a changing climate.

This essay will use Panama as a prototype to explore how a small, growing, and rather distinctive nation will face what may be the greatest ever challenge to mankind. Some of the challenges are more typical, such as the impact of CDM projects on indigenous and other communities, and how middle income nations might approach dealing with quickly shifting land and water-based ecosystems. Still, each nation is different and will face its own set of unique problems and challenges. For Panama, it is the Panama Canal, a central part of its economic edifice that will be profoundly affected by a changing climate. This paper will contemplate how a rapidly changing climate may directly, and perhaps indirectly, undercut the approaches and perspectives of various communities, as well as Panama as a whole, regarding their hopes, potential and prospects for joining the industrialized world.

The discussion will proceed as follows. Part I will briefly explain climate change and its possible and probable ecological consequences, beginning with a very brief explanation of the underlying scientific causes. It will then explore both the current and future effects of this process, with an emphasis on the Global South and more specifically, South and Central America.³³ Part II

History of the Panama Canal: French and American Efforts (2001), available at <http://www.pancanal.com/eng/history/index.html> [hereinafter *History of Canal*].

31. See PANAMA CANAL AUTHORITY, PROPOSAL FOR THE EXPANSION OF THE PANAMA CANAL: THIRD SET OF LOCKS PROJECT 34-41 (2006), available at <http://www.pancanal.com/eng/plan/> (follow Panama Canal Expansion Proposal – Third Locks Project hyperlink).

32. A record breaking ice melt during the summer of 2007 opened up the Northwest Passage. John Roach, *Arctic Melt Opens Northwest Passage*, NAT'L GEOGRAPHIC NEWS, Sept. 17, 2007, available at <http://news.nationalgeographic.com/news/2007/09/070917-northwest-passage.html>. Arctic summers could become completely ice free by 2030, which would open up both the Northwest and Northeast Passages. See generally Marcel De Armas & Maria Vanko, *Mitigating Black Carbon as a Mechanism to Protect the Arctic and Prevent Abrupt Climate Change*, 8 SUSTAINABLE DEV. L. & POL'Y 41 (2008). Accordingly, there is a new desire to expand icebreaker fleets. Andrew C. Revkin, *Experts Urge U.S. to Increase Icebreaker Fleet in Arctic Waters*, N.Y. TIMES, Aug. 16, 2008, at A6. Climate change could alter the entire shape of globalization. See, e.g., Timothy Aepfel, *Stung by Soaring Transport Costs, Factories Bring Jobs Home Again*, WALL ST. J., June 13, 2008, at A1.

33. See RICHARD S. ODINGO, THE CLEAN DEVELOPMENT MECHANISM IN AFRICA: A

will briefly explore the international legal response, including the various perspectives of high, middle and low income nations, and instruments such as the Kyoto Protocol's CDM, specifically directed at Southern Tier middle income industrializing nations, such as Panama. Part III turns to Panama and its place within the Southern Tier.³⁴ It begins with a general introduction to Panama's political and economic history, before turning to its climate, ecology and natural resources. It will then discuss the current and projected effects of climate change and Panama's role in the legal labyrinth established to address the problem. As an industrializing tropical nation with indigenous populations, Panama is a microcosm of the challenges faced by similarly situated nations and may demonstrate potential difficulties and solutions. Part IV focuses on what makes Panama extraordinarily distinctive: the Panama Canal.³⁵ This section will begin with a short history of the canal and will then discuss the ongoing expansion project and the rationale and expectations of Panamanians for this undertaking. Part V turns to the implications of climate change for the Panama Canal system, including the extent to which a warming Arctic Ocean may present a competing route to Canal traffic.³⁶ Such an outcome may have severe consequences for Panama and its people, as they embark upon a hugely expensive modernization project. Finally, Part VI will provide conclusions regarding the impact of climate change on a small, booming, middle income nation whose future, at least according to the World Bank, is bright despite broad economic disparities within its population.³⁷ It may be that the forces of industrialization that are responsible for climate change, will ultimately lead to industrializing countries having less control over their destinies as they attempt to pursue this path.

II. CLIMATE CHANGE: CAUSES & EFFECTS

A. *Causes*

Global warming is a distortion of the quite natural phenome-

FRAMEWORK FOR THE DESIGN OF SUSTAINABLE DEVELOPMENT PROJECTS (Climate Network Africa, 2001); Steffen Kallbekken & Hege Westskog, *Should Developing Countries Take on Binding Commitments in a Climate Agreement? An Assessment of Gains and Uncertainty*, 26 THE ENERGY J. 41, 48 (2005); *infra* notes 52–112 and accompanying text.

34. *Infra* notes 182–242 and accompanying text.

35. *Infra* notes 243–97 and accompanying text.

36. *Infra* notes 298–326 and accompanying text.

37. *Panama Country Brief*, *supra* note 19; *infra* Part VI.

non that keeps our planet at average temperatures and supports the flora and fauna inhabiting its multifarious environs.³⁸ A basket of gases³⁹ maintain the equilibrium between incoming solar and outgoing terrestrial radiation. Known as greenhouse gases ("GHGs") because they operate much as a greenhouse, these gases prevent infrared radiation from escaping the Earth's atmosphere. This trapped heat warms our planet and keeps it at a sustainable and comfortable temperature.⁴⁰ Scientists have long theorized,⁴¹ and ice core studies in Greenland and Antarctica have confirmed, a link relating the regular and natural oscillations between colder and warmer global climate epochs with varying concentrations of GHGs.⁴² Despite normal climatic variations throughout history, industrialization has now given rise to record levels of GHG emissions, which in turn has magnified the normal greenhouse effect

38. *Why Electricity Matters*, *supra* note 8, at 114-23.

39. There are approximately thirty trace greenhouse gases ("GHGs"), the most important being CO₂, methane, nitrous oxide, hydrofluorocarbons ("HFCs") and chlorofluorocarbons ("CFCs"). TIM FLANNERY, *THE WEATHER MAKERS: HOW MAN IS CHANGING THE CLIMATE AND WHAT IT MEANS FOR LIFE ON EARTH* 30-31 (Atlantic Monthly Press 2006). Methane is the second most important GHG, after CO₂; it flourishes in swamps, farts and belches and is estimated to have brought about 15-17% of the global warming this century. *Id.* Nitrous Oxide (laughing gas) is derived from burning fossil fuels and biomass and from fertilizers that contain nitrogen. *Id.* The HFC and CFC family of chemicals are the only GHGs that are manmade. *Id.*; see also J.R. SAND, S.K. FISCHER & V.D. BAXTER, *ENERGY AND GLOBAL WARMING IMPACTS OF HFC REFRIGERANTS AND EMERGING TECHNOLOGIES: TEWI-III* (June 12, 1997), available at http://www.osti.gov/bridge/product.biblio.jsp?query_id=0&page=0&osti_id=489696. These chemicals are also responsible for ozone depletion and have been phased out under international instruments addressing ozone depletion. See, e.g., Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, 1513 U.N.T.S. 293; Montreal Protocol on Substances that Deplete the Ozone Layer, Sept. 16, 1987 S. Treaty Doc. No. 100-10 (1988), 1522 U.N.T.S. 29 [hereinafter Montreal Protocol].

40. Without GHGs the earth would be uninhabitable, as average temperatures would drop from the current 60°F to 5° F. DOELLE, *supra* note 21; Clare Breidenich, Daniel Magraw, Anne Rowley & James W. Rubin, *The Kyoto Protocol to the United Nations Framework Convention on Climate Change*, 92 AM. J. INT'L L. 315, 316 n.7 (1998).

41. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1565-70.

42. Glaciers in Greenland and Antarctica contain geophysical records of atmospheric and oceanic changes and glacial ice cores record the rise and fall of temperature changes during alternating ice ages and interglacial period. F. Sherwood Rowland, *Atmospheric Changes Caused By Human Activities: From Science To Regulation*, 27 *ECOLOGY L.Q.* 1261, 1285 (2001) ("During the last million years, the Earth has passed through a series of very cold spells (the Ice Ages) interspersed with warmer, interglacial periods . . ."). Scientists now understand the relationship between GHGs and their crucial effect on the ability of earth to emit the radiation that keeps temperatures at a certain level. *Id.* at 1281.

to such an extent that it is causing alterations to our climate.⁴³ What is currently occurring is neither ordinary nor natural – it is most definitely human made.⁴⁴

A by-product of industrialization, climate change is caused mostly by the industrialized nations of the North⁴⁵ that spew emissions from carbon-based energy sources fueling factories, businesses, homes, technology, machinery and transportation: the foundation of modern societies.⁴⁶ Furthermore, the emissions of a rapidly industrializing Second World are swiftly escalating as industrial production shifts to Second and Third World countries and as middle income nations, some with huge populations, mimic the consumption patterns of the industrialized North.⁴⁷ As these nations attempt to become full-fledged members of the industrialized world with respect to standards of living, they also duplicate

43. E.g., Elizabeth Kolbert, *Field Notes from a Catastrophe: Man, Nature, and Climate Change* 41-44 (Bloomsbury Publishing 2006); Ryokichi Hirono & Heike Schroder, *The Road to and from Kyoto Protocol: The Perspectives of Germany and Japan*, 5 INT'L REV. FOR ENVTL. STRATEGIES 39, 41 (2004) (noting that global temperatures and CO₂ levels have increased more rapidly recently than any other time in the last 10,000 years with CO₂ level, by parts per million or "ppm," increasing from 285 in the mid-nineteenth century to 365 today). CO₂ levels are predicted to rise as high as 760 ppm by mid century, with a corresponding projected rise in surface temperatures. Press Release, Ken Caldeira, CO₂ Emissions Could Violate EPA Ocean-Quality Standards Within Decades (Sept. 19, 2007), http://www.eurekalert.org/pub_releases/2007-09/ci-cec091907.php (last visited Nov. 11, 2009). The consequences of such a steep rise in the average global temperature are potentially catastrophic. See generally Elizabeth Kolbert, *The Darkening Sea: What Carbon Emissions are Doing to the Ocean*, THE NEW YORKER, Nov. 20, 2006, at 66-75. Indeed, the last time CO₂ concentrations were at this level was during the Eocene period, when sea levels were believed to be almost three hundred feet higher than in modern times. Elizabeth Kolbert, *The Climate of Man-III*, THE NEW YORKER, May 9, 2005, at 52.

44. FCCC, *Feeling the Heat: Introduction*, http://unfccc.int/essential_background/feeling_the_heat/items/2917.php (last visited Oct. 11, 2009) (discussing major causes and subsequent effects of climate change).

45. Generally considered the "Annex I Parties" of the Kyoto Protocol, this grouping includes OECD countries of Western Europe, the United States, Canada, Australia, Japan, and to a lesser extent, former Soviet bloc nations, which were previously known as the Second World. FCCC, *Parties & Observers*, http://unfccc.int/parties_and_observers/items/2704.php (last visited Oct. 19, 2009); Jayati Ghosh, *The Global North-South Carbon Divide*, THE GUARDIAN, Oct. 1, 2009, <http://www.guardian.co.uk/commentisfree/cif-green/2009/oct/01/climate-change-debate-copenhagen>.

46. Leah H. Martinez, *Post Industrial Revolution Human Activity and Climate Change: Why the United States Must Implement Mandatory Limits on Industrial Greenhouse Gas Emissions* [sic], 20 J. LAND USE & ENVT'L. L. 403, 404-06 (2005).

47. For an analysis of the Second World's emerging status in the international community, see generally PARAG KHANNA, *THE SECOND WORLD: EMPIRES AND INFLUENCES IN THE NEW GLOBAL ORDER* (Random House 2008).

the North's GHG emissions, especially as they become the factories for the goods that feed Western consumption.⁴⁸ Oddly enough, we often cheer this momentum and generally view it as progress;⁴⁹ indeed, within the development paradigm it *is* progress.⁵⁰ The problem is this paradigm is plunging headlong into an increasingly stressed environment that is making "progress" unsustainable. In ecological terms, the current Western lifestyle, even as it begins to evolve, is ultimately and profoundly unsustainable.⁵¹

B. Effects: Current and Predicted

1. The Damage Thus Far

Although the climate is warming as a result of Northern lifestyles, the transformation underway will have a disproportionate effect on the nations and peoples of the Third World because of geography and limited resources to adapt to and face the challenges of a quickly warming climate.⁵² The consequences of global warming are evolving and unfolding, even as the international community continues to vacillate; nonetheless, thus far, the following realities have been observed.⁵³ Earth's average surface temperature increased over the twentieth century, and the 1990s was the warmest decade of the century.⁵⁴ Average sea levels climbed and the heat content of the world's oceans rose; warmer oceans increase the quantity of atmospheric water vapor, which in

48. *Climate Change and the Poorest Nations*, *supra* note 6, at 1600-05. These nations make a firm distinction between their survival emissions and the luxury carbon emissions of OECD nations. *Id.*

49. This author is always struck by cheerleading within the U.S. media as people in China, India or other countries begin buying cars or otherwise imitating the wasteful polluting lifestyle that currently characterizes our culture. See, e.g., Elisabeth Rosenthal, *Fast Food Hits Mediterranean; a Diet Succumbs*, N.Y. TIMES, Sept. 24, 2008, at A1.

50. The author has previously explored ideas of progress and development in some depth. See *Deconstructing Development*, *supra* note 15.

51. Western lifestyles are probably unsustainable when practiced by the small group of high income nations. Current burgeoning environmental catastrophes, such as climate change demonstrate this. When extended to the entire global population the Western lifestyle is most definitely unsustainable and may prove to be so even in its newer, greener permutations. However, sustainable development discourse has focused on poor nations with only a few nods to the wasteful, polluting and ultimately unsustainable lifestyles of the industrialized West. For a more extended discussion of this disconnect and related issues, see Ruth Gordon, *Unsustainable Development* (forthcoming).

52. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1560.

53. For the latest IPCC Assessment Reports, see *supra* note 1.

54. Rob Gutro, *Earth Gets a Warm Feeling All Over*, NASA, Feb. 8, 2005, http://www.nasa.gov/vision/earth/lookingatearth/earth_warm.html.

turn increases precipitation, an effect already being observed along with increases in average cloud cover.⁵⁵ Warmer oceans also trigger more intense storms and hurricanes.⁵⁶ Ecosystems are under stress, as animal migratory patterns shift, and both fauna and flora attempt to adapt to a swiftly changing climate.⁵⁷ As the freeze line shifts northward, the Arctic is dramatically changing. Snow cover is decreasing as is Arctic ice,⁵⁸ and other areas outside the Arctic region are experiencing shorter periods of lake and river ice cover.⁵⁹ Glaciers are melting at an unprecedented rate in both the Arctic and Antarctica,⁶⁰ as are mountain snowcaps. In the twentieth century, there was a widespread retreat of mountain glaciers in non-polar regions.⁶¹ More alarmingly, the Greenland ice sheet, which climate scientists consider one of the most important barometers of climate change, is disappearing at a faster rate than had previously been anticipated.⁶² This disappearance may have already reached a point of terminal decline.⁶³ Indeed, the polar regions, and especially the Arctic, have been

55. A. E. Dessler, Z. Zhang & P. Yang, *Water-Vapor Climate Feedback Inferred from Climate Fluctuations, 2003–2008*, 35 GEOPHYSICAL RESEARCH LETTERS, available at <http://www.agu.org/pubs/crossref/2008/2008GL035333.shtml>.

56. BRENDA EKWURZEL & SUSAN JOY HASSOL, FINDINGS OF THE IPCC FOURTH ASSESSMENT REPORT: CLIMATE CHANGE IMPACTS (2007), available at http://www.ucsusa.org/global_warming/science_and_impacts/science/findings-of-the-ipcc-fourth.html.

57. Elizabeth Kolbert, *Chilling*, THE NEW YORKER, Mar. 20, 2006. A recent study has shown that many species have shifted their migratory range northward by about 3.8 miles per decade. John Esterbrook, *Global Warming Kicks Off A Migration: Studies: Many Plants and Animals are Moving Northward*, CBS News, Jan. 2, 2003, <http://www.cbsnews.com/stories/2003/01/02/tech/main534993.shtml>; see also Andrew C. Revkin, *Warming is Found to Disrupt Species*, N.Y. TIMES, Jan. 2, 2003, at A1.

58. *Changes in Ice: The 2007 IPCC Assessment, Testimony Before the H. Comm. on Science* (Feb. 8, 2007) (testimony of Dr. Richard V. Alley).

59. For the National Oceanic and Atmospheric Administration's ("NOAA") latest Arctic Report Card on the sea ice cover, see D. Perovich et al., *Sea Ice Cover*, <http://www.arctic.noaa.gov/reportcard/seaice.html> (last visited Oct. 11, 2009).

60. *Id.*; Press Release, National Snow and Ice Data Center, Arctic Sea Ice Extent Remains Low; 2009 Sees Third-Lowest Mark (Oct. 6, 2009), http://nsidc.org/news/press/20091005_minimumpr.html (last visited Oct. 11, 2009).

61. See D. Perovich et al., *supra* note 59.

62. Greenland lost an annual average of 195 km³ of ice per year from 2003 to 2008, which can produce an annual rise in the global sea level of five centimeters over the next century. Delft University of Technology, *An Accurate Picture of Ice Loss in Greenland*, SCIENCE DAILY, Oct. 10, 2008, <http://www.sciencedaily.com/releases/2008/09/080930081355.htm>. The summer of 2007 was particularly warm with over 350 m³ of ice melted in only two months. *Id.*

63. See Matthew D. Zinn, *Adapting to Climate Change: Environmental Law in a Warmer World*, 34 ECOLOGY L.Q. 61, 74-75 nn.70-74 (2004) (citing to scientific articles describing the unbalance of the Greenland ice shelf); see also Louise Huffman, *Arctic Sea Ice Will Probably Not Recover*, INTERNATIONAL POLAR YEAR 2007-2008, Feb.19,

deteriorating so dramatically that there is genuine concern that the Earth's climate is changing more rapidly than current scientific models predicted.⁶⁴ Indeed, some native communities near the poles are being readied for removal as their habitats deteriorate.⁶⁵

2. Potential Future Consequences

Our planet has reached a tipping point towards a warmer climate, regardless of any ameliorating actions mankind might undertake. At this juncture, we can only blunt the consequences of global warming by taking prompt action.⁶⁶ The future is uncertain and will depend on measures undertaken by a thus far reluctant international community.⁶⁷ Nonetheless, climatologists predict that climate change will have varying and uneven consequences, many detrimental and some potentially catastrophic.⁶⁸ Generally, we can expect more of the previously noted outcomes, only at a more rapid pace and with increasingly onerous results.

The deterioration of the polar regions is expected to accelerate, as is the related problem of rising ocean levels.⁶⁹ Heat waves

2008, http://www.ipcc.org/index.php?option=com_k2&id=2130:arctic-sea-ice-will-probably-not-recover&view=item&Itemid=9.

64. See Huffman, *supra* note 63 (expressing concern that Arctic ice will disappear completely much sooner than previously estimated); De Armas & Vanko, *supra* note 32, at 41 (noting that Arctic ice was at a record low in 2007, 39% lower than the long term average from 1979 to 2000).

65. Jonathan Shaw, *The Great Global Experiment*, HARVARD MAG., Nov.–Dec. 2002, at 3.

66. See Steven Ferrey, *Gate Keeping Global Warming: The International Role of Environmental Assessments and Regulation in Controlling Choices for Future Power Development*, 19 FORDHAM ENVTL. L. REV. 101, 104 (2009) (noting that severe damage to the planet has already occurred and cannot be reversed).

67. The IPCC has carefully and cautiously attempted to estimate the likely effects of global warming, indeed some would say too cautiously. See Elizabeth Kolbert, *The Climate of Man – I*, THE NEW YORKER, Apr. 25, 2005, at 56, available at http://www.newyorker.com/archive/2005/04/25/050425fa_fact3. This task is exceedingly complex as scientists attempt to determine likely temperature changes, and then what changes will flow from these variants. *Id.* Moreover, there are feedback loops that may influence the rate of warming and other effects, such as the level of oceanic expansion. Finally, the impact will also vary depending on the extent and timing of curbs on global emissions. *Summary for Policymakers, supra* note 4, at 12.

68. The IPCC defines “adverse effects of climate change” as “changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.” FCCC art. 1, § 1.

69. Thawing permafrost, shrinking snow cover and dwindling sea ice is expected in both the Arctic and Antarctic. *E.g.*, Edward A.G. Shuur et al., *Vulnerability of Permafrost Carbon to Climate Change: Implications for Global Carbon Cycle*, 58

are highly probable, with predictably negative effects on humans, fauna and flora.⁷⁰ More intense and frequent precipitation is likely, causing more floods, landslides, avalanches, increased soil erosion and greater flood runoff.⁷¹ More powerful tropical cyclones, typhoons and hurricanes, with higher peak wind speeds and heavier precipitation⁷² present severe risks to human life, catalyzing infectious diseases and epidemics.⁷³ Scientists also project more coastal erosion, the destruction of coastal structures and infrastructure and damage to coastal ecosystems, such as coral reefs and mangroves.⁷⁴ At the same time, some areas will experience additional and more intense droughts as precipitation decreases.⁷⁵

The most severe effects of global warming will occur in the Southern Hemisphere and Third World peoples will generally be the first harmed, endure the most challenging consequences, and

BIOSCIENCE 701 (September 2008). Glacial melting and contraction of the Greenland ice sheet will continue to contribute to sea level rise, as mass losses due to higher temperatures occur more rapidly than gains from precipitation; indeed, the Greenland ice sheet is enormous, holding a billion tons of fresh water, and if it is released into the Arctic Ocean, sea levels will rise, placing severe stress on coastal areas and low-lying communities and in the case of some islands, may mean their disappearance. William C. Burns, *Global Warming – The United Nations Framework Convention on Climate Change and the Future of Small Island States*, 6 DICK. J. ENVTL. L. & POL'Y 147, 165-70 (1997); see also Henry W. McGee, Jr., *Litigating Global Warming: Substantive Law in Search of a Forum*, 16 FORDHAM ENVTL. L. REV. 371, 380-85 (2005); Elizabeth Kolbert, *Global Warning*, THE NEW YORKER, Dec. 12, 2005, at 39; IPCC WORKING GROUP II REPORT, *supra* note 1, at 11.

70. Richard Wolfson & Stephen Schneider, *Understanding Climate Science*, in CLIMATE CHANGE POLICY: A SURVEY 30 (Stephen Schneider et al. eds., 2002) [hereinafter CLIMATE CHANGE POLICY]. Increased flooding and droughts will further damage groups and shrink food supplies. IPCC WORKING GROUP II REPORT, *supra* note 1, at 6.

71. See Wolfson & Schneider, *supra* note 70, at 31. Millions more people will be in flood plains, and the effects will particularly be felt in Africa and Asia, while island nations will be even more exposed to flooding.

72. Extra-tropical storm tracks are projected to move towards the poles and this poleward movement will change wind, precipitation, and temperature patterns, continuing a broad of observed trends over the last half-century. See *Summary for Policymakers*, *supra* note 4, at 16.

73. Pierrehumbert, *supra* note 5, at 578-79.

74. Ocean ecosystems are highly sensitive to temperature changes and higher ocean temperatures will undoubtedly put them under stress. *Summary for Policy Makers*, *supra* note 4, at 5.

75. Joan Kleypas & Ove Hoegh-Guldberg, *Coral Reefs and Climate Change: Susceptibility and Consequences*, in STATUS OF CARIBBEAN CORAL REEFS AFTER BLEACHING AND HURRICANES IN 2005 21 (Clive Wilkinson & David Souter, eds., 2008). Global increases in precipitation are "very likely" to occur, while increases in areas affected by drought are considered "likely." See *Summary for Policymakers*, *supra* note 4, at 8-9.

be the least equipped to address problems.⁷⁶ Droughts, floods and food scarcity are already problems in some areas of Africa and these tribulations are likely to intensify.⁷⁷ Clashes over insufficient supplies of water, increasing desertification,⁷⁸ countless climate refugees,⁷⁹ and an additional 100 million people at risk for hunger are all distinct possibilities.⁸⁰ At the same time, African nations are poor and lack the resources to effectively deal with the effects of climate change, since both technological and financial resources are scarce.⁸¹ Small island states are doomed because of

76. This includes native communities of the polar region, whose habitat is already under severe stress. See Margot Roosevelt/Shishmaref, *Vanishing Alaska*, TIME, Sept. 27, 2004, at 68, available at <http://www.time.com/time/magazine/article/0,9171,1101041004-702149,00.html> (describing flooding of Eskimo villages); Shaw, *supra* note 65. According to one study, "[d]eveloping countries are twice more vulnerable to the adverse effects of climate change than industrialized countries, and island states are three times more vulnerable." CENTRE FOR SCIENCE & ENVIRONMENT, GREEN POLITICS: GLOBAL ENVIRONMENTAL NEGOTIATIONS 16 (Anil Agarwal et al. eds., 1999) [hereinafter GREEN POLITICS].

77. Already vulnerable to drought, less rainfall is predicted, raising particular difficulties regarding water resources. See Summary for Policymakers, *supra* note 4, at 7 (explaining that drying has been observed in Southern Africa and parts of Asia and that more intense and longer droughts have been observed in the tropics and subtropics). Fourteen countries in Africa already suffer from water scarcity, and another eleven nations are estimated to suffer similar fates within the next twenty-five years. OXFAM, AFRICA – UP IN SMOKE?: THE SECOND REPORT FROM THE WORKING GROUP ON CLIMATE CHANGE AND DEVELOPMENT 13 (2005), available at http://www.oxfam.org.uk/what_we_do/issues/climate_change/downloads/africa_up_in_smoke.pdf?m=234&url=http://www.oxfam.org.uk/what_we_do/issues/conflict_disasters/downloads/asylum_wpaper.pdf [hereinafter AFRICA – UP IN SMOKE?].

78. See Summary for Policymakers, *supra* note 4, at 7; AFRICA – UP IN SMOKE?, *supra* note 77, at 18.

79. One think tank defines "climate refugees" as "people who have to leave their habitats, immediately or in the near future, because of sudden or gradual alterations in their natural environment related to at least one of three impacts of climate change: sea-level rise, extreme weather events, and drought and water scarcity." The Global Governance Project, *Policy Forum on Climate Refugees*, <http://www.glogov.org/?pageid=80> (last visited Oct. 15, 2009). Most climate refugees are expected to originate from Asia, Africa, Latin America, and small island states. See Frank Biermann & Ingrid Boas, *Protecting Climate Refugees: The Case for a Global Protocol*, ENV'T MAG., Nov.-Dec. 2008, available at <http://www.environmentmagazine.org/Archives/Back%20Issues/November-December%202008/Biermann-Boas-full.html>.

80. Vector and water borne diseases are expected to increase as well as heat stress, air pollution, water failures and water and food-borne diseases, which are particularly problematic in the absence of sufficient medical services. AFRICA – UP IN SMOKE?, *supra* note 77, at 18. Rapidly changing ecosystems invite coastal erosion, flooding, and additional subsidence problems. Poor people rely on natural resources for survival, but 25% to 40% of Africa's natural habitats could be lost by 2085. *Id.* at 6.

81. *Id.* at 2-3; see WORLD BANK, AFRICA: REGIONAL BRIEF (2009), <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/0,,menuPK:258652~pagePK:146732~piPK:146828~theSitePK:258644,00.html?> (last updated Sept. 2009). Africa is an enormous and diverse continent with varying levels of industrialization

geography.⁸² Rising sea levels bring the possibility of annihilation in the worse circumstances,⁸³ and in any case, will exacerbate flooding, intensify storm surges, erosion and other coastal hazards and directly affect freshwater resources, agricultural production and island biodiversity.⁸⁴ Being in the path of storms, hurricanes, and cyclones with economies heavily dependent on tourism,⁸⁵ there is little doubt the impact will be dire.⁸⁶ Finally, the Inuit of the Arctic face total destruction due to the Arctic's vulnerability to climate change.⁸⁷ This region will be discussed in more detail below, but it is certain that deteriorating ice, permafrost and snow⁸⁸ have had a tremendous impact, as the Inuit depend on

and poverty levels. *Id.* Moreover, given its size and varying population densities and industrialization, it varies climatically. *Id.* Consequently, global warming will have variable effects throughout the continent.

82. See John Crump, *Snow, Sand, Ice and Sun: Climate Change and Equity in the Arctic and Small Island Developing States*, 8 SUSTAINABLE DEV. L. & POL'Y 8, 9 (2008) (stating that small island states are first to suffer consequences of climate change).

83. See Alexander Gillespie, *Small Island States in the Face of Climatic Change: The End of the Line in International Environmental Responsibility*, 22 UCLA J. ENVT'L. L. & POL'Y 107, 112-13 (2004). Predictions of rising ocean levels over the next 100 years range from a best-case scenario of .18 meters (.6 feet) and a worst case of .59 meters (1.9 feet), if melting glacial ice sheets are not taken into account. *Summary for Policymakers*, *supra* note 4, at 13. If this melting is incorporated into the calculations, the oceans could rise by four to six meters (thirteen to nineteen feet) and perhaps as high as seven meters (twenty three feet), over the next century. *Id.* Since many small island states are less than three to four meters above the present mean sea level, the potential to become completely inundated is irrefutable. *Id.*

84. See Tuiloma Neroni Slade, *The Making of International Law: The Role of Small Island States*, 17 TEMP. INT'L & COMP. L.J. 531, 539-40 (2003).

85. Jacqueline M. Hamilton & Richard S. J. Tol, *The Impact of Climate Change on Tourism and Recreation*, in HUMAN INDUCED CLIMATE CHANGE: AN INTERDISCIPLINARY ASSESSMENT 146, 149 (Michael E. Schlesinger et al. eds., Cambridge University Press, 2007). For example, between 1995 and 2003, tourism accounted for 74.64% of total exports in the Bahamas. UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS DIVISION FOR SUSTAINABLE DEVELOPMENT, TRENDS IN SUSTAINABLE DEVELOPMENT 24 (2006), available at http://www.un.org/esa/sustdev/publications/trends2006/trends_rpt2006.pdf; ASPECTS OF TOURISM 22: TOURISM, RECREATION AND CLIMATE CHANGE 15 (Colin Michael Hall & James E.S. Higham eds., 2005).

86. Beach erosion, soil salinization, increased stress on coastal ecosystems, and damage to infrastructure will negatively impact tourism. Nobuo Mimura et al., *Small Islands*, in IPCC WORKING GROUP II REPORT, *supra* note 1, at 687-90.

87. The Inuit have already suffered the consequences from climate change, and in 2005, they filed a petition with the Organization of American States Inter-American Commission on Human Rights. See Crump, *supra* note 82, at 11; SHEILA WATT-CLOUTIER ET AL., 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, (Dec. 7, 2005), available at http://www.ciel.org/Publications/ICC_Petition_7Dec05.pdf [hereinafter INUIT PETITION].

88. Annual average Arctic temperatures are increasing at more than twice the rate of temperatures around the planet. INUIT PETITION, *supra* note 87, at 36. The region is already experiencing "deteriorating ice conditions, decreasing quantity and

thick ice to travel, hunt and communicate between communities.⁸⁹ The effect on Inuit life and culture has been profound, leading to the relocation of some populations.⁹⁰

Of course, industrialized nations face some of the same physical consequences and some areas will suffer just as seriously as Third World nations. The Netherlands presents one of the more extreme cases because it is below sea level, and confronts inexorable inundation.⁹¹ The United States and other nations have shorelines below sea level⁹² while other states have islands that may disappear.⁹³ To varying extents, these areas face drought, unpredictable weather patterns, distressed ecosystems and the like. Moreover, hurricanes and storms regularly strike the United States⁹⁴ and European nations have already experienced additional heat waves.⁹⁵ Yet, these nations caused the problem, reaped the benefits of unbridled industrialization, and can halt its

quality of snow, unpredictable and unfamiliar weather, and a transfigured landscape." *Id.* The petition notes that these changes are confirmed by scientific studies, as well as Inuit elders and hunters' knowledge of their environment. *Id.* at 37.

89. The quality, quantity and timing of snowfall have also changed and permafrost is melting at an alarming rate, causing "landslides, severe erosion and loss of ground moisture, wetlands and lakes." INUIT PETITION, *supra* note 87, at 2. For the Inuit people, this means serious effects on hunting, loss of traditional knowledge, and everyday life. INUIT PETITION, *supra* note 87, at 2. Increasingly violent storms have exacerbated erosion, which exposes permafrost to warmer air and water. INUIT PETITION, *supra* note 87, at 2-3; Jon Bowermaster, *Global Warming Changing Inuit Lands, Lives, Arctic Expedition Shows*, NAT'L GEOGRAPHIC NEWS, May 15, 2007, available at <http://news.nationalgeographic.com/news/2007/05/070515-inuit-arctic.html> (discussing the changing levels of ice change landmarks used for generations).

90. INUIT PETITION, *supra* note 7, at 3; Felicity Barringer, *Flooded Villages File Suite, Citing Corporate Link to Climate Change*, N.Y. TIMES, Feb. 27, 2008, at A16, available at <http://www.nytimes.com/2008/02/27/us/27alaska.html?n=Top/News/Science/Topics/Global%20Warming> (describing effects of rising sea levels on Alaskan villages).

91. The Netherlands – Britannica Online Encyclopedia (2009), <http://www.britannica.com/Ebchecked/topic/409956/The-Netherlands>.

92. See RICARDO ALVAREZ ET AL., *FEELING THE HEAT IN FLORIDA: GLOBAL WARMING ON THE LOCAL LEVEL 1-2* (Jeff Fiedler et al. eds. 2001).

93. Burns, *supra* note 69, at 166-68.

94. While no hurricane can be attributed to climate change, the disaster following Hurricane Katrina awakened the citizens of the U.S. to the reality of the possible effects of climate change. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1578. After a year hiatus, the nation again faced an active hurricane season with two major hurricanes out of eight total hurricanes from the Atlantic. See NOAA SATELLITE AND INFORMATION SERVICE NATIONAL CLIMATIC DATA CENTER, 2007 ATLANTIC OCEAN TROPICAL CYCLONES (2008), <http://lwf.ncdc.noaa.gov/oa/climate/research/2007/2007-atlantic-trop-cyclones.html>.

95. See *Summary for Policymakers*, *supra* note 4, at 7-8.

advance; they are also in a much better position to deal with the effects, however adverse.⁹⁶ While adaptation capacities vary widely across the planet and are as varied as the potential results of global warming itself, technologically advanced industrialized nations have a distinct advantage.⁹⁷

3. The Vicinity: Climate Change in Central America

A 2007 Report by Working Group II of the IPCC⁹⁸ indicates that Central America has already been affected by climate change and additional damage is on the horizon.⁹⁹ In western Central America, precipitation has declined and temperature has risen.¹⁰⁰ Increases in sea levels are probably already affecting coastal areas throughout Latin America.¹⁰¹ Climate related disasters, including such familiar events as hurricanes, increased 2.4 times between 1970 and 1999; this continues a pattern noted during the 1990s and even more so between 2000 and 2005.¹⁰² The coasts of Belize, Costa Rica, Panama and El Salvador are extremely vulnerable to climate changes and extreme hydrometeorological events.¹⁰³ In Nicaragua and Honduras, climate driven fluctuations in vector densities, such as temperature, humidity, solar radiation and rainfall have caused a spike in dengue fever and other maladies.¹⁰⁴ Unfortunately, the poorest communities are often the most vulnerable because they are frequently located near extreme events: they subsist in hurricane paths, on unstable lands, in precarious settlements, in low-lying areas, or in places prone to flooding from

96. See HIROKI KUDO, STRATEGY FOR GLOBAL WARMING COUNTERMEASURES IN EUROPE AND IMPLICATIONS FOR JAPAN (Apr. 2004), available at <http://eneken.ieej.or.jp/en/data/pdf/261.pdf>.

97. For example, the U.S. could reduce emissions more easily due to its heavy reliance on fossil fuels. Laura Thoms, *A Comparative Analysis of International Regimes on Ozone and Climate Change with Implications for Regime Design*, 41 COLUM. J. TRANSNAT'L L. 795, 829-30 (2001).

98. The IPCC considers and issues sector reports on the implications of climate change in each regional segment of the globe, including Central America and has issued sector reports on fresh water resources (chapter 3), ecosystems (chapter 4), coastal systems (chapter 6), among others. See IPCC WORKING GROUP II REPORT, *supra* note 1.

99. Unless otherwise noted, this section relies upon the following report by Working Group II of the IPCC. Graciela Magrin et al., *Chapter 13: Latin America*, in IPCC WORKING GROUP II REPORT, *supra* note 1, at 583.

100. *Id.*

101. Central America is dominated by the North America Monsoon System. *Id.* at 583-84.

102. *Id.* at 585.

103. *Id.* at 586-87.

104. *Id.*

rivers.¹⁰⁵

Finally, the changing climate has meant the over-exploitation of natural resources, which has been particularly devastating to artisanal fishing in coastal waters and has also destroyed mangrove, estuary and salt marsh habitats.¹⁰⁶ Projected temperature and precipitation changes in Central America are expected to be severe and unless mitigation strategies are quickly and efficiently implemented, they are expected to devastate Central America's economies and peoples.¹⁰⁷

Capabilities to cope and adapt vary but Central America is generally more affluent and able to attract more foreign investment and funding than sub-Saharan Africa or small island nations.¹⁰⁸ On the other hand, none of these nations are as rich or technologically advanced as industrialized Northern Tier states, meaning their adaptation capabilities are more limited, as is their culpability in causing the problem.¹⁰⁹ As will be discussed in more detail, at least some middle income nations have been able to attract supplementary funding and, to a lesser extent, technology transfers by way of the CDM.¹¹⁰ Generally, middle income nations are more industrialized and have superior internal capacities, and are therefore in a better position than extremely poor or small nations,¹¹¹ even if abilities to adjust are uneven. As nations on the cusp of achieving economic modernization, they must adjust their

105. Extreme climatic events and their effects can be observed in part by looking at the number and ferocity of hurricanes. Two of note were Hurricane Beta in November of 2005, which affected Nicaragua by causing 4 deaths, 9,940 injuries as well as destroyed homes, crops and wildlife; and Hurricane Stan, which affected Guatemala, El Salvador, Nicaragua and Costa Rica with losses of U.S. \$3,000 million and more than 1,500 deaths and devastating the infrastructures of the affected countries in October 2005. *Id.* at 585.

106. *Id.* at 606. Over-exploitation has also caused sanitation problems. *Id.*

107. Projected changes have been summarized as follows:

Central American:	2020	2050	2080
temperature changes (°C) – Dry Season	+0.4 to +1.1	+1.0 to +3.0	+1.0 to +5.0
temperature changes (°C) – Wet Season	+0.5 to +1.7	+1.0 to +4.0	+1.3 to +6.6
Precipitation changes (%) – Dry Season	-7 to +7	-12 to +5	-20 to +8
Precipitation changes (%) – Wet Season	-10 to +4	-15 to +3	-30 to +5

Id. at 594.

108. *Climate Change and the Poorest Nations*, *supra* note 6, at 1616 n.299 (listing problems that discourage investment in low income nations).

109. For example, "[a]daptation for coasts will be more challenging in developing countries than in developed countries due to constraints on adaptive capacity." IPCC, *Summary for Policy Makers*, in IPCC WORKING GROUP II REPORT, *supra* note 1, at 12.

110. See Martina Jung, *Host Country Attractiveness for CDM Non-sink Projects*, 34 ENERGY POL'Y 2173 (2006) [hereinafter *Host Country Attractiveness*].

111. See *infra* Part II.C.

development goals to a changing environment.¹¹²

III. THE INTERNATIONAL LEGAL RESPONSE

A. *Denial, Tepidity, Refusal, Entreaties*

The international community successfully dealt with depletion of the ozone layer¹¹³ and hopes were high that a similar response would be forthcoming regarding climate change, a problem that appeared to be comparable as a global problem in need of a global solution.¹¹⁴ Indeed, given the magnitude of the current and anticipated crisis, an urgent, vigorous and robust international response might have been expected. Regrettably, the response thus far has been modest at best. Part of the problem lies in the causes of global warming, which are wide-ranging and involve numerous industries and concerns. At least in the United States, varied interests united to negatively influence the debate, succeeding in convincing the public and policy makers that climate change either did not exist, had not been scientifically validated, would simply be too expensive to address or that mitigation efforts would put the U.S. at a competitive disadvantage vis-à-vis such nations as China which have not undertaken reduction commitments.¹¹⁵ Furthermore, climate change is intimately tied to industrialization, modern life and a consumer culture that encompasses rampant and sometimes wasteful consumption.¹¹⁶ It is exceedingly difficult and costly to transform economies, societies and cultures, and the inadequate legal mechanisms adopted thus far reflect the complexities and hesitancy. Confronting climate change entails potentially enormous short and medium term costs in exchange for long term results, a configuration that makes taking expensive and politically unpalatable action anathema to politicians who have a relatively short-term political life.¹¹⁷

112. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1600-01.

113. For an extensive history of the international community's collaborative response to ozone layer depletion, see generally CAMERON MAY, *THE MONTREAL PROTOCOL: CELEBRATING 20 YEARS OF ENVIRONMENTAL PROGRESS* (Donald Kaniaru ed., Cameron May Ltd. 2007) [hereinafter *MONTREAL PROTOCOL: ENVIRONMENTAL PROGRESS*].

114. See Thoms, *supra* note 97, at 843-44.

115. See Thoms, *supra* note 97, at 839-40.

116. With the current steep and permanent rise in the cost of energy, the age of freewheeling consumption may be coming to an end. For a brilliant satirical perspective of this recent trend, see Jon Mooallem, *The End Is Near! (Yay!)*, N.Y. TIMES MAG., Apr. 19, 2009, available at <http://www.nytimes.com/2009/04/19/magazine/19town-t.html>.

117. DOELLE, *supra* note 21, at 303-09 (discussing key challenges for climate

In contrast, Third World nations distinguish between their “development” emissions and the “luxury” emissions of industrialized nations, whom they judge to have already used up their fair share of the atmosphere.¹¹⁸ Third World nations also reason that to adopt mandatory reduction commitments at this point in their efforts to modernize would slow their development efforts and essentially freeze global inequality.¹¹⁹ Those at the top of the economic hierarchy would continue to reap the benefits of wealth gained during an era unrestrained by expensive environmental mandates, while Third World nations would be forced to slow their efforts to join this enviable club.¹²⁰ Hence, Third World nations have been united in insisting that those who caused the problem must be the nations and peoples that discover and fund the necessary remedies to both halt the damage and assist in adaptations to what are now unavoidable consequences.¹²¹ They have consistently called for the transfer of appropriate technologies and additional funding that go beyond customary development assistance.¹²²

Beyond these common goals however, Third World unanimity rapidly fragments¹²³ because while climate change is a global problem requiring global solutions, it has varying implications even

change negotiations); Hirono & Schroeder, *supra* note 43, at 43; Martinez, *supra* note 46, at 413-14 (noting some political disagreements in the U.S.).

118. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1600-05.

119. *Gate Keeping in Global Warming*, *supra* note 66, at 112.

120. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1600.

121. For a distinctly Third World approach to climate change and other environmental problems, see generally, GREEN POLITICS, *supra* note 76. At this point, the question is whether we run into the brick wall at 20 mph or 100 mph, which would be the case if we do not act quickly.

122. These goals were recently extended for another year at the twelfth meeting of the Conference of the Parties. FCCC, *Part Two: Action Taken by the Conference of the Parties at its Twelfth Session*, 13 (Jan. 26, 2007), available at <http://unfccc.int/resource/docs/2006/cop12/eng/05a01.pdf>. The ozone regime set the stage for Third World countries insisting on additional funds to implement comprehensive environmental agreements. See Daniel Bodansky, *The United Nations Framework Convention on Climate Change: A Commentary*, 18 YALE J. INT'L L. 451, 479-80 (1993). In the wake of the Montreal Protocol, which set definitive targets for ozone depleting substances, these nations contended that they would not accept obligations to limit ozone depleting substances without funding and technology. Funding mechanisms were established in the London Amendment to help developing countries implement the Montreal Protocol. London Amendment to Montreal Protocol art. 10, June 27-29, 1990, 30 I.L.M. 537, available at http://ozone.unep.org/Treaties_and_Ratification/2Bi_1_London_amendment.shtml.

123. *Climate Change and the Poorest Nations*, *supra* note 6, at 1602-03.

across the Third World.¹²⁴ The calamities faced by some areas and peoples such as island nations and perhaps more urgently, the indigenous communities residing in the Arctic region have led these nations and peoples to be among the most vocal and strident voices for swift and robust international action.¹²⁵ At the other end of the spectrum, oil-producing countries question whether there really is a problem.¹²⁶ Rapidly industrializing nations such as China are intent on immediate industrialization and believe emission reduction commitments will only slow growth.¹²⁷ These nations have been among the most vociferous proponents of differential responsibilities to address a problem they view as not being of their making.¹²⁸

Thus, while global warming will have implications for every area, country, and person, it can be localized and particularized, both in its potential effects and in terms of possible solutions. The impact is a function of geography and the means to adapt. The latter, in turn, is a product of industrialization, income, the ability to attract CDM projects and additional funds, as well as how a nation is situated in the international economic and political hierarchy.¹²⁹ The international solutions thus far reflect this complexity and the varying array of interests.

124. *Climate Change and the Poorest Nations*, *supra* note 6, at 1580-89.

125. The Inuit nation has taken the bold step of suing the United States in the Inter-American Court on Human Rights to require the U.S. to undertake mitigation efforts. *See* INUIT PETITION, *supra* note 87; *see also* *Climate Change and the Poorest Nations*, *supra* note 6, at 1622; Rebecca Tsosie, *The Climate of Environmental Justice: Taking Stock: Indigenous People and Environmental Justice: The Impact of Climate Change*, 78 U. COLO. L. REV. 1625, 1669-1671 (2007); Luke Cole, Dir., Ctr. On Race, Poverty, & Env't., Comments at the University of Colorado Law School Conference: The Climate of Environmental Justice: Taking Stock (Mar. 17, 2007).

126. *See* *Climate Change and the Poorest Nations*, *supra* note 6, at 1602.

127. *See, e.g.*, Dadi, *supra* note 8 (providing analysis of developmental and environmental concerns in China); Rosenthal, *supra* note 8 (providing analysis of same).

128. They assert that industrialized countries have used up their share of the atmosphere. They also make a distinction between their development emissions and western luxury emissions. *See, e.g.*, Anil Agarwal, *A Southern Perspective on Curbing Global Climate Change*, in CLIMATE CHANGE POLICY, *supra* note 70, at 375, 377. These are valid points, especially in light of the huge numbers of poor people within their borders and throughout the Global South. Unfortunately, the planet cannot sustain these nuances and they must somehow be assisted in industrializing in a manner that is less harmful to climate. Their calls for funding and technical assistance must be heeded.

129. *Climate Change and the Poorest Nations*, *supra* note 6.

B. *The International Legal Response*

Initial international efforts to understand and address climate change began within the scientific community, which was becoming increasingly alarmed that mankind was causing irreversible damage to the Earth's climate.¹³⁰ By the 1970s, members of the international scientific community began to convene regularly as they amassed evidence.¹³¹ In 1979, these meetings culminated in the first World Climate Conference, organized by the World Meteorological Organization and the United Nations Environment Programme ("UNEP").¹³² Throughout the eighties, the scientific community strongly urged the political community to rely upon and adopt the precautionary principle: to search for alternatives to fossil fuel dependent economies and lifestyles before there was absolute proof of harm.¹³³

The international *legal* effort began in earnest with the 1992 Framework Convention on Climate Change ("FCCC").¹³⁴ Employing the Framework/ Protocol model, which successfully phased out ozone depleting chemicals,¹³⁵ the Convention contained few concrete commitments but inaugurated an institutional structure to work towards agreement on concrete obligations. With regular meetings of the parties, information gathering mechanisms, and a bureaucracy to coordinate these efforts,¹³⁶ it was assumed that cli-

130. GREEN POLITICS, *supra* note 76, at 26. The earliest theories regarding the negative effect of man-made emissions on the climate were advanced as early as 1827, although proof was hard to come by. In the 20th century it became possible to measure this effect and with computer modeling, project the results. Agence France-Presse, *Global Warming: A Timeline*, COSMOS MAG., Sept. 21, 2007, available at <http://www.cosmosmagazine.com/node/1595>.

131. Hirono & Schroder, *supra* note 43, at 41; see generally DOELLE, *supra* note 21 (discussing the involvement of the scientific community in enacting environmental policy).

132. Hirono & Schroeder, *supra* note 43.

133. Hirono & Schroeder, *supra* note 43, at 41-42.

134. FCCC, *supra* note 2. The FCCC was adopted in May 1992 in New York after fifteen months of negotiations. It was opened for signature at the 1992 UN Conference on the Environment and Development in Brazil. For a more detailed summary, see *Climate Change and Poorest Nations*, *supra* note 6, at 1582-85; see also DOELLE, *supra* note 21, at 23; Hirono & Schroeder, *supra* note 43, at 45.

135. The framework and protocol approach was used with great success in addressing the problem of ozone depletion. See generally Montreal Protocol, *supra* note 39. Successive protocols resulted in the elimination of the production and use of chemicals that were destroying the ozone layer; indeed, the atmosphere is recovering. MONTREAL PROTOCOL: ENVIRONMENTAL PROGRESS, *supra* note 113.

136. It was hoped the institutional structure would facilitate the negotiation of binding commitments and indeed it was extraordinarily successful with respect to ozone depletion. See generally MONTREAL PROTOCOL: ENVIRONMENTAL PROGRESS, *supra* note 113.

mate change was on a similar trajectory to the success achieved with Ozone depletion.¹³⁷ Instead, it took over five years to negotiate emission reduction commitments and the obligations assumed were and remain profoundly inadequate. The Kyoto Protocol, adopted in December 1997,¹³⁸ is an exceedingly complex agreement. Under the protocol, industrialized nations, designated as Annex I nations,¹³⁹ agreed to binding emission reduction commitments.¹⁴⁰ If fully implemented, it would reduce the emissions of industrialized nations to about 5% below 1990 levels,¹⁴¹ a woefully insufficient target.

Numerous details regarding implementation remained before enough Annex I countries would ratify the instrument, which meant additional years of negotiation¹⁴² before agreement was finally reached in 2001. The next three years entailed an intense effort to gain a sufficient number of ratifications from Annex I nations,¹⁴³ an endeavor made more challenging by the United

137. DOELLE, *supra* note 21, at 13-15. Ozone depletion, however, involved a small group of chemicals and a small industry that developed substitutes and thus were in favor of treaties to phase out the offending chemicals. *See id.* Indeed, most Americans do not know what actually transpired—they simply eventually replaced their appliances with new models that did not contain ozone depleting substances. *See id.* Climate change, however, entails comprehensive changes across industrialized societies and requires adjustments by numerous industries and the citizenry at large. *See id.* It is radically different from addressing ozone depletion and effective solutions have been elusive. *See id.*; *see generally* MONTREAL PROTOCOL: ENVIRONMENTAL PROGRESS, *supra* note 113; *see also* Thoms, *supra* note 97, at 799.

138. Kyoto Protocol, *supra* note 2.

139. The Annex I nations are Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, and the United States of America. The European Union is also a party under Annex I. Each nation commits to reducing emissions to 1990 levels, but the actual percentages vary because each nation's emissions differ. Kyoto Protocol, *supra* note 2, at art. 3.1. Moreover, there is a great deal of flexibility and various permissible mechanisms to meet these goals.

140. These country-specific commitments are based on the level of emissions produced by each nation in combination with sinks, limited to afforestation, reforestation, and deforestation since 1990. DOELLE, *supra* note 21; Kyoto Protocol, *supra* note 2, at art. 3.3.

141. Kyoto Protocol, *supra* note 2, at art. 3.1; DOELLE, *supra* note 21, at 24-25.

142. *See* DOELLE, *supra* note 21, at 24-28 (providing detailed discussion of the negotiations at various stages of bringing the Protocol into existence).

143. The Protocol requires ratification by 55 parties to the Convention, "incorporating parties included in Annex I which accounted in total for at least 55 percent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I." Kyoto Protocol, *supra* note 2, at art. 25.1.

States' widely condemned decision not to ratify the Protocol.¹⁴⁴ American rejection made it necessary to make additional concessions to obtain the requisite number of ratifications, further weakening an already weak agreement.¹⁴⁵ Nonetheless, by some miracle, the Protocol came into force in 2005.¹⁴⁶

The Protocol presents policies and measures¹⁴⁷ to reduce carbon emissions and affords Annex I nations a considerable degree of flexibility in meeting their reduction targets.¹⁴⁸ While the focus here will be the CDM, which directly involves non-Annex 1 developing nations, other options include emissions trading and joint implementation. Annex I nations may engage in emissions trading, which allows parties to buy or sell the right to emit.¹⁴⁹ Emission trading permits those facing higher costs in reducing their emissions, to purchase the right to emit from those finding it easier and cheaper to reduce their emissions. It also creates an incentive to reduce GHG emissions, because the corresponding remaining rights to emit can be sold.¹⁵⁰ A second option is joint implementation, which permits Annex I nations to meet their reduction targets in concert.¹⁵¹ Joint implementation allows cross border investment between Annex I nations which permits emis-

144. Soon after taking office, President Bush announced that the United States would not ratify the Protocol. Julian Borger & Ian Black, *US U-Turn on Emissions Fuels Anger*, THE GUARDIAN, Mar. 15, 2001, at 15, available at <http://www.guardian.co.uk/environment/2001/mar/15/usnews.globalwarming>. A host of world leaders condemned the Bush administration for its opposition to the treaty. See Paul Meller, *European Union Voices Concern for Climate Pact*, N.Y. TIMES, Mar. 29, 2001, at A22, available at <http://www.nytimes.com/2001/03/29/us/european-union-voices-concern-for-climate-pact.html>.

145. Ratifications had to represent 55% of 1990 GHG emissions. Kyoto Protocol, *supra* note 2, at art. 25. For a detailed discussion of the negotiations, see DOELLE, *supra* note 21, at 27; Hirono & Schroeder, *supra* note 43, at 46-49.

146. Kyoto Protocol, *supra* note 2, at art. 25; DOELLE, *supra* note 21, at 27; Kim Murphy, *Russia moves to ratify Kyoto Protocol*, BOSTON GLOBE, Sept. 24, 2004, at A6, available at http://www.boston.com/news/world/europe/articles/2004/09/24/russia_moves_to_ratify_kyoto_protocol/.

147. This includes improving energy efficiency, protecting and enhancing sinks, sustainable agricultural practices, and reducing counter-productive subsidies and fiscal incentives. Hirono & Schroeder, *supra* note 43, at 50.

148. Hirono & Schroeder, *supra* note 43, at 50. Annex I nations agreed to reduce emissions at least 5% below 1990 levels. *Id.* Individual national commitments are listed in Annex B, with reductions ranging from 8% for the European Union (EU) to an increase of 10% for Iceland. *Id.*

149. Kyoto Protocol, *supra* note 2, arts. 6 & 17.

150. Hirono & Schroeder, *supra* note 43, at 51.

151. This may mean many projects are undertaken in economies in transition, where there are more opportunities to reduce emissions at a relatively low cost. Hirono & Schroeder, *supra* note 43, at 50-51.

sion reductions to be undertaken where they are cheapest.¹⁵² Aimed primarily at nations in transition, it combines aspects of emissions trading and projects, such as those authorized by the CDM.¹⁵³

Given the immediate need of developing Non-Annex I countries to modernize and provide essential services to their populations, they have not been required to undertake mandatory reduction commitments,¹⁵⁴ and have refused to assume emission reduction targets.¹⁵⁵ Thus, treaty parties have undertaken "differentiated responsibilities" under the Protocol.¹⁵⁶ The notion of differentiated responsibilities for industrialized nations versus Third World nations has been a persistent demand of low and middle income nations. If these nations are to ever address climate change, they insist that industrialized nations take the initial costly steps to reduce emissions and transfer funds and appropriate technologies to help them undertake mitigation efforts. In some respects, the CDM personifies both considerations.

C. *The Clean Development Mechanism*

The CDM allows Annex I nations to earn credits and thereby meet reduction targets by means of clean development projects in Non-Annex I developing nations. Presumably, these projects would be less expensive than projects in industrialized nations, and would have the additional benefit of helping countries modernize with less harm to the environment.¹⁵⁷ Thus, in some respects the CDM is a safety valve for rich nations that is available if domestic mitigation measures become too expensive.¹⁵⁸ The

152. These projects generate emission reduction units ("ERUs"). The end result may be a proliferation of projects in economies in transition, where there are more opportunities to reduce emissions at a relatively low cost. Hirono & Schroeder, *supra* note 43, at 50-51.

153. DOELLE, *supra* note 21, at 35-36.

154. Only 38 nations are subject to the Protocol's mandatory obligations. *Why Electricity Matters*, *supra* note 8, at 126. Some economists have argued that developing countries would actually benefit by undertaking mandatory emission reduction targets. See Kallbekken & Westskog, *supra* note 33, at 41, 57.

155. For an expansive explanation of Third World views on climate change, see GREEN POLITICS, *supra* note 76, at 15-123.

156. Non-Annex I nations include most of the unindustrialized and industrializing world. The former eastern bloc is in another category. Kyoto Protocol, *supra* note 2, at art. 10.

157. See Kyoto Protocol, *supra* note 2, at art. 12; DOELLE, *supra* note 21, at 25-30. All of the credits earned accrue to the Annex I nation. *Id.*

158. The CDM has been described as "a flexibility mechanism that offers participating developing countries the opportunity to obtain cheap emission reduction

CDM is a complex instrument that requires significant institutional capacity in the host country,¹⁵⁹ entailing a great deal of technical expertise.¹⁶⁰ Very poor nations and exceptionally small economies lack institutional capacity, have no emissions to reduce and are simply unattractive for many kinds of direct foreign investment; most are unlikely to attract CDM projects.¹⁶¹ Despite calls for, and an emphasis on, the equitable geographic distribution of CDM projects, most have gone to China, India, Brazil and nations in Central and South America.¹⁶² Indeed, middle income nations such as Panama have been among the beneficiaries of CDM projects.¹⁶³

credits by investing in greenhouse gas abatement or sequestration project in a developing country and receiving in return emission credits that can be used to meet their Kyoto targets." Kallbekken & Westskog, *supra* note 33, at 42. If reductions can be attained in a less costly manner in Southern Tier nations, which have no emission reduction targets, Annex I nations can still achieve their reduction targets, and do so more cheaply. DOELLE, *supra* note 21, at 29-30.

159. See, e.g., FCCC CDM METHODOLOGIES PANEL, REPORT OF THE FORTIETH MEETING OF THE METHODOLOGIES PANEL (Sept. 14-18 2009) (regarding methodological approaches to CDM mechanism); see also Catherine Potvin et al., *A Participatory Approach to the Establishment of a Baseline Scenario for a Reforestation Clean Development Mechanism Project*, 12 MITIGATION & ADAPTATION STRATEGIES FOR GLOBAL CHANGE 1341 (2007).

160. If a party chooses to participate in a CDM project, it must have a designated national authority responsible for CDM project involvement in the country. Kyoto Protocol, *supra* note 2, at art. 12; see also DOELLE, *supra* note 21, at 35. Many poor nations lack the critical technical capacity necessary to undertake such projects. See *Climate Change and the Poorest Nations*, *supra* note 6, at 1614-17.

161. *Climate Change and the Poorest Nations*, *supra* note 6, at 1614-15. See *Host Country Attractiveness*, *supra* note 110, at 2174 (utilizing three criteria: "the scope for cheap emissions reductions, the institutional capacity of a host country to process JI [joint implementation] deals, and the general investment climate" to analyze the likely distribution of CDM projects in host nations). Poor nations tend to have few emissions to reduce, insufficient institutional capacity and have abysmal investment climates. See *id.* at 2173-82. While nations may have varying degrees of these factors, in the end they are unlikely to attract CDM projects. See *id.* at 2182-83.

162. The Marrakesh Accords emphasizes the importance of an equitable geographic distribution of CDM project activities at regional and sub regional levels. *Host Country Attractiveness*, *supra* note 110, at 2174; Conference of the Parties to the FCCC on its Seventh Session, Marrakesh, Morocco, Oct. 29-Nov. 10, 2001, *The Marrakesh Accords & The Marrakesh Declaration*, U.N. Doc. FCCC/CP/2001/13/Add.2 (Jan. 21, 2002), available at <http://unfccc.int/resource/docs/cop7/13.pdf>. As of May 2007, there were 483 CDM projects and the largest beneficiaries were India (156); Brazil (88); Mexico (73); and China (37) and most of the remainder have been distributed in Southeast Asia and South and Central America. FCCC, CDM Registration, <http://www.cdm.unfccc.int/statistics/registration/numofregisteredprojectbyhostpartiespiechart.html> (last visited Jan. 12, 2010).

163. As of July 2009, Panama had attracted six CDM projects. FCCC, CDM Registration, <http://www.cdm.unfccc.int/statistics/registration/numofregisteredprojectbyhostpartiespiechart.html> (last visited Jan. 12, 2010). In terms of emissions to reduce, institutional capacity, and general investment climate, Panama is among the nations

Both Annex I nations and private entities can undertake CDM projects in eligible countries, even if the decision to accept or reject a project is up to the host country.¹⁶⁴ The mechanism allows project developers to earn carbon credits for projects that reduce GHG emissions and contribute to the overall sustainability of host countries.¹⁶⁵ Emission reductions must be over and above business as usual, requiring a determination of what business as usual is and would be.¹⁶⁶ The result is a considerable and quite complex quandary involving the establishment of baselines, comparing emissions in a host country if a CDM project is undertaken versus the emissions that would result in the absence of such a project.¹⁶⁷ Since CDM project endeavors are likely to be coupled with an overall increase in energy consumption, there is a risk that the methods used to estimate baselines will result in an overestimation of emission reductions from CDM projects.¹⁶⁸

There are concerns about sustainability and the types of projects that might be desired or offered under the CDM, such as

that have solid CDM capacity and a very good investment climate, but because it is small geographically, it has small mitigation potential. *Host Country Attractiveness*, *supra* note 110, at 2176-78. Latin America has been viewed as a "pioneer and precursor of CDM projects in the carbon finance business" and thus when the CDM became operational in 2003, six of the first nine first project methodologies approved by the CDM Executive Board were from Latin America. IRINA FALCONETT & KEN NAGASAKA, *SUSTAINABLE ENERGY FOR PANAMA WITHIN THE FRAMEWORK OF THE KYOTO PROTOCOL: A STOCHASTIC ANALYSIS OF DIFFERENT OPTIONS* (2001). Currently, China dominates the CDM market, followed by India, although Latin America continues to be a significant participant in the carbon market. *Id.*

164. Doelle believes some host countries will be unable to determine whether a CDM project is "consistent with sustainable development" and will be unlikely to reject projects. DOELLE, *supra* note 21, at 32.

165. FALCONETT & NAGASAKA, *supra* note 163, at 4.

166. POTVIN ET AL., *supra* note 159, at 1343.

167. FALCONETT & NAGASAKA, *supra* note 163, at 4.

168. See DOELLE, *supra* note 21, at 30-31. The Marrakesh decision provided several options for establishing baselines: "1. Existing actual or historical emissions; 2. Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment; and 3. The average emissions of similar project emissions of comparable project activities undertaken in the previous five years in like circumstances and whose performance is among the top 20 percent of their category." *Id.* Doelle predicts that "the first option is most likely to be applied for energy efficiency or conservation projects, or for straight energy replacement projects. Given that CDM projects are likely to combine economic development and GHG emissions reduction, it is more than likely CDM project activities will be associated with an increase in overall energy consumption, which makes the first option unattractive to project participants as a baseline. For most CDM projects, parties are therefore more likely to rely on options two and three. The net effect of this is an overall overestimation of the emissions reductions achieved from CDM projects." *Id.* at 31.

nuclear power plants,¹⁶⁹ so-called clean coal technology, large scale hydro projects and sink projects such as forest plantations.¹⁷⁰ Whether such decisions should be made at the national or international level is a debatable topic. These concerns pit questions of sovereignty against whether the international community should accept credits for a particular project that may or may not cause other environmental problems, even as it reduces GHG emissions. Moreover, there are no requirements for meaningful environmental assessments or public participation at the local or international levels.¹⁷¹ At the local level, this may mean communities are frozen out of the process and their habitats may be at risk or sacrificed in the name of addressing climate change through CDM projects. Although participation in a CDM project is voluntary, there are fears in some quarters that nations may be pressured to accept undesirable projects or might find it difficult to reject offered projects.¹⁷² On the other hand, at least some nations may be able to seek out projects that best fit their need for particular technologies and to pursue distinct modernization strategies.¹⁷³

Sink projects under the CDM are limited to "afforestation"¹⁷⁴ and "reforestation"¹⁷⁵ (collectively "AR") projects, both of which are

169. See DOELLE, *supra* note 21, at 31. Nuclear projects were declared ineligible as CDM projects under the Marrakesh Accords. The same rule applied to joint implementation projects. *Id.*

170. See DOELLE, *supra* note 21, at 43-45.

171. See DOELLE, *supra* note 21, at 31-32. Doelle notes that there is little international oversight as to whether projects really are sustainable and whether the reductions, to the extent there are reductions, should be recognized as meeting Annex I nation targets. Thus the international community may be forced to accept credits for projects that create other environmental problems. *Id.*

172. See DOELLE, *supra* note 21, at 32. Doelle postulates that the countries will be approached by an Annex I country or a private entity with a project linked to a specific technology or project and "[t]he 'choice' of the host country at that point will be to . . . look a gift horse in the mouth and turn down the offer of assistance, or take what is being offered." *Id.*

173. See *Why Electricity Matters*, *supra* note 8, at 149. For example, between 1993 and 2005, renewable energy programs created small power producer programs in five Asian countries, which contributed substantially to the national energy supply. *Id.*

174. "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources. FCCC, CDM Executive Board, Glossary of CDM Terms, http://cdm.unfccc.int/Reference/Guidclarif/glossary_of_CDM_terms.pdf (last visited Jan. 12, 2010).

175. "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989." *Id.* at 22.

related to “human conversion of land from non-forest uses to forest.”¹⁷⁶ Small-scale AR projects include “agroforestry, community forest plantations, forest regeneration, and improved fallows while large-scale ones include industrial plantations.”¹⁷⁷ Annex I nations can only make limited use of sink credits to meet the commitment targets,¹⁷⁸ and for a number of complex reasons, proposed projects have tended towards plantations. Despite many obstacles, smaller projects may present opportunities to modify current land use patterns.¹⁷⁹ If such policies do not yield the necessary results, some scientists and policy makers have advocated avoiding deforestation as a valid carbon emissions reduction approach.¹⁸⁰ Scientists and policy-makers are studying whether compensating small-scale farmers for avoiding deforestation might result in “land use management and carbon sequestration becom[ing] more attractive for the rural poor and be[ing] more likely to be adopted in low income communities.”¹⁸¹

IV. EXPLORING PANAMA

A. *The Emergence of a Nation*¹⁸²

From the outset of European imperialism in Central America, Panama’s identity has been based upon a kind of geographic destiny, as Panamanian fortunes fluctuated with the geopolitical importance of the isthmus.¹⁸³ Explored and settled by the Spanish

176. POTVIN ET AL., *supra* note 159, at 1342.

177. POTVIN ET AL., *supra* note 159, at 1342.

178. Annex I nations cannot use more than the equivalent of 1% of its assigned amount from sinks credit under the CDM to meet its first commitment period target. DOELLE, *supra* note 21, at 35. The maintenance of sinks, such as forests, were largely excluded as was the notion of counting future avoided emissions. *Id.* at 48. This means that land use projects aimed at preserving forests are ineligible, as are projects that would not replace particular emissions but instead would foster future development that would never utilize dirty technologies. *See id.* at 48.

179. POTVIN ET AL., *supra* note 159, at 1342.

180. *See generally* Oliver Coomes, Franque Grimard, Catherine Potvin & Philip Sima, *The Fate of the Tropical Forest: Carbon or Cattle?*, 65 ECOLOGICAL ECON. 207 (2008), available at http://biology.mcgill.ca/faculty/potvin/articles/coomes_etal_08.pdf [hereinafter *Carbon or Cattle?*].

181. *Id.* at 208.

182. This very brief history is only to introduce the reader to Panama and more particularly to the role of the Panama Canal and the United States in Panamanian history. A complete history of the peoples, politics, ethos, and sociology of this diverse and culturally rich nation is beyond the scope of this paper. *See generally* PANAMA: A COUNTRY STUDY (Sandra W. Meditz & Dennis M. Hanratty eds., 4th ed. 1989); Thayer Watkins, *Political and Economic History of Panama*, <http://www.sjsu.edu/faculty/watkins/panama.htm> (last visited Jan. 12, 2010).

183. PANAMA: A COUNTRY STUDY, *supra* note 182, at xxiii.

in the 16th century,¹⁸⁴ Panama remained part of the Spanish Empire for 300 years (1538-1825) and was a crucial transportation interchange for shipping gold and silver to Spain,¹⁸⁵ and for transporting slaves throughout the Western hemisphere.¹⁸⁶ As opposition to colonialism swept Central America in the early 19th century, Panama became of strategic value in the revolutionary struggle.¹⁸⁷ Pressure for independence from the Spanish Empire escalated¹⁸⁸ and by 1825, under the leadership of Simon Bolivar, the present day territories of Panama, Bolivia, Venezuela, Ecuador and Columbia formed the short-lived republic of Gran Columbia.¹⁸⁹

184. Rodrigo de Bastidas, sailing westward from Venezuela in 1501 in search of gold, was the first European to explore the Isthmus of Panama. A year later, Christopher Columbus arrived and established a short-lived settlement in the Darien. As in North America, European explorers did not "discover" unpopulated territories. The territory that is present day Panama has been populated for the last 11,000 years and it was settled by the Chibchan, Cuna, Chomican, Cueva Guaymi, Choco, and numerous other Indian tribes, some of which survive to this day. The size of the Indian populations is unknown, but has been estimated at more than 500,000 people. Jan Knippers Black & Edmundo Flores, *Chapter 1: Historical Setting*, in PANAMA: A COUNTRY STUDY, *supra* note 182, at 6; ANTHONY G. COATES & OLGA F. LINARES, CENTRAL AMERICA: A NATURAL AND CULTURAL HISTORY 227 (Yale University Press 1997).

185. Jan Knippers Black & Edmundo Flores, *Chapter 1: Historical Setting*, in PANAMA: A COUNTRY STUDY, *supra* note 182, at 7-9. In 1513, Vasco Nunez de Balboa's difficult expedition from the Atlantic to the Pacific established that the isthmus was the conduit between these seas and Panama rapidly became a center and junction of Spain's New World Empire. Gold and silver arrived from South America, was transported across the Isthmus, loaded on ships and dispatched to Spain. The route became known as the Camino Real, or royal road. *Id.* Panama was the principal shipping point to and from South and Central America in colonial days. See COATES & LINARES, *supra* note 184, at 181. Cities were created specifically because of Panamanian exports—60 percent of all metals in the area were shipped through Panama in the 1570s. *Id.*

186. Black & Flores, *supra* note 184, at 9.

187. For example, General Miranda of Venezuela offered a canal concession to Britain in exchange for support. Black & Flores, *supra* note 184, at 15.

188. Panama's first act of separation from Spain was non-violent. When Simon Bolivar secured the liberation of New Granada, the Spanish viceroy fled Columbia for Panama where he ruled as a tyrant until his death in 1821. Black & Flores, *supra* note 184, at 15. His replacement was a liberal constitutionalist who permitted a free press and other liberties. *Id.* When he left for Ecuador in 1821, he left a Panamanian native as acting governor. *Id.* Several Panamanian cities immediately initiated plans to declare independence and the official day of Panamanian independence is celebrated as November 28, 1821. *Id.*

189. After Panama declared independence, there were discussions as to whether it should remain part of Columbia, which then was comprised of present-day Columbia and Venezuela, or whether it should unite with Peru. It was decided that it would remain part of Columbia and was designated a department with two provinces. With the addition of Ecuador, the nation became known as Gran Columbia. Black &

When the ephemeral Gran Columbia dissolved in 1830, Panama remained a province of Colombia, although it repeatedly attempted to secede over the next 80 years.¹⁹⁰ Columbia successfully withstood these challenges to its control, often with the assistance of the United States pursuant to the Bidlack-Mallarino Treaty.¹⁹¹ This Pact granted the United States a concession to build and operate a cross-Isthmus railroad and to use military force to defend and protect both the railroad and Columbia.¹⁹² This arrangement disintegrated in 1903, however, when Columbia rejected a U.S. proposal for canal rights over the narrow isthmus. Panama proceeded to proclaim its independence and, with U.S. backing, seceded from Colombia. The new nation promptly signed a treaty with the US authorizing construction of a canal, which marked the beginning of a new and distinct chapter in Panamanian history.¹⁹³

Since the early days of the American republic, the United States has perceived Central America as being within its sphere of influence and thus subject to intervention at will if it was necessary to protect its interests, however defined. The Canal placed Panama at the center of the U.S. imagination regarding the tropics and in particular, the jungle and the native.¹⁹⁴ "Turn of the century U.S. natural science textbooks typically included a classification of the tropical flora, fauna, temperatures and diseases in

Flores, *supra* note 184, at 15-16; see also Panama, Encyclopedia Britannica Online, <http://www.britannica.com/eb/article-41028> (last visited Jan. 12, 2010).

190. See Black & Flores, *supra* note 184, at 17. Three abortive attempts to separate from Columbia occurred between 1830 and 1840 alone. *Id.* Between 1850 and 1900 Panama had 40 administrations, 50 riots, 5 attempted secessions, and 13 U.S. interventions. *Id.* at 21. By 1903 Panama's independence from Columbia had earned it virtual protectorate status in relation to the United States. ROSEMARY THORP, *PROGRESS, POVERTY AND EXCLUSION: AN ECONOMIC HISTORY OF LATIN AMERICA IN THE 20TH CENTURY* 86 (1998).

191. The Bidlack-Mallarino Treaty of 1846 was a pact signed by Nueva Granada (now Colombia and Panama) and the United States, which granted the U.S. a right-of-way across the Isthmus of Panama in exchange for a U.S. guarantee of neutrality for the isthmus and the sovereignty of New Granada thereafter. Panama, Encyclopedia Britannica Online, <http://www.britannica.com/eb/article-41028> (last visited Jan. 12, 2010).

192. The United States and Gran Columbia entered into the treaty in 1846. Watkins, *supra* note 182.

193. The history of Panama in the 19th and 20th century is intimately tied to the history of the Panama Canal, which will be discussed in more detail below. See text and notes *infra* Part IV.A.

194. Stephen Frenkel, *Jungle Stories: North American Representations of Tropical Panama*, 86 GEOGRAPHICAL REV. 317, 324 (1996). Explorers had presented nonwhite people as "remnant exotic others, untouched by the outside world as were their ancestors when Balboa passed that way." *Id.*

Central America. . . intertwined with . . . opinions concerning heat, disease, dark-skinned peoples . . . and economic underdevelopment."¹⁹⁵ Views of the people of Panama invariably shaped negotiations regarding building and maintaining the Canal, the nature of the American presence in the nation, and the compensation owed to the Panamanian people for using their territory to facilitate American commercial and military interests.

Still, from the founding of Panama, the U.S. and Panama were essentially linked, with the U.S. freely and frequently interfering in the Panamanian economy and political system as Panama essentially became a U.S. protectorate. Sovereignty over the Canal Zone was never definitively settled and was a constant irritant to Panamanians.¹⁹⁶ Throughout the 20th century, resentment mounted, riots and violence sometimes erupted, payments were increased, concessions were made and eventually, albeit almost 100 years later, the U.S. exited.

B. Panama: The Ecology

Panama has a tropical climate with uniformly high temperatures and little seasonal variation. Although temperatures on the Pacific side of the isthmus are somewhat lower than on the Caribbean side, climate regions are determined more by rainfall than temperature, which varies regionally from between approximately four to twelve feet annually.¹⁹⁷ Panama's tropical environment supports an abundance of plants; forests predominate, with sporadic patches of crops, shrubs and grasslands. Although nearly 40% of Panama remains wooded, deforestation is a continuing threat,¹⁹⁸ while mangrove swamps proliferate along parts of both coasts.¹⁹⁹

195. *Id.* at 318. The transisthmus railroad also brought Panamanians in contact with rough and tumble Americans headed to the west coast and exposed Americans to Panama. Americans invariably brought their highly racialized politics, culture and views with them. John Biesanz & Luke M. Smith, *Race Relations in Panama and the Canal Zone*, 57 AM. J. OF SOC. 7, 10-11 (1951) (drawing a distinction between the Canal Zone and the rest of Panama).

196. Mercer D. Tate, *Panama Canal and Political Partnership*, 25 J. OF POL. 119, 130 (1963).

197. Almost all of it falls from April to December. Patricia Kluck, *Chapter 2: The Society and its Environment*, in PANAMA: A COUNTRY STUDY, *supra* note 182, at 73.

198. Tree cover has been reduced by more than 50% since the 1940s and subsistence farming is widely practiced from the northeastern jungles to the southwestern grasslands. Patricia Kluck, *Chapter 2: The Society and its Environment*, in PANAMA: A COUNTRY STUDY, *supra* note 182, at 74.

199. Banana plantations abut the deltas near Costa Rica. Patricia Kluck, *Chapter*

In some respects, Panama shares the ecological fate of other South and Central American nations detailed above,²⁰⁰ except its economy is intimately tied to the Panama Canal. Still, tourism, agriculture, and other industries are directly linked to its ecosystems that in turn are being affected by climate change.²⁰¹ Panama is increasingly being exposed to extreme climate events, and ecosystem changes have already led to the increased frequency and force of floods and fires. Pest and disease outbreaks, such as dengue and cattle deaths due to pneumonia, have increased and coral reefs have undergone major bleaching episodes where local sea surface temperatures have risen.²⁰² As the global climate has grown warmer, ocean levels have begun to rise, which is having a negative impact on some local communities.²⁰³ Additional human health consequences of climate change include increased rates of asthma and other respiratory diseases, allergies and increased risks of cancer.²⁰⁴ Predictions of future adverse effects include:

changes in species distribution, changes in population size, and changes in the timing of reproductions and migrations, all of which increase the likelihood of non-linear, abrupt irreversible changes. Ecosystem degradation can rarely be reversed. Degradation of ecosystem services represents a loss of natural assets that are an important part of Panama's ecological wealth.²⁰⁵

2: *The Society and its Environment*, in PANAMA: A COUNTRY STUDY, *supra* note 182, at 74.

200. CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 586 (Martin L. Parry et al. eds., 2007) available at <http://www.ipcc.ch/> (follow "WG II Impacts, Adaptation and Vulnerability" hyperlink).

201. Interview by Roberto Lopez with Scott Muller, Founder of Conservación y Desarrollo Sostenible en Acción, <http://www.fenixpanama.com/Panama-climate-change.html> [hereinafter Muller Interview].

202. *Id.*

203. *Id.* He notes that recent strong storms have resulted in ocean flooding of indigenous communities such as the Kuna. Also, recent studies by the Smithsonian Tropical Research Institute have shown that since 1910 the average level of the sea in Kuna Yula has risen by more than 15 centimeters and the local sea level is now rising around 2 cm a year. He predicts that eventually the Kuna will have to move the majority of their communities to the mainland at some future point. *Id.*

204. CLIMATE CHANGE AND HUMAN HEALTH: RISKS AND RESPONSES (A.J. McMichael et al. eds., 2003), available at <http://web.wkc.who.int/projects/uhe/heatw/>. Diarrhea from water borne illnesses is already one of the leading causes of childhood deaths. See Umesh D. Parashar et al., *The Global Burden of Diarrhoeal Disease in Children*, 81 BULL. WORLD HEALTH ORG. 235, 236 (2003), available at <http://www.who.int/bulletin/volumes/81/4/Editorial2.pdf>.

205. See Muller Interview, *supra* note 201; see also Andrea Gawrylewski, *Opening Pandora's Locks*, 21 THE SCIENTIST 10 (2007) (discussing the natural mangrove flood protection and the result if they are removed).

Moreover, over the last 50 years there have been unprecedented changes in ecosystem management, chiefly because of increased demands for food, fresh water, timber, fiber, and fuel.²⁰⁶ The rainforests of Darien have been particularly impaired, as erosion accelerates.²⁰⁷ 65,000 indigenous people, who are members of three cultures—Kuna, Embera and Wounan—have lived traditional and environmentally sustainable existences for centuries, but this is changing.²⁰⁸ The almost pristine tropical island of Coiba, located on the Pacific coast of the Panamanian province of Veraguas, contains one of Central America's most diverse ecosystems.²⁰⁹ Currently designated as a national park, it is under increasing pressure to be developed as a tourist destination, meaning an influx of hotels and infrastructure. It is a study in land use policies and the juxtaposition of economic development and conservation. At the same time, Panama is a quite modern nation with modern needs, such as energy. It is currently embarked on a number of projects to produce needed energy and is contemplating how to balance these efforts with conservation. It also has indigenous groups that might stand in the way of some of these efforts.

C. *Panama and the Clean Development Mechanism*

As previously noted, the CDM allows industrialized nations listed in Annex I to meet their emission reduction commitments by reducing emissions in developing nations;²¹⁰ Panama is precisely the kind of nation the CDM was designed to benefit. It pos-

206. Muller Interview, *supra* note 201. Muller notes that Panama's global economic output in 2000 was greater than its output in the entire 19th century. In Darien, human intervention and the migration of agricultural colonizers have led to uncontrolled forestry, mining, agriculture and hunting, which have resulted in deforestation, soil erosion, and disruption of the fragile ecological equilibrium and dislocation of traditional indigenous practices. *See id.*

207. Muller Interview, *supra* note 201.

208. Muller Interview, *supra* note 201. Muller notes population shifts due to the opening of the Darien Highway. He also cites a 1994 IUCN Resolution 19.66: "Opening the Darien Gap." *See id.*

209. Carl Steinitz et al., *A Delicate Balance: Conservation and Development Scenarios for Panama's Coiba National Park*, ENV'T., June 1, 2005, at 26. Though the island was once a prison, it is now preserved from human activity following its designation as a national park. *Id.*

210. For a variety of reasons, poor nations have generally been unable to attract such projects. *See generally Climate Change and the Poorest Nations*, *supra* note 6, at 1617-19. Although the bulk of CDM projects have gone to China, India, Brazil and Mexico, Panama has sought and attracted such projects. *See* FCCC, CDM Project Activities, <http://cdm.unfccc.int/Projects/registered.html> (last visited Jan. 12, 2010).

sesses the necessary institutional capacity, has tropical forests that could serve as potential sinks, and is on the brink of expanding its modernization and industrialization endeavors, which the international community has an interest in being carried out in a climate friendly manner. Panama resembles many middle-income nations in some respects, although its economy has always been more service oriented than many other nations in South and Central America.²¹¹ Panama is under pressure to diversify its economy by, for example, increasing tourism, which in turn places the typical pressures on resources and conservation. And then there are the ecological challenges raised by the canal itself and the expansion project in particular.²¹²

At the heart of Panama's modernization efforts, is the increase in energy production allowing for electricity to power the rudiments of a modern society. At the same time, pressures on pristine areas, implicate the role of deforestation and has meant further stresses on eco-system management, even as these projects do not fit comfortably within the CDM framework, since this framework does not favor sink projects.²¹³ Thus far, CDM efforts in Panama have focused on the possibility of creating or preserving sinks and producing cleaner energy. Both endeavors raise a number of complex issues, including meeting the needs and concerns of the more vulnerable members of various communities. These issues are likely to be common, as CDM projects are pursued throughout the developing world.

1. The Persistent Need for Energy

Fossil-based energy is one of the most important causes of the climate problem as energy is a fundamental underpinning of contemporary lifestyles. As a middle-income nation attempting to improve its infrastructure and increase its industrial, trade, and business production, the need for energy is constant and increas-

211. See WORLD RESOURCES INSTITUTE, EARTHTRENDS COUNTRY PROFILES: PANAMA, ECONOMIC INDICATORS, http://earthtrends.wri.org/pdf_library/country_profiles/eco_cou_591.pdf. (determining that manufacturing, industries and construction are responsible for one million of the eight million metric tons of annual emissions).

212. For a detailed discussion see notes 271-77 and accompanying text.

213. It may have a profound effect on indigenous groups and present serious difficulties in shifting land use patterns. The CDM does not favor reforestation projects, and tends to lean towards plantations. There is also debate regarding methodological issues for CDM projects, especially concerning leakage. Leakage occurs when afforestation activities are offset by deforestation elsewhere. POTVIN ET AL., *supra* note 159, at 1342.

ing.²¹⁴ In an effort to bring more electrical power to the entire nation, Panama has embarked on a course to build numerous hydroelectric dams²¹⁵—forty-seven as of April 1, 2008²¹⁶—the kind of venture that has previously faced withering criticism on ecological grounds.²¹⁷ While there have been protests and organizing efforts on the part of the latter, and some effort to allow a limited amount of participation and influence, it appears more customary to celebrate and idolize these voices while simultaneously ignoring and marginalizing them.²¹⁸

While it seems to be a classic case of balancing rather familiar contending interests, there is now an additional thumb on the scale, which is to avoid contributing to climate change. The influx of CDM funds, however, is likely to tip the scales against communities that appear to stand in the way of energy production. Panamanians tend to choose modernization,²¹⁹ and thus dissenting voices are less likely to prevail.²²⁰ The addition of CDM fund-

214. Total energy production in Panama has increased 39% since 1980, with energy consumption rising in complement. See WORLD RESOURCES INSTITUTE, EARTHTRENDS COUNTRY PROFILES: PANAMA, ENERGY AND RESOURCES, <http://earthtrends.wri.org/text/energy-resources/country-profile-141.html>.

215. Panama is building dams at an unprecedented rate with 31 expected to be fully operational by 2013. *Power Companies in Mini-hydro JV for Panama*, INT'L WATER POWER & DAM CONSTRUCTION, July 2, 2009, available at <http://www.waterpowermagazine.com/story.asp?storyCode=2053475>.

216. Cultural Survival, Panama Dam Construction Steps Up the Pace, <http://www.culturalsurvival.org/node/819531>.

217. See Tamar Gutner, *World Bank Environmental Reform: Revising Lessons from Agency Theory*, 59 INT'L ORG. 773 (2005) (noting problems of inclusion of environmental policy at Bank). For example, the Bank's dam building operation in Sadar Sarovar, India, was not even complying with its own environmental and resettlement policies. See *id.* at 774-75.

218. See *Panama's Ngobe Indians Win Temporary Halt to Dam Construction*, ENV'T NEWS SERVICE, June 22, 2009, <http://www.ens-newswire.com/ens/jun2009/2009-06-22-01.asp>. The Inter-American Commission on Human Rights ordered the government of Panama to suspend construction of the dam, which the Ngobe Indians protested would destroy the environment and their livelihood. In contrast, as a preventative step, the FCCC, in Section 12 of the Addendum of the Kyoto Protocol, stipulates that comments by local stakeholders should be submitted. Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Montreal, Can., Nov. 28-Dec. 10, 2005, *Decisions Adopted by the Conference of the Parties*, ¶ 64, U.N. Doc. FCCC/KP/CMP/2005/8/Add.1 (Mar. 30, 2006), available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf>.

219. More than 78% of voters in the referendum approved expansion of the canal. See Tucker Reals, *Panamanians Vote to Expand Canal*, CBS NEWS, Oct. 22, 2006, available at <http://www.cbsnews.com/stories/2006/10/23/world/main2113478.shtml>.

220. Some scholars have "investigated strategic and structural factors that explain variations in Kyoto Protocol ratification and the pace at which countries move to ratify." Sammy Zahran et al., *Ecological Development and Global Climate Change: A Cross-National Study of Kyoto Protocol Ratification*, 20 SOC'Y & NAT. RESOURCES 37,

ing may make further opportunities to increase energy production through the use of dams almost irresistible.

2. Altering Land Use Patterns: Deforestation, Reforestation & the CDM

Slowing tropical deforestation may be a more important factor in moderating climate change than has been previously understood.²²¹ Parties to the FCCC have promulgated proposals that “would enable trading of carbon saved by reducing tropical deforestation, just as carbon is currently traded from reducing industrial emissions.”²²² This would bring nations, such as Panama, with high forest cover and low rates of deforestation, decisively within the new framework.²²³ Moreover, without this opportunity to sell carbon credits, countries with high forest cover and low rates of deforestation might be denied a key inducement to maintain low deforestation rates. With preventative credits, however, these countries would have a significant tool to manage new forest exploitation or policies that encourage or permit deforestation.²²⁴

39 (2007). Termed “ecological modernization” theory, it characterizes nations by their economic, political and cultural development in terms of their readiness to commit to and comply with the Kyoto Protocol. *Id.* This theory analyzes the connection between economic development and developing institutions that regulate the impact of humans on the natural environment. There is some debate regarding whether nations must have industrialized, whether they can assimilate environmental signals from international society, whether nations must transition through stages of development or can leapfrog and the so on. The cultural dimension of ecological modernization emphasizes the values and behaviors of mass publics towards nature. Publics that value aesthetics, identity, and self-actualization over economic growth, characterize ecologically modernized countries—termed postmaterialism. This usually, but not necessarily, comes with economic development. *Id.* at 42.

221. “Carbon emissions from tropical deforestation are expected to increase atmospheric CO₂ concentration by between 29 and 129 ppm [parts per million] within 100 years, which is much more than previously estimated.” Gustavo A. B. da Fonseca et al., *No Forest Left Behind*, 5 PLoS BIOLOGY 1645 (2007), available at <http://www.ibcperu.org/doc/isis/9058.pdf>.

222. *Id.* at 1645.

223. *Id.* Nations with low rates of deforestation and high forest cover, contain 18% of tropical forest carbon. Current proposals would award carbon credits to countries based on their reductions of emissions from a recent historical reference rate. If such proposals became law, countries with high forest cover and low rates of deforestation would be left with little potential for reforestation credits under the Kyoto Protocol’s CDM. *Low Deforestation Countries to See Least Benefit from Carbon Trading*, MONGABAY.COM, Aug. 13, 2007, available at <http://news.mongabay.com/2007/0813-deforestation.html>.

224. There is a possibility that introducing additional sources of carbon credits could lower the price of carbon, thereby weakening the incentive to reduce deforestation in countries where rates are high. But they still might be valuable in reducing global CO₂ emissions. Fonseca et al., *supra* note 221.

The high capital requisites required to invest in new land-use practices is an acknowledged barrier to adopting potentially more sustainable or desirable land-use practices among poor farmers.²²⁵ Thus the possibilities of CDM projects could present unique opportunities to modify land-use patterns and increase carbon sinks.²²⁶ These land use dilemmas can be observed in a study that examined whether the villagers of the Ipeti-Embera region²²⁷ could be persuaded to commit to carbon sink activities, such as teak production²²⁸ instead of engaging in cattle ranching, which often means deforestation for grazing land. It seems that over the life of the project (25 years), the carbon project would be a much more profitable enterprise than raising cattle.²²⁹ But, the high returns come from the high value of the teak that is sold at the end of the 25 year period, meaning farmers will have a very long “wait period” with respect to CDM projects. Conversely, raising cattle generates a steady stream of revenue as well as other benefits.²³⁰ Thus while farmers ultimately may gain more from the CDM project, the returns are distant and risky for asset-poor farmers who will be more likely to stick with their traditional cattle ranches, despite strong community interest in a CDM affores-

225. POTVIN ET AL., *supra* note 159, at 1342. The authors conclude that Panama’s “lack of financial resources prevents the successful adoption of agroforestry practices among smallholders” *Id.*

226. *See id.* (“Plantations on land previously dedicated to non-forest uses, from small to medium size, have been proposed as viable AR strategies in several communities in Chiapas, Mexico. . . . Benefits are likely to include increased production to meet subsistence and monetary needs. However, potential drawbacks include the reduction of land available for food production, increased vulnerability to market forces and the uneven distribution of social and economic benefits among participants.”).

227. The study was based on a “participatory study conducted among the Emberá people in the community of Ipeti-Emberá . . . [which is] 120 km east of Panama City, along the Pan-America Highway.” *Carbon or Cattle?*, *supra* note 180, at 208. The community has 3198 ha [hectares] of land and 81 households who are engaged in a “mix of subsistence and market-oriented agriculture, forest product extraction, raising livestock, handicraft and off-farm wage labor. Households are both income and asset poor, earning in 2004, \$1,110 US/year (range: \$967-3495) and holding 38.8 ha [hectares] of land . . . and \$1236 on non-land assets” *Id.* at 208. For additional information on the indigenous community residing in Ipeti-Emberá, see POTVIN ET AL., *supra* note 159, at 1342.

228. Carbon sink activities would include teak plantations. *Carbon or Cattle?*, *supra* note 180.

229. Planting the teak would be financed by CDM carbon payments. *Carbon or Cattle?*, *supra* note 180.

230. Other benefits of cattle ranching include low time demand, high liquidity (for insurance and investment), limited sunk costs, lower price risk (cattle vs. carbon) and limited coordination/administrative costs. *Carbon or Cattle?*, *supra* note 180, at 209.

tation project and its promise of significant financial rewards.²³¹

One proffered solution would be to support villages in protecting tropical forests and avoiding forest loss, in return for carbon sequestration payments.²³² Avoided deforestation—where residents are compensated in return for preserving forests—would represent a promising alternative to pasturing and raising cattle.²³³ Under the Kyoto Protocol, however, only projects that convert non-forested lands to forest, qualify for emission reduction credits.²³⁴ Yet, given that 20% of GHG emissions are due to tropical deforestation, discussions have begun on providing incentives for emissions reductions that result from avoiding deforestation in non-Annex I nations.²³⁵ If current policies are not reconsidered, it may be that countries that have done the best job protecting their tropical forests from deforestation stand to gain the least from the CDM regime.

3. Considering Local Voices

Indigenous cultures and communities are at risk as the priorities of the nation are deemed to outweigh their more local and particular interests. Development discourse, however, demands consultation and taking into account the needs and aspirations of local communities. Those who come to consult do so with mixed intentions, however, whether it is corporations or the government agencies whose primary concern is ensuring that specific dams are built.²³⁶

231. *Carbon or Cattle?*, *supra* note 180, at 209.

232. Another possibility would be to “give the full amount of CERs [emission reduction credits] at the onset of the project to offset the establishment cost . . . [but it could] lead to incentive compatibility problems in the long run.” *Carbon or Cattle?*, *supra* note 180, at 209. Another option is to have an NGO or business partner subsidize the costs of establishing a plantation, which would reduce the investment required by the participants. *Id.* The alternatives to reduce initial costs and realize returns earlier are “few and fraught with high risk and moral hazard problems. In all cases, the threat of fire or disease or pest outbreaks, premature cutting, and the continuous need to monitor local conditions and enforce appropriate behavior would reduce their attractiveness to external organizations.” *Id.*

233. *Carbon or Cattle?*, *supra* note 180, at 209.

234. *Id.*

235. The World Bank is considering the Forest Carbon Partnership Facility and a voluntary carbon market that would operate alongside Kyoto. In Ipeti-Emberá it is predicted that without a CDM afforestation project, carbon stocks would decrease from approximately 302,000 in 2004 to 156,000 in 2024. Forest cover is likely to fall over the next 20 years without incentives. *Carbon or Cattle?*, *supra* note 180, at 209.

236. For example, an American corporation and the Panamanian government partnered to develop a hydroelectric dam in Charco la Pava, Panama, aimed at bringing electricity to Panama City, pressuring rural inhabitants to have their homes

However, it is difficult to listen to those one believes to be undeveloped.²³⁷ There is the notion of the noble environmentalist—meaning the indigenous are in unison with the environment. Those groups or peoples deemed not as unified with the natural world, according to western precepts, are not accorded any voice; their prerogatives are displaced by western voices, however sympathetic. Even when groups fit within the ‘noble indigenous environmentalist’ stereotype, often they are not heard even as they attempt to speak. What is even more disconcerting is those who purport to listen do not realize they are tone deaf. This is an ominous trend when it comes to CDM projects, which are touted as being not only in the interest of the nation, but also of the entire world as they will reduce emissions of GHGs. Environmental anthropologists have noted that rise of global environmentalism,²³⁸ which is the province of large environmental organizations that have undertaken to defend the environment and those who support environmental sustainability, embraces and envelops indigenous peoples who are viewed as repositories of local knowledge.²³⁹ These entities engage in particular discourses and indige-

bulldozed. Additionally, an affiliate of a Virginia-based corporation received a concession from the Panamanian government to build two hydroelectric dams along the Changuinola River in Bocas del Toro province, an area in the heart of Palo seco Park, a nationally protected area. Ellen L. Lutz, *Dam Nation*, 31 CULTURAL SURVIVAL Q. 16, 17 (2007).

237. The following summary, unless otherwise noted, is taken from conclusions gleaned by Professor Carla Guerron-Montero in her study of the Archipelago of Bocas del Toro and Panama City. She found that even when mechanisms were set up to listen to local voices, those voices were largely unheard and/or ignored. Some were found not to fit within the stereotypical mode of ‘the noble environmentalist’ and thus were not even included in the discussion. Others appeared to be included, but were routinely and roundly ignored. Moreover, indigenous participation was strong, however largely ignored, treated as backward or dangerous, as no effort was made to codify the wealth of empirical indigenous data into systematic social science data. Carla Guerrón-Montero, *Marine Protected Areas in Panama: Grassroots Activism and Advocacy*, 64 HUMAN ORGANIZATION 360, 367 (2005). This is not surprising. The idea of listening to and incorporating the objects of development has become part of development discourse, but it is rarely executed. See generally *Deconstructing Development*, *supra* note 15; Declaration of Indigenous Peoples on Climate Change (2002) 7 A.I.L.R. 97 (Austl.), available at <http://www.austlii.edu.au/au/journals/AILR/2002/18.html>.

238. See Guerron-Montero, *supra* note 237. Global environmentalism is defined as the “environmental politics of politicians, resource managers, and scientists, who partly as a result of their international recognition, imagined themselves to be in charge of world-wide environmental management programs.” *Id.* Examples of well-known causes of global environmentalism include rain forest management, global warming politics or marine resources harvesting. *Id.*

239. See Guerron-Montero, *supra* note 237, at 361. Indigenous peoples are viewed and used by donor organizations depending on the latter’s “conceptions of

nous peoples "have to fit the environmental and indigenous rights rhetoric of the incomparable qualities of indigenous knowledge."²⁴⁰ Dams may meet the energy needs of wider Panama, however, these dams may displace those residing in locations where such dams are built. Nonetheless, these dams, as well as the encouragement of land use changes that might help rural communities, require extensive community participation.²⁴¹ The goal would be to move beyond traditional discourses to new paradigms as the Clean Development Mechanism gains strength and credence.

V. AN EXPANDED CANAL

The Panama Canal has played and continues to play a larger than life role in the economic and political life of Panama. It has also been an integral part of Panamanian history since the 19th century and played a key role in its independence. This section will begin with a brief history of the Canal, which in many respects continues and completes the history outlined in Part III,

environmental truth" and this notion has shifted. *Id.* Large environmental organizations have migrated from the language of science in the 1970s and 1980s to a discourse of inclusion in the 1990s (partly because of pressure from indigenous communities and a shift back to a language of science and conservation.) *Id.* This may be due in part to shifts in funding sources, which have shifted from individuals and private foundations to mostly private corporations, such as Monsanto, Shell and Chevron, and bilateral and multilateral organizations, such as the World Bank and USAID. *Id.* Shifting accountability to these kinds of entities transforms discourse from one that incorporates indigenous knowledge to one that gives primacy to scientific language. Simply by framing research and advocacy agendas as global has given a strong advantage to environmentalism because their work is perceived of as urgent and thus more relevant.

240. See Guerron-Montero, *supra* note 237, at 361. For example, environmentalists Thom Henley and Wade Davis who visited the Penan developed an environmental discourse on the significance of Penan indigenous knowledge comprised of at least two different conceptions of indigenous knowledge: (1) objectivist conceptions, focusing on "the structural or systematic nature of indigenous knowledge and its utilitarian or adaptive significance;" and (2) "the environmentalist conception of indigenous knowledge, based on travel by activists to areas inhabited by indigenous people, stresses knowledge from a western perspective." *Id.* (citing Peter Brosius, *Endangered Forests, Endangered People: Environmentalist Representations of Indigenous Knowledge*, 25 *INDIGENOUS ENVTL. KNOWLEDGE AND ITS TRANSFORMATIONS: CRITICAL ANTHROPOLOGICAL PERSP.* 47 (Roy Ellen et al. eds., 2000)).

241. In the Ipetí-Emberá project, both baseline and CDM scenarios were "developed after numerous workshops, meetings, interviews, and participatory exercises all of which provided ample room for discussion, debates and recognition of heterogeneity within a seemingly homogenous community." POTVIN ET AL., *supra* note 159, at 1358. The scenarios developed were "the people's best projections given current economic constraints, land availability and anticipated future demographic and environmental dynamics." *Id.* There is a growing body of evidence that local participation can increase the accuracy of other data. *Id.*

above.²⁴² It will then discuss the current expansion project, the science and implications of a melting Arctic Ocean and how these two seemingly disparate events on opposite sides of the globe are in fact very much related.

A. *The Panama Canal: A Brief History*²⁴³

The history of Panama is intimately tied to its geography and within this history is the possibility of breaching the peninsula; indeed the first survey exploring the possibility of a canal to cross the narrow isthmus separating the Atlantic and Pacific oceans was undertaken as early the 1520s and 1530s.²⁴⁴ Beginning in the latter part of the 19th century, the irrepressible ambitions and aspirations of the United States regarding Panama and a canal²⁴⁵ lead to the intertwining of these two countries' fates.²⁴⁶

During the 19th century, governments and private investors in Great Britain, France and the United States periodically demonstrated an interest in building a canal in Central America. While other locations were weighed, Nicaragua and Panama were the clear frontrunners from the outset.²⁴⁷ The United States and Columbia entered into the Mallarino-Bidlack Treaty of 1846,²⁴⁸

242. See *supra* notes 155-200 and accompanying text.

243. For a complete and thorough history of the Panama Canal, see Panama Canal Authority, *A History of the Panama Canal: French and American Efforts*, <http://www.pancanal.com/eng/history/index.html> [hereinafter *History of Canal*].

244. Black & Flores, *supra* note 184, at 9. As the isthmus became increasingly important for transporting gold, silver, and other resources, the delays and impediments posed by the trail known as the Camino Real (Royal Road) inspired surveys ordered by the Spanish Crown. *Id.* In 1534, Charles V of Spain ordered the Panama regional governor to survey a route to the Pacific following the Chagres River. *History of Canal, supra* note 245. It was the first survey for a canal through Panama and it largely followed the course of the canal that was ultimately built. *Id.*

245. The United States was seeking a quicker passage to the west coast in the wake of the California gold rush in 1848. Nonetheless, U.S. interest in a canal came relatively late and it was not necessarily focused on Panama. PANAMA: A COUNTRY STUDY, *supra* note 182, at xxiii; AIMS MCGUINNESS, *PATH OF EMPIRE: PANAMA AND THE CALIFORNIA GOLD RUSH* 5 (2008).

246. The Canal inescapably linked Panama to the United States, and thus the Canal has dominated Panamanian politics and foreign policy, beginning with its role in creating the nation. After securing rights to build and then constructing the Canal, Panama became a virtual protectorate of the United States, and the precedent of American intervention established at independence frequently reoccurred during the first half of the twentieth century. *History of Canal, supra* note 245; PANAMA: A COUNTRY STUDY, *supra* note 159, at xxiii-xxv.

247. Black & Flores, *supra* note 184, at 19.

248. Black & Flores, *supra* note 184, at 19. The treaty was actually ratified and became effective in 1848. It gave the U.S. the right to build and operate the railroad and to use military force to protect the railroad and Columbian territory. *Id.* "The

which inter alia, gave the United States the right to build, operate, and protect a cross-Isthmus railroad;²⁴⁹ it foreshadowed the Canal in some respects, and certainly encouraged those envisaging a cross-Isthmus channel.²⁵⁰

Yet, it was a French company that obtained a concession from Columbia and undertook the first bona fide effort to actually construct a canal.²⁵¹ These efforts began in 1888 and continued for the next 20 years although, for a variety of reasons, including the harsh Panamanian climate, disease,²⁵² and obstacles that required yet to be discovered technology to be overcome,²⁵³ they ultimately proved unsuccessful.²⁵⁴ The French company, New Interoceanic,

treaty removed the existing restrictive tariffs and gave the United States and its citizens the right of free transit of persons and goods over any road or canal that might be constructed in the isthmus. In addition, the United States guaranteed the neutrality of the isthmus and Colombia's sovereignty over it, with a view to ensuring uninterrupted transit for the duration of the treaty, which was to be twenty years or as long thereafter as the parties gave no notice to revise it." *Id.*

249. On January 28, 1855, the first train from the Atlantic to the Pacific Ocean traversed the completed track of the Panama Railway. Black & Flores, *supra* note 184, at 18. "Between 1848 and 1869, about 375,000 persons crossed the isthmus from the Atlantic to the Pacific, and 225,000 crossed in the opposite direction." *Id.* The Railroad also led to the founding of the new port city of Colón at the Atlantic terminus; it remains the second largest city in Panama to this day. *Id.* With the 1869 completion of the first transcontinental RR in the United States, passenger and freight traffic across the isthmus declined. *Id.*

250. "The railroad track followed generally the line of the present canal." Black & Flores, *supra* note 184, at 18.

251. See History of Canal, *supra* note 245. In the name of La Societe Civile Internationale du Canal Interoceanique de Darien, Lucien Wyse negotiated a treaty with the Columbian government to build an interoceanic canal through Panama. Known as the Wyse Concession, this treaty provided the waterway would revert to the Columbian government after 99 years. *Id.*

252. The eradication of various tropical diseases was a large part of America's successful effort.

253. Ferdinand de Lesseps built the Suez Canal. The rights were awarded to Ferdinand de Lesseps and the Universal Interoceanic Canal Company. Construction began in 1881, but this and a subsequent French company, the New Company of the Interoceanic Canal Company (New Interoceanic), were unsuccessful. Black & Flores, *supra* note 184, at 19.

254. Emory R. Johnson, *The Panama Canal: The Title and Concession*, 18 POL. SCIENCE Q. 197, 199-202 (1903). By 1889, disease, the harsh Panamanian environment, and financial scandals in France led to the Universal Interoceanic Canal Company's bankruptcy. A new company, "The New Company of the Interoceanic Canal" assumed its assets but it too was met by disappointment and failure. *Id.* A visit to the Panama Canal exhibit on the building of the Canal indicates that U.S. companies and engineers devised a number of technological innovations that may have had much to do with their ultimate success. For a detailed history of the French effort to build a canal in Panama, see History of Canal, *supra* note 245.

eventually sought to sell its interests to the United States,²⁵⁵ which under the McKinley administration, was considering a canal via Nicaragua.²⁵⁶ When McKinley was assassinated and Theodore Roosevelt became President, support for a canal gained momentum, as Roosevelt believed that it was essential and indispensable to protecting and advancing American interests.²⁵⁷ After an intense internal American political debate, Panama prevailed over Nicaragua as the preferred canal site and²⁵⁸ America began negotiating with Columbia for a concession to build the Canal through the then Columbian province of Panama. The resulting Hay-Herran Treaty was rejected by Columbia; Roosevelt then backed Panama's independence movement.²⁵⁹ Panama declared independence on December 2, 1903, but it is doubtful that the forces of liberation would have prevailed without the U.S. military

255. See *History of Canal*, *supra* note 245. By 1898 the Company had depleted half its original capital and had to abandon the project or sell it; they decided on the latter. *Id.* The New Company hired William Nelson Cromwell, a New York lawyer, to lobby the United States Congress to induce the U.S. Government to buy New Company's interests in the Canal. Charles D. Ameringer, *The Panama Canal Lobby of Philippe Bunau-Varilla and William Nelson Cromwell*, 68 AM. HIST. REV. 346, 347 (1963). It was a hard sell, but five years later the U.S. agreed. *History of Canal*, *supra* note 245.

256. In 1899, Congress created and funded The U.S. Isthmian Canal Commission of 1899-1902 to study the possibility of alternative routes and in 1901, the commission decided on the Nicaraguan route, which had official and popular support. *History of Canal*, *supra* note 245. The Nicaraguan route was longer, but it was believed to enjoy engineering advantages. Although Nicaragua had several active volcanoes, its lower altitude made building easier and two lakes in the area—Lake Managua and Lake Nicaragua—could be integrated into the canal system. OVIDIO DIAZ ESPINO, *HOW WALL STREET CREATED A NATION: J.P. MORGAN, TEDDY ROOSEVELT, AND THE PANAMA CANAL* 12-14 (2001). Moreover, given French failures Panama seemed to be a means to defeat, whereas Nicaragua was a clean slate. *History of Canal*, *supra* note 245.

257. *History of Canal*, *supra* note 245. This came home to Roosevelt when a naval ship based in San Francisco had to sail around the horn to get to Cuba at the start of the Spanish American War. The trip took 67 days and made the desirability of a canal glaringly apparent. *Id.*

258. For a detailed history of the American debates, political wrangling and deliberations resulting in Panama see *History of Canal*, *supra* note 245. In August 1902, the U.S. Senate approved the Spooner Act for a Panamanian route canal. The Spooner Act authorized President Roosevelt to buy the assets of the French New Company of the Inter-oceanic Canal. The Act also gave the President permission to negotiate with Columbia and the territories they possessed for concession. For a contemporary account see Johnson, *supra* note 254, at 197.

259. When Columbia rejected the treaty, the United States backed a Panamanian rebellion. President Roosevelt was willing to make a show of force and the United States, which had troops in the area to guard the Panama Railroad, added extra troops and warships which enabled Panama to gain independence in only a few days. Roosevelt "dispatched warships to both sides of the isthmus – the Atlanta, Maine, Mayflower and Prairie at Colon and the Boston, Marblehead, Concord and Wyoming at Panama City – thus effectively blocking the sea approaches." *History of Canal*, *supra* note 245.

presence.²⁶⁰ While this was a triumph for the U.S. with respect to the Canal, it damaged U.S.-Latin American relations for many years.²⁶¹

The new, independent Republic of Panama promptly ratified the Hay-Bunau-Varilla Treaty on February 23, 1904, and upon ratification Panama received 10 million dollars²⁶² in exchange for relinquishing sovereignty over a ten mile strip of land on either side of the Canal, which became known as the Panama Canal Zone.²⁶³

Construction, which would last for ten years, began on May 4, 1904.²⁶⁴ It entailed numerous technical innovations,²⁶⁵ advances in entomology²⁶⁶ and other sciences.²⁶⁷ Because most of the manual laborers were from the West Indies,²⁶⁸ the project predictably brought the American brand of racism and discrimination to building the canal and to life within the Canal Zone.²⁶⁹ Accord-

260. History of Canal, *supra* note 245.

261. History of Canal, *supra* note 245. For a short review of U.S.-Central American relations, see Lars Schoultz, *Latin America and the United States*, in CENTRAL AMERICA: A NATURAL AND CULTURAL HISTORY 49, (Anthony Coates ed., 1987).

262. History of Canal, *supra* note 245. The U.S. agreed to annual payments of \$250,000 commencing nine years after the ratification. Tate, *supra* note 196, at 120.

263. History of Canal, *supra* note 245. The U.S. was granted the right to use, occupy and "control a zone of the land and land under water for the construction, maintenance, operation, sanitation, and protection." Tate, *supra* note 196, at 120. It was also granted "all the rights, powers and authority within the zone." *Id.* Panama also agreed not to tax any property or employees of the Canal. The cities of Colon and Panama were excluded from the ten mile wide Zone, but it included lands and waters outside the Zone that were necessary and convenient for the Canal and other incidental enterprises. *Id.* For a detailed contemporaneous account of the deliberations leading to the American agreement to build the Canal, see *id.*

264. History of Canal, *supra* note 245. The Panama Canal was completed in 1914, and first ship passed through on January 7, 1914, although the official opening was August 15. It was built at a cost of \$375,000,000, including \$10,000,000 paid to Panama and the \$40,000,000 paid to the French company that owned the previous concession. *Id.*

265. Innovations included a dirt-spreader, track-shifter and more powerful steam shovels. For additional advances and further details, see History of Canal, *supra* note 245.

266. See e.g., Paul Sutter, *Nature's Agents or Agents of Empire? Entomological Workers and Environmental Change during the Construction of the Panama Canal*, 98 ISIS 724 (2007).

267. History of Canal, *supra* note 245.

268. Building the Canal required more laborers than could possibly be supplied by Panama, and thus labor had to be recruited from outside the country. While high skilled technical labor came from America, most of the manual laborers hailed from various islands in the West Indies. History of Canal, *supra* note 245.

269. A 1963 account notes: "[t]here were not enough men for the job in Panama, and there were limitations on where workers could be obtained: Orientals could be legally employed in Panama only by letting work out on contract; Italians were tried

ingly racial segregation, which was an integral part of the American landscape, was brought to the Canal Zone, where the races were separated by law and custom.²⁷⁰ Descendants of these workers can be found within the contemporary racial mosaic of present day Panama and they face varying degrees of segregation, often based on language.²⁷¹

Although the imperial political machinations that led to the building of the Canal and the racial and political legacy it wrought were far from ideal, the technological feat that resulted in the Panama Canal cannot be underestimated²⁷² nor can the lucrative nature of a Canal linking the Pacific and Atlantic oceans. Over time, however, with the waves of self-determination enveloping the international community, the gradually declining hubris of the United States, and the growing resentment of the Panamanian people, U.S. control was challenged as the Panamanian people became increasingly impatient. This evolution can be observed in contemporaneous accounts of the Canal and the Canal Zone, and the series of modifications to the original compact, which finally culminated in a new treaty governing relations between the two nations.²⁷³ The wide grant of sovereignty over a zone that encompassed not only the Canal, but a zone of 10 miles on either side of the Canal, in due course became exceedingly problematic for Panamanians, who resented a foreign sovereign within their borders, and what they perceived as colonial control over the Canal.²⁷⁴ Panamanians increasingly sought additional compensation and control over the Canal and the Canal Zone and a series of modifications to the Hay-Bunau-Varilla Treaty²⁷⁵ and continually

but lacked stamina to withstand the heat; Spaniards were too scarce. Reluctantly, the government turned to the West Indian Negro though his efficiency was said to be only one-third that of ordinary labor in the United States. The wage began at twenty cents an hour." Tate, *supra* note 196, at 120 (citations omitted); see also Biesanz & Smith, *supra* note 195, at 8.

270. See Biesanz & Smith, *supra* note 195, at 8. Wage rates were discriminatory, with U.S. laborers being paid a higher rate than all others, most of whom were black and were also excluded from many higher-level jobs. Tate, *supra* note 196, at 123-24.

271. See Biesanz & Smith, *supra* note 195, at 8. The racial mosaic of Panama is complex and has been greatly affected by the Canal and the U.S. presence. A full discussion is beyond the reach of this paper.

272. History of Canal, *supra* note 245 (detailing technical aspects of the Canal). For a pre-American involvement, scientific view of the French effort, see generally *The Panama Canal*, 6 SCIENCE 503 (1885).

273. The 1977 Torrijos-Carter Treaties abrogated the Hay-Bunau Varilla Treaty. See, e.g., Tate, *supra* note 196, at 121-23; J.C.J. Metford, *The Background to Panama*, 40 INT'L AFFAIRS 277 (1964).

274. See Tate, *supra* note 196, at 133.

275. See Tate, *supra* note 196, at 121. In 1936, the General Treaty of Friendship

increased the yearly sum due from the United States.²⁷⁶ Finally, on December 31, 1999, after a protracted struggle within the U.S. and with Panama,²⁷⁷ the United States ceded control of the Panama Canal.

B. Expanding the Panama Canal

1. Politics and Rationales

The Panama Canal Authority ("PCA") determined that sometime between 2009 and 2012, the Canal would reach its maximum capacity, and lacking expansion, its capacity would stagnate.²⁷⁸

and Cooperation was signed, which altered the 1903 treaty giving U.S. canal rights. Then, in 1955 the Treaty of Mutual Understanding and Cooperation was enacted, again altering the amount the U.S. was required to pay Panama. *Id.*

276. See Tate, *supra* note 196, at 120-22. In the General Treaty of Friendship and Cooperation, ratified after three years in 1939, the U.S. renounced the grant of lands and waters outside the Canal Zone and residence and commerce in the Zone was limited to certain specific classes of persons with particular employment relationships in the Zone. Additionally, the annual payment was raised to \$430,000 and Panama was granted a corridor through the Zone to Colon, which had been accessible only by ship under the terms of the 1903 Treaty. After eight years of negotiation and with a great deal of pressure by Panama, on January 25, 1955, the two nations entered into a Treaty of Mutual Understanding and Cooperation, which amended the original 1903 treaty and increased the annual annuity to \$1,930,000 and gave Panama the right to tax the income of Canal residents, regardless of their residence; albeit not the income of U.S. citizens or military personnel. *Id.* at 121.

277. See Lieutenant Colonel Gregory M. Huckabee, *Suffering the Slings and Arrows of the Panama Canal Treaties*, 40 Navy L. Rev. 65, 72 (1992). The following is the Lieutenant Colonel Huckabee's description of the process of handing over the Canal: "[t]he second treaty, called the Treaty Concerning the Permanent Neutrality and Operation of the Panama Canal, declared the waterway to be permanently neutral, as would be any canals yet to be built. The most difficult part of this compact was Article V which held that, after termination of the Panama Canal Treaty on December 31, 1999, only the Republic of Panama shall be authorized to operate and maintain military forces, defense sites, and military installations within Panama. The United States, however, was to continue to defend the Canal from external threats. After the Treaties' signing in September 1977, they were sent to the U.S. Senate for its 'advice and consent,' triggering one of the most protracted and torturous chapters in the history of the U.S. Senate." *Id.*

278. PANAMA CANAL AUTHORITY, PROPOSAL FOR THE EXPANSION OF THE PANAMA CANAL: THIRD SET OF LOCKS PROJECT 39 (2006), <http://www.pancanal.com/eng/plan/documentos/propuesta/acp-expansion-proposal.pdf>. For example, the size of vessels increased by 20% during the last five years. The larger the vessel, the smaller number of transits the Canal can handle. Additionally, the vessels passing through the Canal demand an increasing amount of services. *Id.* at 34. Without expansion, the revenue increases would be in the form of toll increases, which in turn risks driving clients away. Additionally, without expansion, service will deteriorate and become less competitive. *Id.* at 39. Without the capacity to meet the forecasted demand, the Canal will have a less diversified user base, will become more strategically vulnerable and will affect its ability to serve the most efficient vessels. *Id.* at 41.

Thus it proposed adding a new larger-capacity lock²⁷⁹ to the Canal system and, on July 14, 2006, the Panama National Assembly unanimously approved this proposal.²⁸⁰ Ultimately, however, in accordance with the Panama constitution, the Panamanian government left the final decision regarding expansion to the Panamanian people,²⁸¹ who approved it in a 2006 national referendum.²⁸² Construction began in 2007 and will conclude in 2014, which is the Canal's 100th anniversary.²⁸³ By expanding the Canal, the Canal Authority anticipates increasing the Canal's capacity to meet growing demand, as well as maintaining the Canal's competitiveness and the value of the maritime route through Panama.

The expansion project will be the largest project regarding the Canal since it was originally constructed; it will double the Canal's capacity and permit additional traffic by creating a new lane of travel via a new set of locks; it will allow the Canal to accommodate ships that can transport more than 12,000 containers.²⁸⁴ The project is estimated to cost approximately \$5.25 billion

279. The length of the Panama Canal is approximately 51 miles. A trip along the canal from its Atlantic entrance would take you through a 7 mile dredged channel in Limón Bay. The canal then proceeds for a distance of 11.5 miles to the Gatun Locks. This series of three locks raise ships 85 feet to Gatun Lake. It continues south through a channel in Gatun Lake for 32 miles to Gamboa, where the Culebra Cut begins. This channel through the Cut is 8 miles long and 492 feet wide. At the end of this Cut are the locks at Pedro Miguel. The Pedro Miguel locks lower ships 52.5 feet to a lake, which then takes ships to the Miraflores Locks which lower ships 52 feet to sea level at the Canal's Pacific terminus in the bay of Panama. Jaime Rodriguez, *Channeling the Oceans: Modernizing the Panama Canal with GPS*, POINT OF BEGINNING, Nov. 1, 2004, available at <http://www.pobonline.com/CDA/Archives> (follow "November 2004" hyperlink; then follow "Channeling the Oceans" hyperlink).

280. Press Release, Embassy of Panama, Panama Canal Expansion Takes Major Step Forward, (July 17, 2006), <http://www.embassyofpanama.org/canal/>.

281. Gawrylewski, *supra* note 205.

282. *Panama Votes for a Bigger Canal*, THE ECONOMIST, Oct. 23, 2006, at 1, available at http://www.economist.com/agenda/displaystory.cfm?story_id=E1_RDSTQJQ. Some 78% of Panamanians voted in favor of the expansion referendum. *Id.*

283. The new set of locks will be constructed between 2007 and 2014, and is projected to be open to transit at the beginning of 2015. Chris Kraut, *Panama Canal Expansion is Chugging Along*, L.A. TIMES, June 1, 2009, available at <http://articles.latimes.com/2009/jun/01/business/fi-panama-canal1>.

284. 'Panamax' is a maritime shipping standard that refers to ships that can fit through the current locks. The new locks will allow post Panamax ships to journey through the Canal. Trade between Asia and the Americas has exploded in recent decades and many carriers are using ships that are 50% wider than Panamax vessels; these huge ships can carry 8,000 cargo vessels each. These shipments currently off-load on the U.S. west coast. Goods are then transported across the U.S. and Canada by rail. With a wider Canal, goods will arrive in the eastern part of North America directly. Brazil and Venezuela have been increasing grain, oil and other raw material

dollars, and will ultimately be financed by Canal users via the toll system;²⁸⁵ thus the Canal Expansion proposal maintains that the project will not burden the country financially nor require that the state maintain debt.²⁸⁶ The project also promises to financially benefit Panama by offering employment and added links to the global economy.²⁸⁷

2. Plans and Strategies

The PCA is responsible for safeguarding the water resources of the Canal Watershed and they profess to have developed a strategy of programs to protect the environment and the natural resources of the watershed.²⁸⁸ In determining the best way to expand the Canal, the proposal concludes that a third set of locks project is “environmentally viable.”²⁸⁹ Thus the expansion plan includes constructing two additional sets of locks that will flank the already existing Gatun Locks (at the Atlantic head of Gatun Lake) and the Miraflores Locks (at the Pacific end of the Canal).²⁹⁰

sales to China and are also counting on a third, broader lock. Lorne Matalon, *Panama Canal Expansion Spurs Environmental Debate*, NAT'L GEOGRAPHIC NEWS, June 27, 2007, available at <http://news.nationalgeographic.com/news/2007/06/070627-panama-canal.html>. According to the Panama Canal Authority (“PCA”): “The investment will double the Canal’s capacity, increase its operational efficiency and provide economic benefits to Panama, which in turn will improve the quality of life for all Panamanians.” PANAMA CANAL AUTHORITY, *supra* note 278, at 9. According to the most likely demand forecasts, the third set of locks will yield a 12% internal rate of return. *Id.* at 12. Canal traffic will not be interrupted during construction, however, because the construction is outside existing operational areas. The plans for the Canal’s expansion project include several phases. The pre-construction phase includes developing the final design, models and contracts. The first step in constructing the locks includes dredging the channels. Building the new locks is scheduled to take between five and six years, and includes dredging “both new lock access channels, Gatun Lake navigational channels and sea entrances.” *Id.* at 9.

285. Tolls will be set in a manner that will allow them to double within the next 20 years, to account for the cost of the expansion and to ensure it is profitable. In addition, the third set of locks program will make growing contributions to the National treasury because the Canal will continue to make these payments according to the net tonnage of vessels transiting the Canal. PANAMA CANAL AUTHORITY, *supra* note 278, at 59.

286. PANAMA CANAL AUTHORITY, *supra* note 278, at 61.

287. PANAMA CANAL AUTHORITY, *supra* note 278, at 65. According to the PCA’s economic plan, total proceeds from shipping transit tolls, after construction and maintenance costs will be at least 1.72 billion each year for the next 20 years. Gawrylewski, *supra* note 205.

288. Additionally, the PCA is a signatory of the United National Global Pact and is a member of the World Business Council for Sustainable Development. PANAMA CANAL AUTHORITY, *supra* note 278, at 49.

289. PANAMA CANAL AUTHORITY, *supra* note 278, at 48.

290. Gawrylewski, *supra* note 182.

"No immitigable or permanent adverse impacts on the population or the environment are anticipated" because it is believed that adverse environmental consequences can be mitigated through existing procedures and technology.²⁹¹ According to the Expansion Proposal, the project will not cause permanent or irreversible effects on water or air quality, and there are no "elements within the scope of the project that will compromise its environmental viability, including communities, primary forests, national parks or forest reserves, relevant patrimonial or archaeological sites, agricultural or industrial production areas, or tourist or port areas."²⁹² The project will generally be concentrated in areas already encroached upon by other Canal projects, and included within cost estimates are funds for reforestation and the restoration of excavated materials.²⁹³ Finally, water supply requirements will be satisfied by building water reutilization basins, deepening the Gatun Lake's and Gaillard Cut's channels and elevating Gatun Lake's maximum operational level; no new reservoirs are required.²⁹⁴ Thus, the PCA has gone to some lengths to ensure the economic and environmental viability of the Canal's expansion. This paper questions whether it has adequately considered its new competition—the Arctic Ocean.

VI. POTENTIAL COMPETITION: A NORTHERN PASSAGE

As Panama increases the capacity of the Panama Canal, a new route to connect the Atlantic and Pacific Oceans may be imminent. A passageway across the top of the Earth has long been sought, but given an impenetrable ice cover over the top of the planet much of the year, has long been denied. This frozen obstacle, however, vanishes as a changing climate melts the Arctic at an unprecedented rate; the global impact will be profound and the consequences for Panama quite significant.

A. *Climate Change and the Arctic Circle*

The North Pole is actually part of an ocean that is covered, depending upon the season, by varying amounts of ice.²⁹⁵ There is

291. PANAMA CANAL AUTHORITY, *supra* note 278, at 48.

292. PANAMA CANAL AUTHORITY, *supra* note 278, at 48-49.

293. PANAMA CANAL AUTHORITY, *supra* note 278, at 54.

294. PANAMA CANAL AUTHORITY, *supra* note 278, at 53.

295. "The Arctic includes part or all of the territories of eight nations: Norway, Sweden, Finland, Denmark, Iceland, Canada, Russia, and the United States as well as the homelands of dozens of indigenous groups that encompass distinct sub-groups

generally thicker ice in the winter and thinner ice in the summer. The polar regions are sensitive to temperature variations and thus profoundly affected by a warming climate;²⁹⁶ indeed, even a degree of variation that exceeds the natural variability in the earth's climate can be critical.²⁹⁷ Thus, as global temperatures increase, Arctic sea ice melts at an unparalleled rate.²⁹⁸ Climatologists believe that swift escalation in Arctic thawing is due to man-made global warming,²⁹⁹ predicting that Arctic ice cover may disappear much sooner than initially envisaged.

The last few decades and especially the last few years have been telling. Perennial ice,³⁰⁰ the sea ice remaining after the sum-

and communities." ARCTIC CLIMATE IMPACT ASSESSMENT, IMPACT OF A WARMING ARCTIC: ARCTIC CLIMATE IMPACT ASSESSMENT 6 (Cambridge University Press 2004).

296. MARUFU C. ZINYOWERA & ROBERT T. WATSON, *THE REGIONAL IMPACTS OF CLIMATE CHANGE: AN ASSESSMENT OF VULNERABILITY* § 3.3 (Cambridge University Press 1997). Temperatures in the Arctic have risen almost twice as fast as those for the rest of the planet, and in the next century, temperatures may increase as much as nine to thirteen degrees. See John Roach, *Most Polar Bears Gone By 2050*, *Studies Say*, NAT'L GEOGRAPHIC NEWS, Sept. 10, 2007, available at <http://news.nationalgeographic.com/news/2007/09/070910-polar-bears.html> (predicting that the polar bear population is due for a rapid decline). One of the primary reasons the Arctic warms faster than other habitats is because of its snow and ice cover, both of which reflect sunlight. Snow and ice reflect up to 85% of sunlight, while water only reflects 15% and absorbs the rest. As temperatures increase, additional ice and snow melt. This loop is accelerating, as the Arctic loses more of its ability to reflect the sun's energy back into the atmosphere. "In effect, warmth leads to more warmth." Jonathan Leake, *Arctic is Melting Even in Winter*, TIMES ONLINE, Oct. 26, 2008, <http://www.timesonline.co.uk/tol/news/environment/article5014744.ece> (explaining the heart of the melting in the Arctic is a simple science: ice is white, most of the sunlight hitting it is reflected back into space, and when it melts it leaves open and darker ocean that absorbs light and gets warmer, melting more ice and making it more difficult for ice to form again in the winter).

297. Richard Black, *Arctic Ice 'Disappearing Quickly'*, BBC News, Sept. 28, 2005, available at <http://news.bbc.co.uk/2/hi/science/nature/4290340.stm>.

298. NASA scientists have demonstrated that from 2004 to 2006, the Arctic's usually permanent ice cover shrunk by 14% and Arctic ice melted four consecutive years in a row: 2002-2006. This "Texas-sized" loss and longer melting periods have been attributable to man-made global warming, and this human-induced melting could result in even faster melting in future years. See Melissa McNamara, *NASA: Arctic Melt is 'Alarming'*, CBS EVENING NEWS, Sept. 14, 2006, available at <http://www.cbsnews.com/stories/2006/09/14/eveningnews/main2011009.shtml>; Black, *supra* note 297.

299. E.g., McNamara, *supra* note 298 (stating Arctic's ice loss is due to man-made global warming); Black, *supra* note 296 (stating man-made global warming at least partially to blame for Arctic ice melting).

300. This stands in the way of shipping through the Arctic. This ice used to cover 50-60% of the Arctic but has been rapidly decreasing. Furthermore, "very old ice that remains in the Arctic for at least six years" comprised over 20% of the ice in the Arctic in the 1980s, and has since decreased to 6%. Gretchen Cook-Anderson, *Researchers Say Arctic Sea Ice at Risk Despite Cold Winter*, NASA FEATURE, Mar. 12, 2008, http://www.nasa.gov/topics/earth/features/seaice_conditions_feature.html.

mer melt season, declined by approximately 193,000 square miles each decade between 1970 and 2000,³⁰¹ and since then, the rate of decline has practically tripled.³⁰² With less perennial ice, thinner seasonal ice predominates and thinner seasonal ice melts more rapidly.³⁰³ Beginning in summer 2007, Arctic sea ice was at its lowest recorded level since satellite measurements began in 1979.³⁰⁴ 2008 began with NASA researchers announcing that perennial sea ice was at an “all-time low.”³⁰⁵ Since perennial sea ice is an “indicator of the long-term health” of Arctic ice, matters seemed to be rather dire³⁰⁶ as seasonal ice, some of which is less than one-year old, appeared to be more dominant. With only a four-foot thickness, such ice cover left the region more vulnerable to winds and currents.³⁰⁷ By the end of the 2009 Arctic summer, some recovery was observed as the National Snow and Ice Data Center (“NSDIC”) reported more ice cover than during the record-breaking summers of 2007 and 2008.³⁰⁸ Sea ice did not return to previous levels, and the majority of Arctic ice cover is young, thin and comprised of first and second-year ice, more prone to melting during the summer.³⁰⁹ Thus, despite “a little recovery,” scientists still expect ice-free summers in the next few decades.³¹⁰

301. Tabatha Thompson, *NASA Examines Arctic Sea Changes to Record Low in 2007*, NASA MISSION NEWS, <http://www.nasa.gov/vision/earth/lookingatearth/quikscat-20071001.html>.

302. Between 2005 and 2007, perennial ice shrunk by an area the size of Texas and California combined. *Id.*

303. This type of ice was more evident during the summer, but is now present year round. Even summer ice was at a record low in 2002, after decreasing 9% per decade between 1979 and 2002. *See* ARCTIC CLIMATE IMPACT ASSESSMENT, *supra* note 294, tbl. 997. “Sea-ice extent is very likely to continue to decrease, particularly in summer. Model projections of summer sea-ice extent range from lots of several percent to complete loss. As a result, the navigation season is projected to be extended by several months.” *Id.*

304. The Select Committee on Energy Independence and Global Warming, *Melting Arctic Circle Ice Drives Polar Bears Closer to Extinction*, <http://globalwarming.house.gov/impactzones/arctic>; National Snow and Ice Data Center, *Arctic Sea Ice Shatters All Previous Record Lows*, Oct. 1, 2007, available at http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html.

305. Mason Inman, *Shrinking Arctic Sea Ice Thinner, More Vulnerable*, NAT’L GEOGRAPHIC NEWS, Mar. 18, 2008, available at <http://news.nationalgeographic.com/news/2008/03/080318-arctic-ice.html>.

306. *Id.*

307. *Id.*

308. The sea ice measured in September 2009 “was the third lowest since the start of satellite records in 1979.” National Snow and Ice Data Center, *supra* note 60.

309. National Snow and Ice Data Center, *supra* note 60.

310. According to the National Snow and Ice Data Center (“NSIDC”), September 2009 demonstrated an average ice area of 2.07 million square miles; this is 409,000 square miles greater than the record-setting low for 2007. However, the ice extent

Over the course of the past 30 years, roughly 386,000 square miles of Arctic sea ice, an area larger than Texas and Arizona combined, have already melted.³¹¹ Recent research suggests that summer Arctic sea ice could completely disappear as early as 2020.³¹² Sea ice is the key indicator and agent of heat and moisture at the ocean surface, and ocean currents. Even if melting sea ice does not directly affect sea levels, it will affect perennial ice, which in turn changes sea levels.³¹³ As the rate of sea ice decline intensifies, the consequences for the Arctic region will be profound.

B. Competing with the Panama Canal

As perennial ice has decreased by 41% over the last 23 years,³¹⁴ it has impacted the Arctic many ways, the most important of which is on shipping and trade.³¹⁵ With rapidly decreasing year-round ice, shipping and navigating through the Arctic may become possible.³¹⁶ Some climatologists predict significant ice cover for much of the 21st century,³¹⁷ while others conclude that "it is probable that after the year 2050 the so-called Northwest Pas-

was still 649,000 square miles below the 1979 to 2000 September average. "Arctic sea ice is now declining at a rate of 11.2 percent per decade, relative to the 1979 to 2000 average." National Snow and Ice Data Center, *supra* note 60.

311. National Snow and Ice Data Center, *supra* note 60.

312. National Snow and Ice Data Center, *supra* note 60; *see also* John Roach, *supra* note 32. While recent scientific research illustrates a consensus that the Arctic will be devoid of ice in future summers, opinions differ on exactly when this will occur. Despite some disagreement over the exact timing, there is overwhelming consensus on a declining sea ice cover, which is a burgeoning global problem, with 2005's record setting lows providing the "exclamation point." NSIDC, *Sea Ice Decline Intensifies*, Sept. 28, 2005, available at http://nsidc.org/news/press/20050928_trendscontinue.html (quoting Mark Serreze of NSIDC).

313. Cook-Anderson, *supra* note 300.

314. Scott G. Borgerson, *Arctic Meltdown: The Economic and Security Implications of Global Warming*, FOREIGN AFFAIRS ONLINE, Mar./Apr. 2008, <http://www.foreignaffairs.org/20080301faessay87206/scott-g-borgerson/arctic-meltdown.html>.

315. Ice thickness and density, permafrost levels, hydrology, fisheries, terrestrial systems, and human activities will be affected by temperature variability. *See generally* ZINYOWERA & WATSON, *supra* note 295.

316. While recent scientific research illustrates a consensus that the arctic will be devoid of ice in future summers, opinions differ on exactly when this will occur. Despite some disagreement over the exact timing, there is overwhelming consensus on a declining sea ice cover that is a burgeoning global problem, with 2007's record setting lows providing the "exclamation point." *See* Roach, *supra* note 32 (quoting scientist Mark Serreze of the National Snow and Ice Data Center).

317. In 2005, a team of scientists from the U.S. Arctic Research Commission presented an analysis on the possibility of navigation through the Arctic. The scientists concluded that during the 21st century the central Arctic and its tangential seas would still have "significant ice cover." GlobalSecurity.org, *Panama Canal* –

sage to the north of Canada could be ice-free during the three summer months and could be navigable to ships other than ice-breakers during this short period.”³¹⁸ Panama has chosen to base their expansion plans on the rosier scenario. However, given the rapid pace of global warming, one must wonder.

The routes that currently compete with the Panama Canal include the U.S. Intermodal System, the Suez Canal, the Cape of Good Hope and Cape Horn.³¹⁹ The proponents of the expansion proposal recognized that there are additional routes that could present competition. They list the Arctic as one such possibility, but then write it off as a “hypothetical route”³²⁰ and conclude that the Arctic route does not present true competition.³²¹ Perhaps the proposal is correct and catastrophic melting will occur later rather than sooner. Yet predictions have become increasingly dire as the pace of melting accelerates and a Northwest Passage has temporarily opened.³²² The question may be whether nations should err

Northwest Passage, <http://www.globalsecurity.org/military/facility/panama-canal-northwest.htm>.

318. *Id.*

319. PANAMA CANAL AUTHORITY, *supra* note 277, at 19.

320. *See id.* at 22.

321. *Id.* at 25-26 (“It is not probable that carriers who offer liner services itineraries between Northeast Asia and the U.S. East Coast, will divert services from the Panama or the transpacific routes to the alleged Arctic route for two or three months every year, especially when the route’s navigability and availability will be unpredictable, it will lack navigational aids, have little port connectivity and comprise Canadian jurisdictional waters, particularly when we consider that itinerary operated services are established in terms of route reliability, certainty and safety.”).

322. The widely reported 2007 summer arctic ice shrinkage resulted in the opening of the Northwest Passage, and according to British scientists lead by Dr. Katharine Giles, such an opening is continuing in the winter months with the thickness of sea ice decreasing 19% from the previous winter. Leake, *supra* note 296. According to Giles, after the 2007 summer melting, the thickness of the winter ice nose-dived. *Id.* Furthermore, winter air temperatures in 2007 were cold enough to sustain the ice, and therefore may not have been the cause. *Id.* Instead, Giles suggests that the Arctic is likely to melt much faster than previously thought, as a rise in water temperature or change in ocean circulation could have “brought warmer water under the ice.” *Id.* Professor Peter Wadhams of Cambridge University concluded “the Catlin Arctic Survey data supports the new consensus view – based on seasonable variation of ice extent and thickness, changes in temperatures, winds and especially ice composition – that the Arctic will be ice-free in summer within about 20 years, and that much of the decrease will be happening within 10 years.” Peter Griffiths, *Arctic to be Ice-Free in Summer in 20 Years: Scientist*, REUTERS, Oct. 15, 2009, available at <http://www.reuters.com/article/idUSTRE59E18W20091015>. According to Wadhams, the Arctic will essentially be treatable as an open sea in the summer. David Shukman, *Arctic to be “Ice-Free” in Summer*, BBC NEWS, Oct. 12, 2009, available at <http://news.bbc.co.uk/2/hi/science/nature/8307272.stm>. The expedition suffered a number of technical breakdowns that lead to the practice of hand-drilling through the ice, and despite mechanical setbacks, the Catlin Survey provided information about

on the side of caution, especially when so much money is at stake. It is a tough call and Panama, with its ambitious project to expand a national treasure, may be the first test case.

VII. CONCLUSION

Panama is emblematic of many nations facing the uncertain future of a warming climate. It stands at the threshold of completing its quest for modernization and the question is whether it will be able to do so in a diametrically different manner than the nations that preceded it in this pursuit. The answer to this question, as it is for middle income nations generally, is imperative for the entire international community. These nations did not cause our planet's downward descent and they are not in a position to stop it. But their collective impact is potentially enormous and thus we must construct effective mechanisms to ensure that their course is different—that is both cleaner and more efficient. How those at the very bottom of the economic hierarchy fair in this process is also essential if we are to do justice in this process. Thus indigenous voices must be heard and these communities must not be sacrificed in the name of climate change. This would be the height of injustice for these peoples were not complicit in the problem, are more unlikely to reap any of the potential benefits yielded by modernization, and should not bear the brunt of proffered solutions.

Panama also demonstrates how singular the position of individual nation states is bound to be. The Panama Canal, of course is the height of distinction; vital canals are a rarity of the highest order and found in very few countries. It is the center of Panama's economy and its future and it is being affected by something that is very unpredictable on the other side of the planet. It has no control over this course of events even as these measures have a potentially profound impact upon its plans, prospects and opportunities. While no other nation will face the exact same challenge, there will certainly be challenges that are quite particular, and likely to be unexpected and uncontrollable; it will undoubtedly modify future prospects. Let us hope we can alter our current

the ice previously unavailable through satellites or submarines. *Id.* Professor Peter Wadhams is the head of the Polar Ocean Physics Group at Cambridge University and has been studying the Arctic ice since the 1960s—his most current expedition, the Catlin Arctic Survey, took a survey route to the north of Canada. *Id.* Wadhams and his team, lead by explorer Pen Hadow, expected to cross areas of multi-year ice that are thicker and more resilient. Instead, the team found an average thickness of 4.8 meters. *Id.*

destructive trajectory towards climatic catastrophe and find a way to assist those who will feel its negative impact, whether it be potentially more dire economic prospects, as in Panama, or the loss of one's very home, as is facing the peoples of the Arctic region.

