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Facing the Future: Canada's Environmental Security Challenges in the 21st Century

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In 2007 the McClure strait in the Canadian Arctic, as visible from satellite photography, was free of ice for the first time.[1] The legendary Northwest Passage is open; a long lost dream of explorers has finally become reality – the very geography of Canada is experiencing environmental change. In the 21st Century the planet is facing many such changes on scales unseen in human history. But what will such changes have on human society? More importantly, what do these changes mean for the nation-state and its security?

Canada needs to examine its environmental situation from a security standpoint. This research paper will examine the environmental security of Canada and investigate the most important areas of insecurity. To do this, the scattered literature must be

[1] NASA Earth Observatory,"Northwest Passage Open: Natural Hazards," http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=18964 (accessed November 13, 2010).

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analyzed and brought into security terms to properly recognize the importance of the environment from a security perspective. The top priorities for Canada will be identified, detailed, and subsequently analyzed for their security impact. This knowledge is critical to realistically maintain security.

Simultaneously, this research will act as a test to the Four Schools method of environmental security studies,[2] which has previously not been holistically applied to cases comparable to Canada. In fact, because of the new nature of the field, it is prudent that I include a short history and explanation of the field of Environmental Security.

What is Environmental Security(ES)?

The history of the rise of the environment as a prominent political issue is relatively short in comparison to many other mainstream political problems. Its origins can be traced back to the establishment of national parks and some of the first non-governmental organizations in the early 1900s. Real recognition began in the 1940s,[3] and the environment was still seen as a minor issue until the 1980s. Since then, it has quickly risen in prominence with the identification of environmental change, namely climate change, as a serious threat.

This rise of environmental issues evolved with the end of the Cold War and the "widening" of the conceptualization of security. The "new security agenda" began to include a wider array of non-traditional threats such as terrorism, proliferation of weapons of mass destruction, and epidemics, among others.[4] In the course of these events, academics developed the concept of "Environmental Security" (ES). Its broad view contrasts sharply with the traditional, narrower view of security. ES has helped change the approach to security issues, that is, to find solutions to the new problems

[2] Oli Brown, "Environment and Security: How Our Understanding of the Links has Changed" in *International Conference on Environment, Peac and Dialogue among Civilizations, Tehran, Iran, May 9-10 2005* (Montreal: International Institute for Sustainable Development, 2005).
[3] Pamela S. Chasek, David L. Downie, and Janet Welsh Brown, *Global Environmental Politics,* 5th ed. (Philadelphia, PA: Westview Press, 2010), p. xxi-xxiv.
[4] Simon Dalby, *Environmental Security,* (Minneapolis, MN: University of Minnesota Press, 2002), p. xx.

presented in the post Cold War era.[5] Now ES is acknowledged as a viable field of study that confirms the environmental elements of security.[6] A growing field of literature has come into existence over the past two decades:[7] many studies present complex modelling with substantial conclusions illustrating this field's growing rigour.[8]

Literature Review

Over the past few decades an abundance of literature has developed examining the connection between security and the environment. However, very few authors have published on the specific subject of Canada and its environmental security. Some books and studies mention Canada within their international scopes.[9] Only one study has examined Canada's environmental security (ES) as a whole, though mainly in relation to the "New Security Agenda" that arose from the events of September 2001.[10] Additionally, scholars in Canada do acknowledge ES concerns, but in a piecemeal fashion, concentrating on specific problems - each a necessary and worthwhile pursuit. But the environment is a highly interconnected series of ecosystems and actors, as is national security. Therefore, there is a need for a review and evaluation of Canada's ES situation of as a whole; the lack of a comprehensive investigation into Canada's ES can

[5] Maria Julia Trombetta, "Environmental security and climate change: analysing the discourse," *Cambridge Review of International Affairs* 21, no. 4 (2008).
[6] Frank McNeil, "Making Sense of Environmental Security," *North-South Agenda Papers* 39, no. 1 (2000): p. 1.
[7] Ruth Hull, Barbu Constantin-Horia, and Nadezha Goncha, *Strategies to Enhance Environmental Security in Transition Countries* (Dordecht: Springer, 2007), p. 4.
[8] Gunther Baechler, *Violence through environmental discrimination : causes, Rwanda arena, and conflict mode*(Boston: Kluwer Academic Publishers, 1999); Dalby, *Environmental Security; Hull, Constantin-Horia, and Goncha, Strategies to Enhance Environmental Security;* Brown, "Environment and Security"; Jon Barnett, *The Meaning of Environmental Security: Environmental Politics and Policy in the New Security Era* (New York, NY: Zed Books, 2001).
[9] Gwynne Dyer, *Climate Wars* (Toronto: Random House Canada, 2008); Kurt M. Campbell, et al. *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate* (Washington, D.C.: CSIS, 2007); Thomas Homer-Dixon, *The Upside of Down: Catastrophe, Creativity, and The Renewal of Civilization* (Toronto: Alfred A. Knopf Canada, 2006).
[10] Oli Brown, Alec Crawford, and Christine Campeau, *Environmental Change and the New Security Agenda: Implications for Canada's Security and Environment* (International Institute for Sustainable Development, 2008).

cause dangerous blind spots and a lack of preparedness. This thesis seeks to start the process of amalgamating the environmental security discourses in Canada.

There are a significant number of recognized studies that create distant projections of environmental change and their implications.[11] This is certainly a necessary component for effective security analysis, especially in light of likely environmental changes. This research will use the former (short-term) as a criterion of identification of significant threats and then use the latter (projections) to expand on these threats and their implications. This approach provides utility, depth, and substantiation to the potential of such threats.

The Canadian Government has acknowledged the importance of the environment in its International Policy Statement,[12] as well as from government departments themselves.[13] However, the government's interests in environmental security focus on foreign policy – i.e., sustainable development abroad – and rarely consider domestic implications of the environment security nexus. While ES is a concern to the government, its focus is external, primarily on developing countries, as are most ES considerations. The government did conduct one assessment of vulnerability to critical domestic infrastructure from environmental, accidental, and malicious sources, which, while not garnishing any exceptional attention, did apply ES ideas towards Canada's infrastructure.[14] There has been research into the particular problems that Canada is facing by scholars and concerned actors, though these studies primarily concentrate on environmental problems and solutions; security implications are not the usual objective of this research.

So what the literature does tell us, from its aggregate summary, are major areas of concentration in Canadian environmental security? Two areas of interest stand out as particularly important: the Arctic and Global Environmental Change (GEC). The Arctic

[11] Dyer, *Climate Wars*; Campbell, *The Age of Consequences*; Sarah Ladislaw, et al. *A Roadmap for a Secure, Low-Carbon Energy Economy: Balancing Energy Security and Climate Change* (Washington, D.C.: Center for Strategic and International Studies and the World Resources Insitute, 2009).
[12] Johannah Bernstein and Laura Leland, "Canada's Profile in IESPP." *www.envirosecurity.org.* http://www.envirosecurity.org/ges/inventory/IESPP_II-B_Canada_v1.pdf (accessed March 20, 2011).
[13] Environment Canada, Indian and Northern Affairs Canada, Fisheries and Oceans Canada, "Land-Based Pollution in the Arctic Ocean: Canadian Actios in a Regional and Global Context," *Arctic* 81, no. 1 (2008).
[14] Office of Critical Infrastructure and Emergency Preparedness, *Threats to Canada's Critical Infrastructure,* Ottawa, 2003.

environment is experiencing a historically unprecedented set of changes, causing increased action on the part of Arctic and non-Arctic states alike. This issue has been looked at by scholars all around the world and on the Canadian front by scholars of diverse backgrounds, including Rob Huebert, Mary Beth West, and Michael Byers. It is turning into the most important foreign policy issue in the minds of Canadians[15] - one that is spurred by environmental change. Secondly, Canadian environmental security will find itself tightly intertwined with global environmental issues. Foreign environmental changes and events will affect us just as our domestic issues will affect other states and actors. It is a serious concern for the world at large and is becoming a concern for Canada. There are other environmental security threats to Canada: the range of problems is as diverse as the Canadian environment itself. However, for the pragmatism required of security studies, these two cases are the most salient and therefore constitute my case study priorities.

Before these issues are examined in detail, the methods and concepts of Environmental Security need to be specified.

Methods and Concepts

This study will use a broad definition of security in order to recognize the nebulous range of effects the environment can have on security. For Canada and its particular situation in the world, this means security needs to encompass the "survival of the nation-state...[the] core values of Canada" [16] and the environment as well. Because Canada is an industrialized nation, we can operationally define *threats* as any potential events or pressures generated by environmental change that substantially alter the operations of the government, economy, and citizens of Canada. But, because ES recognizes the importance of the environment itself, protection for the environment

[15] Jill Mahoney, "Canadians rank Arctic sovereignty as top foreign-policy priority," The Globe and Mail, http://www.theglobeandmail.com/news/politics/canadians-rank-arctic-sovereignty-as-top-foreign-policy-priority/article1881287/?cmpid=rss1 (accessed March 20, 2011).
[16] Cameron Ross, "Future Security Challenges - a Military Perspective," *Hal Kvisle Lecture Series.* (Calgary, AB: The School of Public Policy Students Association, Feburary 3, 2011).

must be duly noted. With security defined, the method for determining the environment's effects can be explained.

Linking the environment with security is a complex task. There are different ways of conceptualizing the pathways, especially when different definitions of security are considered (e.g. social, economic, or human security have different targets, and therefore different pathways); thus far, there has been no overarching definition or model of ES,[17] especially as it is torn between the environmental political agenda and that of security studies.[18] Early studies opted for analysis with little engagement with theory, resulting in ad hoc definitions and conceptualizations. Over time, four main causal linkages have evolved significant capability in ES: these "schools of thought" have been identified by Oli Brown of the International Institute for Sustainable Development[19] and NATO.[20]

The first pathway between environmental change and security is mainly spearheaded by Thomas Homer-Dixon and the Environmental Change and Acute Conflict Project (ECACP), which has further evolved to become the "Toronto School" of ES. The main idea underlying this approach is that environmental scarcity causes conflict through direct pathways or possibly through indirect means including migration, the perception of relative scarcity,[21] or the strain put on society (i.e., economies, institutions, group relations).[22]

The second school, from Günther Baechler and the Swiss Environment and Conflicts Project (ENCOP), concentrates on how simple scarcity conflicts are rare and that degradation of renewable resources in developing or transitional economies causes socioeconomic crises and endemic violence that tend to target discriminated groups

[17] McNeil, "Making Sense of Environmental Security," p. 1.
[18] Barnett, *The Meaning of Environmental Security,* p. 1.
[19] Brown, "Environment and Security."
[20] Hull, Constantin-Horia, Goncha, "Strategies to Enhance Environmental Security."
[21] Dalby, *Environmental Security,* p. 44.
[22] Thomas Homer-Dixon and Jessica Blitt, *Ecoviolence: Links Among Environment, Population, and Security* (Boulder, CO: Rowman & Littlefield Publishers, Inc., 1998), p. 15.

within these societies.[23] This violence or insecurity is born from "environmental discrimination": a social cleavage that becomes the front line for conflict.[24]

The third idea connecting the environment and security was developed by the International Peace Research Institute in Oslo (PRIO) and has been advanced by the World Bank. This approach points to an abundance of resources as a potential threat to security, examining the impacts from different types of environmental stimuli. The presence of natural resources is not itself a trigger to violence, but there is a significant degree of correlation between the total percentage of GDP based on resources and the presence of civil wars,[25] as well as a correlation between the presence of valuable natural resources and the incidents of civil wars. [26]

The fourth perspective on the environment as a factor in security involves looking at the interconnections of society and the environment as a network. This is an application of a different type of security, *network security*, which addresses the interdependent complexity of large systems and their vulnerabilities. Network threats are evaluated for their effect on systems, and conversely "threat networks" (e.g. Al-Qaeda) also fit under the terms of this method.[27] When connected to ES, this perspective has been able to recognize the environment as an important factor in the security of states, on par with terrorism, epidemics, and other large-scale, non-military threats.[28] For environmental security, this means examining the connections that the environment has with human institutions. This approach identifies not only direct, local threats, but also ones that are more distant yet as considerable in effect. Network security bridges the gap between state-based security and the global view of environmental problems.[29]

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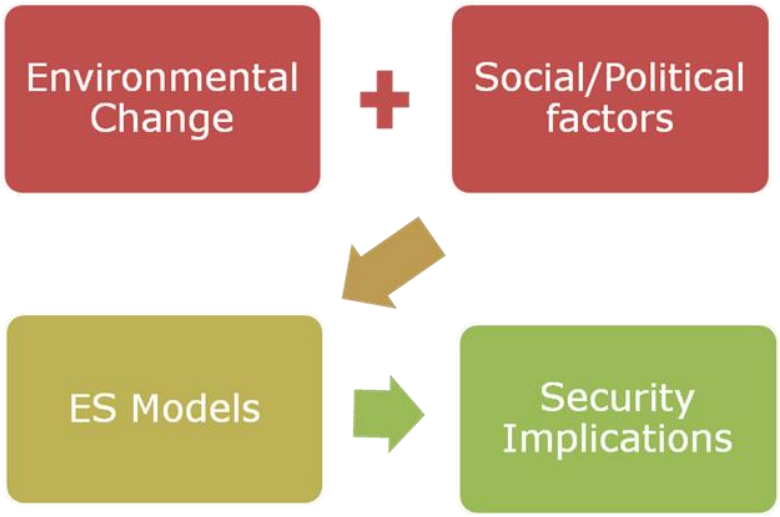
[23] Baechler, *Violence Through Environmental Discrimination,* pp. 86-87.
[24] Dalby, *Environmental Security,* pp.. 52-53.
[25] Ian Bannon and Paul Collier, *Natural Resources and Violent Conflict : Options and Actions* (Washington, D.C.: World Bank, 2003), pp. 2-3.
[26] Bannon and Collier, *Natural Resources and Violent Conflict*, pp. 17-19: Paivil Lujala, Nils Petter Gleditsch and Elisabeth Gilmore, "A Diamond Curse? Civil Wars and a Lootable Resources," *The Journal of Conflict Resolution* 49, no. 4 (2005).
[27] R. Matthew et al, "Networks of Threats and Vulnerability: Lessons from Environmental Security Research," *Environmental Change and Security Project Report* 10 (2004): p. 36.
[28] Matthew et al, "Network of Threats and Vulnerability,"p. 37.
[29] Max Manwaring, *Environmental Security and Global Stability : Problems and Responses* (Lanham, MD: Lexington Books, 2002), p. 1.

For the investigation of Canada's ES concerns, the Four Schools method described will be employed. In the literature, no scholarship was found that used the Four Schools approach to environmental security within the same case and few studies have applied any of these models to industrialized countries. Many ES scholars do work with the models of others, but none have adopted all four approaches within a single study. While one may critique the use of this method on the fact that they have not all been used within one study, they are all well scrutinized and tested frameworks for analysis that are not likely to be degraded through combination.

Each approach will be examined first for current signs of environmental change as well as projected changes. In conjunction, salient social and political factors will be identified. These two sets of information will be scrutinized through relevant and applicable ES causal models to identify the topic's security impact. The simplified process is diagrammed below:

Figure 1: The "Four Schools" Approach



The models will be applied discriminately: not all of the models are applicable all of the time. To be effective and efficient, certain environmental changes will only be

evaluated by certain models and not others. For example, when scarcity may exacerbate social cleavages, Homer-Dixon's and Baechler's approach will be invoked as the network security approach may be inapplicable to that situation. Using such a method tests the field of environmental security as a flexible framework for analysis. By the particular construction of each ES school, they can only work with certain threats. The integration of all four schools produces a more holistic picture of ES. While imperfect, it is still a better means of evaluation than the use of a single school or theory approach. This compound approach is also needed to investigate the possibility of "negative-synergy": the collusion of different types of environmental threats could easily become exponentially more powerful and destructive than previously thought.[30] However, it may be difficult to make all connections due to the complexity of the ecosphere and human sphere. Any recognized connection between environmental threats is still a useful point of information.

Conclusions from this research may identify gaps in the four schools method: new links between environment and security may be observed or nuances to approaches may need to be generated to improve their explanatory/predictive power. Expanding the scope of the theories is vital to provide generalizability; the four schools approach can be applicable outside of the small scope it has been applied to thus far. This study will use the conclusions that are drawn for suggestions to ES as a whole, emphasizing any exceptional or unique findings.

From the theoretical framework worked out above, we can now assess the two strategic ES priorities facing Canada. The first and most immediate is our Northern Territories.

The Arctic

The Canadian Arctic is an awe-inspiring place. On one hand it is seen as the frontier of wilderness filled with untapped bounties amongst the ice-clad land and sea,

[30] Homer-Dixon, *The Upside of Down,* pp. 105-106.

the Ultima Thule.[31] Yet it is much more than that to the peoples of its lands. It is a home that extends historically to the beginning of time where a complex relationship has evolved between its native people and the ecosystem.[32] For the native populations of the Yukon, Northwest Territories, and Nunavut, the Arctic is their lifestyle, land, and home for countless generations. The whole of Canada finds the Arctic a component of our identity, a essential part of what makes Canada the country it has been and continues to be today. A recent international poll found that a majority of Canadians recognize the Arctic as the foremost foreign policy issue facing Canada.[33]

This area of Canada is undergoing major environmental change. While in the past decades ideas about the polar ice caps melting were only hypotheses or conjectures, there are now measurable and highly significant changes present in the Arctic. Global affairs have evolved as always, but a recent trend has put an accelerated interest on Northern territories. The next section of this paper looks to forces at play in the changing situation of the North: the environmental changes, effects of economic development, and the relevant scope of international relations.

Environmental Changes

While the Arctic has been long thought as a distant, separate realm from the rest of the globe, it is highly vulnerable to different forms of environmental change; possibly more so than any other geographical region in the world. The most substantial cause of environmental change in the Arctic is undoubtedly climate change.

The first indicator of environmental change in the Arctic is increasing average air temperatures in northern Canada, which slowed temporarily in 2009. However, 2010 has already shown new records in average air temperatures over the Arctic.[34] This

[31] J. D. Greenberg, "Mounting Tension and Melting Ice: Exploring The Legal and Political Future of the Arctic: The Arctic in World Environmental History," *Vanderbilt Journal of Transational Law* 42, (2009):p. 1309.
[32] Greenberg, "The Arctic in World Environmental History," pp. 1309-1310.
[33] Mahoney, "Canadians rank Arctic sovereignty as top foreign-policy priority," 2011.
[34] J Richter-Menge and J.E Overland, "Arctic Report Card 2010," National Oceanic and Atmospheric Administration (NOAA), http://www.arctic.noaa.gov/reportcard, (accessed October 21, 2010), p. 6.

warming trend extends back throughout the twentieth century;[35] with an average increase of 5ºC over Arctic land masses.[36] It is important to note that the effects of warming are most pronounced in the Arctic, as the loss of snow and ice means less reflective capability and therefore more absorption of heat. This has been seen in the measurements of various studies, with the rate of increase in average temperatures being twice the rate of the rest of the world.[37]

Increases in air temperature mean the loss of ice, namely sea ice. The minimum ice cover in 2010 has only been 31 per cent of the 1979-2000 average, which is no anomaly when considered that the past 8 of 10 lowest minimum covers have been within the past decade.[38] Not only is this ice disappearing, but the trends of ice formation have been altered. Now with more sunlight on the dark ocean waters rather than white ice sheets, the Arctic ocean is retaining heat for a longer duration, causing ice to form later in the season.[39] The loss of sea ice translates into a great deal of different effects. One minor effect is that the loss of ice in the Arctic has caused approximately 15 per cent of the global rise of sea-level.[40] Sea ice also acts as a "shield" to the vulnerable ecosystems of the Arctic Ocean,[41] the loss of which has allowed the composition of sea water to become more acidic and therefore corrosive to certain types of small organisms - a low-level shift that may disrupt the entire food web in the Arctic.[42] Combined with the other effects of climate change, there have been predicted and verified changes in the ecosystems of the Arctic.[43]

While the majority of change is derived from global climate conditions, the Arctic is also vulnerable to the pollution from southern regions. Industrial and agricultural

[35] Richter-Menge and Overland, "Arctic Report Card 2010," p. 8.
[36] Mary Beth West, "Arctic Warming: Environmental, Human, and Security Implications," *Vanderbilt Journal of Transnational Law* 42, no. 4 (2009): p. 1083.
[37] L. Bernstein et al, "Climate Change 2007: Synthesis Report. An Assessment of the Intergovernmental Panel on Climate Change," Intergovernment Panel on Climate Change, http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf (accessed March 20, 2011): p. 30.
[38] Richter-Menge and Overland, "Arctic Report Card 2010," p. 15.
[39] Richter-Menge and Overland, "Arctic Report Card 2010," p. 6.
[40] Bernstein et al, "Climate Change 2007: Synthesis Report," p. 30.
[41] K. C. Gordy, "Dire Straits: The Necessity for Canadian Sovereignty in the Arctic Waterways," *Fordham Envtl. Law Rev.* 20, (2010): p. 551.
[42] Richter-Menge and Overland, "Arctic Report Card 2010," p. 24.
[43] Bernstein et al, "Climate Change 2007: Synthesis Report," p. 33.

contaminants are accumulating in the Arctic from the multitude of rivers that flow into the area and ocean as well as the atmosphere.[44] These contaminants enter at low levels of the food chain (e.g., plankton) and build up in the fatty tissues of higher predators (a process known as biomagnification). This is especially dangerous considering the rather short and concentrated food chain of the Arctic, which has resulted in the specialization of species and irreparability in the ecosystem.

These environmental effects have caused change in human behaviours as well. Below economic interests and international tensions are discussed to provide a more comprehensive understanding of the security implications.

Effects of Economic and International Interests

Due to the undeveloped virtue and the increasing accessibility of the Arctic, there is a great deal of anticipation for the development of the vast natural resources there. This development has already been seen: an example is the discovery and excavation of diamonds which has taken Canada from a non-diamond producing country to creating a $1.6 billion dollar industry for the North, producing a major increase in the GDP growth of the area.[45] Many other precious resources have been identified in the region. Speculations on the vast deposits of oil, natural gas, and minerals mean companies are actively working to expand northward, including on Canadian soil.

While economic interests are human-based phenomena, in the Arctic they are prompted by environmental change and on a scale that will necessarily affect security from an ES standpoint. Such interests may not seem harmful on their own - economic development has increased human happiness in most cases. There are complex ways the development of these resources can affect the security of Canada, which will be discussed in the following sections. What is key to remember here is that the resources are developing interest and alongside increasing accessibility, causing human action.

[44] Environment Canada, Indian and Northern Affairs Canada, Fisheries and Oceans Canada, "Land-Based Pollution in the Arctic Ocean," p. 114.
[45] Craig Byrd, "Diamonds still shining brightly for Canada's north," Statistics Canada, 2006, http://www.statcan.gc.ca/pub/65-507-m/65-507-m2006007-eng.pdf (accessed March 20, 2011).

These human actions, in turn, cause impacts on the security of the Arctic. This is certainly relevant in international relations.

As the Arctic shifts in accessibility, countries are now turning their attentions to the strategic values of the North. All of the Arctic states - Russia, Norway, Denmark, Canada, and the United States - are making efforts to expand and enforce their boundaries. This is causing international legal disputes in many cases as well as militarization of the Arctic, as J.D. Greenberg and others indicate.[46] Countries are now seeing tensions between NATO and Russia rise amongst a so-called "gold-rush" for Arctic oil supplies.[47]

Arctic countries claim to be cooperating on this issue, making public statements for greater negotiations and international commitments in the North.[48] Yet, the military forces of these states are expanding their Arctic capabilities at the same time.[49] Current relations between Arctic countries are increasingly tense but, at the very least, there are significant attempts to cooperate. Canada and Russia have recently used the UN to settle disputes over the Lomonosov Ridge, a resource-rich area on the bottom of the Arctic sea that has major implications for the territory of both states.[50] Binding agreements are also being produced, such as the anticipated treaty to coordinate search and rescue operations in the Arctic.[51]

Non-arctic countries are also interested in the North. South Korea, Japan, and China all have potential gains for resources and trading routes in the opening of the Arctic. Their interest in the outcome can have influence in larger, global institutions

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[46] Greenberg, "The Arctic in World Environmental History," pp. 1384-1385; Rob Huebert, *The Newly Emerging Arctic Security Environment.* Canadian Defence and Foreign Affairs Institute, http://www.cdfai.org/PDF/The%20Newly%20Emerging%20Arctic%20Security%20Environment.pdf, (accessed March 29, 2011).

[47] Greenberg, "The Arctic in World Environmental History," p. 1381.

[48] Huebert, *The Newly Emerging Arctic Security Environment,* p. 1.

[49] See Huebert, *The Newly Emerging Arctic Security Environment,* for an in-depth comparison of stated cooperation objectives and the militarization of the Arctic.

[50] BBC News, "Russia and Canada seek UN ruling on Lomonosov Ridge," British Broadcasting Corporation, http://www.bbc.co.uk/news/world-europe-11331904 (accessed January 2, 2011).

[51] CBC News, "Arctic search and rescue treaty in works," Canadian Broadcasting Corporation, http://www.cbc.ca/canada/north/story/2011/01/06/arctic-search-rescue-treaty.html (accessed March 20, 2011).

(eg., the UN). While the Arctic has long been thought of as the realm of only the few northernmost countries of the world, it is abundantly apparent that it is a key area of strategic concern for both the local states and the international community as a whole.

Security Implications

Many conclusions are possible from the changes in the environment in the North. But one wide-ranging implication comes through as significant – the new-found accessibility of the Arctic regions of Canada. The PRIO/World Bank school of environmental security has some useful concepts for analysis: the Arctic is an untapped bounty of resources that is becoming a practical option for development. This development may cause conflicts between different actors over the potential wealth of the area, in both regional and domestic fronts. Recognizing the same danger of increased openness of the Arctic, the concepts behind network security remind us that these environmental changes have a mass effect on the Arctic and Canada as a whole. This section will discuss four important topics relevant to the security of Canada. First, the overall trend in accessibility will be discussed, including the Northwest Passage (NWP). The second issue to recognize is the particular implications that environmental and social forces will have on the Northern peoples, including their communities, lifestyles, and well-being. Lastly, because the environment generates security implications, it too is vulnerable as a target - an evaluation of the ecological security of the Arctic is necessary to recognize indirect and delayed effects.

Escalating Accessibility

The loss of sea ice and other major environmental trends in the North combined with the economic interests of multiple actors, means that the Canadian Arctic will inevitably see an increase the presence of human activity. Our northern most borders have had little need to be defended in the past, especially in a direct manner.[52] But

[52] The Cold War did cause attention to the Arctic as a regional theatre for confrontation and nuclear proliferation (Greenberg, 2009, p. 1388) as well as the border has been maintained against other incursions since the fall of the Soviet Union (such as the continuous Russian bomber incidents (Leblanc, 2010)).

speculation certainly calls for more traffic in the Canadian Arctic, especially in the NWP.

The NWP is increasingly being eyed as a viable international shipping route. Some projections claim that the route will be a completely effectual route for transport by 2050.[53] However, NASA satellite imagery shows the Passage to be almost completely open [54] and it is already being used. Traffic for the strait has doubled in 2010, with the Canada Borders agency permitting 18 vessels to pass through as of September 2010. Dr. Rob Huebert has pointed to the likelihood that this could be the tipping point for shipping through the Northwest Passage.[55]

With the opening of a previously unused body of water like the NWP comes a host of issues - primarily on the legal status of the passage. To avoid a lengthy discussion of the debate over the status of the strait and the implications, this research will simply focus on the affirmable statement that the NWP will simply have greater traffic no matter the status. This assumption still provides a useful point for analysis as no matter the legal status of the strait, the environmental change here will have major security implications for Canada.

Alongside the NWP, the entire Northern boundary is becoming increasingly open to the world. This access can mean challenges to Canadian sovereignty by foreign powers, as other states have been penetrating our borders. While not in an overtly military or threatening manner, a few recent cases stand to show that our borders have been threatened. Denmark challenged Canadian sovereignty with the infamous occupation of Hans Island; luckily the dispute ended with a peaceful agreement over the island,[56] but the fact remains that military expeditions were mounted by both sides in the name of territorial claims. Even our long-time friend, the US, has violated our

[53] West, "Arctic Warming: Environmental, Human, and Security Implications," p. 1097.
[54] NASA Earth Observatory,"Northwest Passage Open: Natural Hazards," http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=18964 (accessed November 13, 2010).
[55] CBC News, "Northwest Passage traffic up in 2010," Canadian Broadcast Corporation, http://www.cbc.ca/canada/north/story/2010/09/20/northwest-passage-ships-inuvik.html? (accessed March 20, 2011).
[56] Embassy, "Hans Island Agreement," The Hill Times Publishing, http://www.embassymag.ca.ezproxy.lib.ucalgary.ca/page/view/.2005.september.21.tp7 (accessed March 20, 2011).

Northern borders several times: the oil super tanker Manhattan in 1969, the icebreaker Polar Sea in 1985,[57] and recently sending military submarines under the ice through territorial waters (National Post, 2005).

Enforcing Canada's sovereignty in the North has been a controversial and costly process. Much of Canada's northern infrastructure has been too undeveloped to cope with modern threats, such as the lack of ability to detect submarines travelling under the Arctic ice.[58] In 2010, Canada has been investing billions of dollars in modern fighter jets, F-35s, in order to enforce Canadian sovereignty in the North (among other roles).[59] However, while these fighters serve to support the general claim to sovereignty against other state actors, such as the repetitious testing of Canadian airspace by Russian bombers,[60] they do not solve the issue of increased maritime non-state security issues.

Fears of criminal activity are another concern, acknowledged by scholars in the general discussions of increased accessibility.[61] Canada is not yet prepared to defend the borders and maintain the necessary control in this regard. Dr. Rob Huebert and Dr. Michael Byers have demonstrated the lack of Canadian enforcement in the Arctic in the near-past: illegal trafficking incidents have shown the inability of the surveillance and dearth of procedure by Canada.[62] The Canadian government has even recognized the possibility of terrorism in the North with the disclosure of an unclassified report

[57] CBC, "Battle for the Arctic heats up," Canadian Broadcasting Corporation, http://www.cbc.ca/canada/story/2009/02/27/f-arctic-sovereignty.html (accessed March 20, 2011).
[58] CBC, "Battle for the Arctic heats up."
[59] Josh Wingrove, "Part 4: How much is Arctic security worth?," The Globe and Mail, http://www.theglobeandmail.com/news/national/time-to-lead/military/how-much-is-arctic-security-worth/article1774292/?cmpid=rss1 (accessed March 20, 2011).
[60] Daniel Leblanc,"Russian jet confrontation a 'close one,' Defence official says," The Globe and Mail, http://www.theglobeandmail.com/news/politics/ottawa-notebook/russian-jet-confrontation-a-close-one-defence-official-says/article1657338/ (accessed March 20, 2011).
[61] Ken Crist,"Canada and the Arctic: The Issue of Northern Sovereignty," Woodrow Wilson International Center for Scholars, http://www.wilsoncenter.org/index.cfm?fuseaction=events.event_summary&event_id=278388 (accessed March 20, 2011).
[62] Crist,"Canada and the Arctic: The Issue of Northern Sovereignty."

detailing concerns about the potential of the Arctic as a future venue for drug trafficking, illegal, or even terrorist activity.[63]

From the evidence and insecurities analyzed, the environmental changes present in the North show a great threat to the borders of Canada. These security implications fit in neatly with the traditional scope of security: borders are threatened; therefore it is a threat to the state.

Yet, from an ES standpoint, two more possibilities are created. The first, deduced from the PRIO/World Bank approach, is that the presence - or rather discovery - of resources can cause insecurity as different actors try to gain dominance of the resource. This is a combination of both the Northwest Passage as a resource itself and the vital access it gives for the development of resources across the Canadian Arctic. This approach primarily aims to explain conflict over expensive, loot-able resources in a domestic context; it still provides relevance for the international actors and setting of the northern border. The environmental security approach here needs an adaptation: while it is an environmentally-induced threat, the insecurity is heavily generated from the international context. The discovery of resources does not necessarily mean violent conflict in the Arctic. Instead, increased traffic in the north is the threat to the people and environment itself. Looking at the NWP in particular, the new access means that sovereignty could be taken away - essentially a more traditional threat recognized by the whole of security studies. The NWP could be thought of as a resource: its useful and open nature means actors will use it without regards to its well-being - destroying the immediate and connected ecosystems.

Second, this environmental change has altered underlying factors in the network of the Arctic and Canada as a whole. Here the idea of network security is a very important frame with which to view these problems. Previously unimportant and susceptible nodes in both the environment and society of Canada will have greatly increased attention: currently, these nodes are far too weak and under-valued, which thereby means a weak link in both Canadian security and the environment. As stated,

[63] CBC, ``Arctic terror threats real: security agencies,"Canadian Broadcasting Corporation, http://www.cbc.ca/canada/north/story/2010/11/10/cp-arctic-security-threats.html? (accessed March 20, 2011).

because of the weak border enforcement the North is an area for smuggling and potential abuses of the environment and the local people. A state is necessarily predicated on its people - and this fact is not seen in greater magnitude than in the sparsely populated North - the security of Arctic communities and Native peoples is a major concern and specific implications for them are discussed in the following section.

Human Security Concerns

The Canadian citizens that make the Territories their home are crucial elements of northern sovereignty. Not only is their historical and contemporary presence a major predicate for Canadian sovereignty, but they are actively participating as elements of Canadian enforcement. The primary examples of this are the Arctic Rangers: Native men and women that patrol and enforce Canadian law alongside the armed forces stationed in the North. As part of the North and directly subject to environmental and economic changes there, it is crucial to recognize the effects on their communities, traditional lifestyle, and well-being.

Recognizing the current and future duality in the North, between indigenous communities and migrant workforce that will come with the development of resources, Gunther Baechler's concept of "environmental discrimination" becomes an important consideration. As previously described, environmental discrimination is the systematic inequality of access to natural resources[64]. Such discrimination could occur if legislation is administered from the federal government without local and provincial consultation of First Nations peoples. If development occurs without working with the Northern peoples, serious social consequences could occur.

The changes in the North will inevitably affect the very lifestyle of the First Nations living there. The economic development of the North will cause social and cultural changes in primarily indigenous communities as large populations of workers come to the North. The shift in the economic conditions could bring a great deal of benefit to many indigenous people. Yet it could also drastically threaten the traditional lifestyle of the North. If Native peoples are only able to access the benefits of

[64] Baechler, *Violence Through Environmental Discrimination,* p. 280.

development by whole-hearted adopting imposed regulations and institutions, development thereby destroys the Native culture. A specific example of this is the mother tongue of many aboriginals in the North, Inuktituk.[65] If government services, education, and other key parts of society demand the use of English or French, rather than using Inuktituk, the already threatened language's status would be further damaged if not pushed over the brink into obscurity. This issue is especially important, as the future migrants to the area will likely not speak Inuktituk; in turn, the large number of migrant workers will mean a prevalence of other languages in many communities. Without specific programs and policies to protect the Native tongue, it could very well be wiped out by the consequences of environmental change.

The environment will also directly impact the people living in the Arctic. A large component of the northern diet subsists on food that comes directly from the ecosystem as both a part of the traditional lifestyle and as a necessary source of nutrition. If the ecosystem is seriously damaged, a number of effects will directly hit the population living there (especially the Native communities). Pollutants are quickly magnified in the food web of the Arctic ecosystem. This is a direct security threat to the health of the northern peoples, for they rely on a major amount of their food sources and cultural practices.[66]If they eat food sources tainted by pollution, the pollutants are transferred to them and build up, causing toxic effects in high enough doses.

Even if environmental and strict safety regulations are imposed on companies operating in the North (which have thus far been lacking[67]), there will inevitably be accidents that cause substantial pollution. While attempts can be made to capture fallout and restrict environmental damage, many pollutants will persist in the environment. Traces of the Exxon Valdez oil spill of 21 years ago are still being found in the local environment of Alaska; some entire fish stocks are entirely missing since the

[65] Mary Simon, "Inuit and the Canadian Arctic: Sovereignty Begins at Home," *Journal of Canadian Studies/Revue d'Actudes canadiennes* 43, no. 2 (2010): p. 253.
[66] Gordy, "Dire Straits," pp. 585-6.
[67] Before the BP Gulf of Mexico oil spill in the summer of 2010, Canadian federal regulators had allowed oil companies to use blowout-prevention equipment that had not been adequately tested. See (Mayeda, 2010).

spill.[68] Other general changes that significantly affect the food web of the North will also disturb the food supply of northern peoples: if fish stocks are harmed, less fish can be sustainably harvested.[69] Even worse, if harvesting efforts are scaled up to try and meet the same level of production, the yield may cause the fish stock to collapse, in some cases it could cause extinction.[70]

Protecting the cultural interest in the Arctic is a substantial component to modernizing the claim to sovereignty in the North.[71] The historical occupation of the North by the Inuit and their subsequent transfer of title to Canada gives credence to the sovereignty of Canada[72]. Development in the North must also work to actively improve the living conditions of the existing communities there to demonstrate the importance of the claim of Canadian sovereignty there[73]. Many communities are said to be lacking in the quality of health care, education, and other social goods that are assured to Canadians elsewhere in the country.[74]The most holistic solution appears to be the inclusion of the Native peoples to serve their cultural and lifestyle goals, economic development interests, and the sovereignty of Canada as a whole. This conclusion is shared by different scholars and actors concerned with the North.[75]

Lastly, it is important to recognize the effects these security implications will have on the environment itself. Just as social forces produce further socio/political effects, environmental security issues further effect the environment in feedback effects.

[68] BBC News, "*Two decades since the Exxon oil spill,"* British Broadcasting Corporation, http://news.bbc.co.uk/2/hi/programmes/world_news_america/8830774.stm (accessed January 2, 2011).
[69] As ecological harvesting models show, "[be]cause the harvesting effort is constant, the yield varies depending on the size of the exploited population." If the size of a population of fish is decreased in a sustainable harvesting model, the yield also decreases. See Freeman et al., p. 476 for an explanation of resource ecology and maximum sustainable yields.
[70] Bill Freedman, "*Ecology: A Canadian Context,"* (Toronto, ON: Nelson Education, 2011) 476.
[71] Gordy, "Dire Straits," p. 596.
[72] Gordy, "Dire Straits," p. 596.
[73] Gordy, "Dire Straits," p. 593.
[74] Simon, "Inuit and the Canadian Arctic," pp. 252, 254.
[75] Simon, "Inuit and the Canadian Arctic."

Ecological Security

The environment itself is in further danger from the increased development and increased human presence in the North.In a manner of speaking, environmental change begets human behaviour, which consequentially causes further environmental change.

The predicted increase in ships will inevitably have a compound effect on the environment there. A recent study[76] points to the impact of emissions generated by ships on the local atmosphere and snow of the Arctic. The soot from combustion of fossil fuels alters the reflective capacity of the Arctic in several ways: soot depositing on snow will cause it to absorb more heat; particulate may "seed" clouds and cause more cloud-based reflection of solar rays.[77] Additionally, the increase in gases in the local atmosphere of the Arctic could have far greater, immediate impact than the gases that migrate to the north.[78] This combination of changes in the environmental and human behaviour mean a positive feedback loop is generated here: the loss of ice means more traffic, which in turn means more loss of sea ice.

Other predicted changes in the ecosystem are not positive either. Continued trends project dire threats to biodiversity, ecosystem structures, and shifts in the geographical range of species.[79] Arctic vegetation is likely to shift, causing a fundamental change in the composition of the Arctic habitat.[80] In the food web of the Arctic, the few higher level predators are the most susceptible to disturbances in the ecosystem – such as the iconic polar bear.[81]Some species may benefit, but among them are such "pests" and parasites as different types of tree-killing beetles that will

[76] J. J.Corbett et al,"Arctic shipping emissions inventories and future scenarios," *Atmos. Chem. Phys.* 10, no. 19 (2010).
[77] Corbett et al,"Arctic shipping emissions," p. 9698.
[78] Corbett et al,"Arctic shipping emissions inventories and future scenarios," p. 9698.
[79] Bernstein et al, "Climate Change 2007: Synthesis Report," p. 48.
[80] Susan Joy Hassol, "Arctic Climate Impact Assessment Report: Impacts of a Warming Arctic," Arctic Council and the International Arctic Science Committee (IASC), http://amap.no/acia/ (accessed April 23rd, 2011), p. 9.
[81] Bernstein et al., "Climate Change 2007: Synthesis Report," 31; Hossol, "Impact of a Warming Arctic," p. 58.

negatively impact or possibly devastate their local habitats[82]In fact, such changes in the Arctic will reverberate globally, as many species migrate to the North every year for their summer breeding grounds.[83] This includes certain resource stocks – such as fish – that will experience shifts in concentrations causing certain localized effects farther south, devastating local economies in areas reliant on fish stocks such as Newfoundland/Labrador.[84]

Conclusions from the Arctic

The Arctic has a large number of concerns being generated from the changing environment. These changes in themselves show a great potential for security threats, but are greatly compounded by the social factors present in Canada and the international realm.

The environmental changes are already underway. Luckily, Canada is heeding these concerns. In order try and preserve the delicate Arctic environment, the Canadian government is investigating the possibility of establishing a national marine conservation area.[85] Research is also being conducted for the primary reason of reinforcing the claim to the Arctic waters, which is increasingly being eyed as a "key component" of sovereignty claims.[86] From this and other actions, the government is at least taking some measures to protect the delicate Arctic ecosystem in a manner that further purports the Canadian claim to sovereignty: a relatively "close to complete" solution from an environmental security standpoint.

Canada needs to assess the full extent of the potential changes on both the local population and ecosystem. Some research has been produced, but more assessments need to be conducted in order to properly recognize how Canadian Arctic ecosystems

[82] Hassol, "Impact of a Warming Arctic," p. 54.
[83] Hassol, "Impact of a Warming Arctic," p. 45.
[84] Hassol, "Impact of a Warming Arctic," p. 64.
[85] Gloria Galloway, "Ottawa moves to protect Serengeti of the Arctic," The Globe and Mail, http://www.theglobeandmail.com/news/politics/northwest-passage-marine-conservation-park-in-the-works/article1827418 (accessed March 20, 2011).
[86] CBC News, "Arctic research linked to sovereignty push," Canadian Broadcasting Coporation, http://www.cbc.ca/canada/newfoundland-labrador/story/2010/07/19/arctic-research-coast-guard.html (accessed March 20, 2011)

will be affected. This research then can to be used in order to protect the environment from the inevitability of increased human presence, to help create proper regulation and protection for the ecosystem. Allowing unchecked environmental change from both current and future sources will seriously harm the environment in ways that affect the security of the people living there and, in the face of climate change and other transboundary effects, across Canada (if not the globe).

There are definite ways of lessening a state's vulnerability to climate change. A study focussed on Nunavut and the industries based on renewable natural resources show viable methods to prepare the Arctic communities for further environmental changes.[87]

The natural environment is not the only area that will require action. Foreign nations are a major concern for the North: good diplomacy has its place in the modern era faced with large-scale, common environmental issues. Cooperation is not simply an option but a necessity to ensure long lasting stability. The rising international interest in the area means that Canada must prepare itself and in the right attitude and manner. Arctic nations should be wary of a potential arms race over escalating tensions in the region - Canada must seek to "break the cycle" of military escalation.[88] Additionally, economic pressures should be faced with scrutiny. We should continue to develop, but be wary of possible dangers and risks while maintaining the necessary political willpower to protect our long term and environmental interests. Furthermore, attention should be paid to the potential dangers underlying the social dichotomy in the North's future between traditional lifestyles of the Inuit and other native groups and the communities that will come and grow with the development of natural resources in the Arctic. Development must both respect the rights of Northern peoples and work to minimize impact on the environment in order to preserve traditional lifestyles there.

In summary, Canada needs to prepare for environmental change and seek to protect the vulnerable Arctic ecosystem, mitigate social change, and retain sovereignty while working cooperatively with other Arctic states. Otherwise, many of the potential

[87] James Ford et al., "Reducing Vulnerability to Climate Change in the Arctic: The Case of Nunavut, Canada," *Arctic,* 60, no. 2 (2007).
[88] Huebert, *The Newly Emerging Arctic Security Environment,* p. 23.

problems described above could devastate the precious Canadian North and Canada as a whole.

It is easy to recognize that changes in the Arctic are primarily produced from climate change; a warming Arctic is one of many implications of global environmental change that Canada is currently enduring. In the next part of this paper, other threats that global environmental changes poses for Canada are considered.

Threats from Abroad

Environmental change is a global issue. Many changes are happening on a global scale and have wide-reaching security implications. Because of the near ubiquitous presence of humans across the globe, changes are prominent in almost every local environment. These changes will impact the environmental security of both the international system and other countries, just as they have been recognized to affect Canadian security. In the modern era of globalization, Canada's own situation is dependent on environmental security abroad.[89] This dependence is caused by a number of issues investigated below: problems in the global commons, natural disasters, environmental migrants/refugees, conflict abroad, and transnational protests.

Global Commons

It is essential to recognize in dealing with the political issue of the environment the global commons and the tragedy of freedom associated with it; the fact that any resource held in equal access to multiple independent actors will be abused by the rational conclusion of utility maximization.[90] An example of a global commons carrying a threat for Canada is the atmosphere - this physical element of the ecosystem is borderless, shared by every country on earth.

[89] Brown, Crawford, and Campeau, *Environmental Change and the New Security Agenda,* p. 19.
[90] Ken Conca and Geoffrey D. Dabelko, *Green Planet Blues: Environmental Politics from Stockholm to Johannesburg,* 3rd ed. (Boulder, CO: Westview Press, 2004), pp. 37-44.

The atmosphere has been abused for generations. From the industrial revolution onwards, pollutants and greenhouse gases have been continuously put into the atmosphere at artificial levels by human action across the globe. Canada's own emissions record is mostly deplorable: a study comparing OECD members ranked Canada 28th out of 29 countries on twenty-five indicators of sustainability.[91] This is especially deplorable in regards to our greenhouse gas emissions that are 48% above the average OECD level,[92] which are primarily generated by our current increasing rate of energy consumption.

The greatest threat the global commons can present lies in climate change, a well-known phenomenon that is caused by increase in greenhouse gases from human activity, namely our current reliance on fossil fuels for a large proportion of our energy needs. Climate change will also cause an increase of demand of energy, as much of our energy consumption is to deal with the particulars of our environment. In Canada, we use a great deal of energy to heat our homes and businesses, as our winter months bring sub-zero temperatures. The majority of the energy for heating comes from natural gas, accounting for 97% of our heating energy consumption.[93] Climate change will mean that our energy demands will change and strain our current energy systems. In the summer, many areas may experience higher temperatures. While air conditioning is something not currently ubiquitously used in Canada, there will likely be a proliferation of the technology, creating a substantial increase in summer energy demands. This adaptation to the relative increase in temperature will require a great amount of energy, from a time of year that historically has lower demands.

The effects of climate change have been discussed throughout this paper. Nevertheless, it is important, for security implications and their solutions, to recognize this threat as a global environmental effect. Not only does Canadian activity affect this particular global phenomenon, but every other country necessarily affects climate change as well. The implication is that the resolution of this threat exists in an

[91] D. R. Boyd, "Canada vs. The OECD," Eco-Research Chair of Environmental Law and Policy, University of Victoria, http://www.environmentalindicators.com/htdocs/PDF/CanadavsOECD.pdf (accessed March 20, 2011).
[92] Boyd, "Canada vs. The OECD," p. 2.
[93] OECD/IEA, "IEA Energy Statistics: Electricity for Canada," International Energy Agency, http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=CA (Accessed March 29th, 2011).

international context. Climate change certainly will have impacts outside of Canada and will be referred to as a major impetus of environmental and social change in the coming sections of this paper.

Biodiversity can be considered a global resource. Biodiversity, quickly summarized, is "[t]he richness of biologic variation, at all levels of biological organization."[94] It has major implications for security, as biodiversity is a crucial underpinning of the sustainability of many ecosystems. The diverse range of flora and fauna are needed in many ecosystems to support one another. While biodiversity works as an element of the ecosystem as a whole, every part of the environment can be affected in the natural network. Again, network security gives us a perspective to understand this problem. The loss of even small nodes (in this case, species) from a system (ecosystem) can have drastic effects on the entire network, either as a lynchpin or through cascading collapses. Levels of biodiversity can be seen as a measure of fitness and resilience of an ecosystem as a whole. The loss of species, then, damages the ability of the ecosystem to adapt to changes and stress. Eventually, losses can become so great that elements of nature that we rely upon directly will come under threat. Some scholars claim "...biodiversity and life are synonymous,"[95] linking our own survival with the level of biodiversity in a global sense.

While the common idea that "cures for cancer can be found in the rainforest" could be cited, the far more strategic threat comes through agriculture. The natural species that we rely upon for our food are still part of the wider ecosystem. Human agriculture now relies upon a smaller, less diverse number of species - 12 species provide for 90% of the total animal protein consumption of the world,[96] while 9 crops account for over three-quarters of the food consumed by humans.[97] This reduction in diversity means fewer options for nutrition, economic adaptation, and - most critically - adapting to environmental changes.[98] Food security relies most heavily upon a biodiversity of species. The less diverse a country's (or global) agriculture sector is, the chances that the entire crop will be wiped out increases. Additionally, wider

[94] Jeffrey A. Hutchings, *Ecology: a Canadian context.* (Toronto: Nelson Education, 2010), p. 606.
[95] Gary Kline, "Biodiversity and Development," *Journal of Third World Studies* 14, no. 1 (1998): p. 129
[96] Anonymous, "Biodiversity for food security," *Appropriate Technology* 31, no. 3 (2004): p. 51.
[97]Kline, "Biodiversity and Development," p. 131.
[98] Anonymous, "Biodiversity for food security," *Appropriate Technology* 31, no. 3 (2004): p. 51.

biodiversity in ecosystems contributes to agriculture, providing mechanisms for the crucial pollination of crops.[99]It must also be recognized that this is a transboundary problem. Food imports are a considerable part of Canada's food supply while many species that are key pollinators migrate to Canada.

The loss of global biodiversity could even result in a chain reaction that drastically reduces plant life. If this reduction was extreme enough, it could damage the ability of the ecosystem to fix carbon dioxide and release oxygen. This would result in a global reduction of available oxygen, or an asphyxiation of sorts, though this is an extreme end of the logic of collapse.[100]

The global commons do not have homogenous conditions. At times, localized extremes from changes in the global environment manifest as extreme phenomena, i.e., natural disasters, which are the next topic of this research.

Natural Disasters

There is also an acknowledged trend of increased natural disasters associated with climate change.[101] This is true for Canada as well. These types of events are acute and devastating; making them different in nature than the stresses caused by chronic or gradual environmental change that can cause or intensify them.

Impacts of events such as forest fires, flooding, drought, catastrophic crop failure and the like can been seen as domestic phenomenon, however the fact that weather and many other elements of the biosphere are global, this subject is best discussed as being originated from a global circumstances. Natural disasters are the historical primary sources of disaster in Canada, making up 69.9% of all total disasters.[102] In many models of climate change, Canada could also experience more severe weather events: tornadoes, ice storms, and hailstorms even in areas previously unused to such extreme weather events.[103] Floods are also seeing a rising trend, again

[99] Kline, "Biodiversity and Development," p. 129.
[100] Kline, "Biodiversity and Development," p. 129.
[101] OCIEP, *Threats to Canada's Critical Infrastructure,* p. 14.
[102] OCIEP, *Threats to Canada's Critical Infrastructure,* p. 4.
[103] OCIEP, *Threats to Canada's Critical Infrastructure,* pp. 19-22.

this being associated with the effects of climate change.[104] These extreme weather events are predicted to increase due to changes in several different meteorological processes, including changes in heat absorption/distribution, modified hydrological cycles, ocean currents, and prevailing winds.[105]

Because of the indefinite, widespread nature of such crises they are best thought of as a network threat – the most effective manner of negating their security impacts is by strengthening the network as a whole: the Canadian government has recognized disasters in this manner, assessing these environmental threats in the framework of network security.[106] Disasters in Canada present a number of threats to Canadian infrastructure. Physical disruptions can impact vital components of Canadian society, such as transport, communications, and power networks. Furthermore, disasters impact the economy, due to the increasing cost of the impact of natural disasters affecting the complex networks of Canada.[107] Disasters can also be smaller in scale, affecting particular regions and individual homes. Effects on this scale can be identified and mitigated though proper policy choices and hazard-zoning as proposed by Michal C. Moore.[108] In fact, these types of specific policies are the only real method of ensuring security to the immediate residents of areas prone to environmentally induced disasters.

Natural disasters abroad have major implications for Canadian security, under the conclusions we can gather from network security. If a system (e.g., a country, city, or region) undergoes a great enough stress, it can breakdown - this essentially means it undergoes "...a rapid loss of complexity...a simplif[ication of] its internal organization and reduces the range of potential behaviours."[109] In an inter-connected world that we live in, this means a disaster could easily expand outwards and disrupt the integrity of all actors involved. This could be seen in an internal measure, where the disruption of one or more systems expands to others (e.g., disruptions in energy systems cause

[104] OCIEP, *Threats to Canada's Critical Infrastructure,* pp. 17-19.
[105] OCIEP, *Threats to Canada's Critical Infrastructure,* pp. 14-15.
[106] OCIEP, *Threats to Canada's Critical Infrastructure.*
[107] OCIEP, *Threats to Canada's Critical Infrastructure,* pp. 28-29.
[108] Michal C. Moore, "Land Use and Distaster Planning in an Age of Climate Change - The Next Round in Climate Change Adaptation," *The Hal Kvisle Lecture Series,* (Calgary, AB: The School of Public Policy Student Association, March 3, 2011).
[109] Homer-Dixon, *The Upside of Down,* p. 109.

failures in communication services, water, and heating). This may also become observed in the international realm in globalized trade networks severely disrupted by disasters. The impacts aboard would then ripple into domestic areas of concern.

In the following sections concentrating on environmental migrants and refugees and environmentally-induced conflict abroad, the effects of natural disasters in other countries can be considered. Natural disasters and climate change elsewhere in the world will engage Canada through the displacement of persons: environmental migrants and refugees.

Environmental Migrants and Refugees

Many populations already exist in areas threatened by degradation of necessary resources. The causes behind such deprivation lies in both the environmental changes present and the socio/political marginalization of groups living in these areas.[110] Environmental refugees and migrants are therefore a consequence of scarcity but also, more importantly, environmental discrimination, as recognized by Baechler and the ENCOP school of thought. This effect contains two insecurities: the safety and livelihoods of the refugees/migrants themselves; and their impact in the areas/societies that they come upon in their movements.

The plight of environmental refugees has been recognized for well over a decade now. Even before the new millennium, Norman Myers recognized the existence of at least 25 million environmental refugees.[111] And, as per some of Myer's predictions, that number continues to grow. Refugees International published a report that projects the possibility that there could be as many as 200 million displaced persons due to natural disasters and climate change by 2050.[112]

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[110] Norman Myers, "Environmental Refugees," *Population & Environment* 19, no. 2 (1997).
[111] Myers, "Environmental Refugees," p. 167.
[112] Alice Thomas and Renata Rendon, "Confronting Climate Displacement: Learning from Pakistan's Floods." Refugess International, http://www.refugeesinternational.org/sites/default/files/ConfrontingClimateDisplacement.pdf (accessed March 20, 2011), p. 1.

These migrants will inevitably cause tensions or possibly conflict in the areas in which they arrive.[113] Ethnic tensions, social cleavages, and civil unrest are all possibilities recognized with a large influx of refugees/migrants.[114]

Canada is certainly a target country for many of the current and future environmental refugees/migrants. This possibility has been recognized for some time now by academics[115] and even the government has recently acknowledged Canada's role and situation on the topic.[116] Michal C. Moore in a recent presentation on land use and disaster planning acknowledged the potential of environmental refugees as a fact that Canada will inevitably have to accept.[117]

Many climate change models predict the rise of global sea levels by substantial increments, ranging from estimates of 23cm up to 2 metres.[118] The rise of sea levels threatens approximately 10% of the world's population that lives in low-lying coastal areas.[119] What is especially threatening about sea level rise across the globe is a major fact of world demographics: the world is seeing an increasingly reliance on mega-cities, many of which are highly vulnerable to rising sea levels.[120]

Bangladesh is threatened due to the large and growing population residing in a coastal delta that will likely see dramatic rises in sea-level and increased migration of millions of people across South Asia and abroad.[121]The Nile Delta has an 5 million people in areas threatened by potential sea rise, not to mention the historical, social, and

[113] Campbell, *Age of Consequences,* p. 57; Myers, "Environmental Refugees," p. 175-6; Thomas and Rendon,"Confronting Climate Displacement," p. 15.
[114] Myers, "Environmental Refugees," p. 176; "Environmental refugees won't be welcome: expert," *Sault Star*, (Sault Saint Marie)November 26, 1997, A.3.
[115] "U.S. environmental refugees could flood Ontario: professor." *The Gazette,* (Montreal) July 25, 1993, p. E.8.
[116] Penny Becklumb, "Climate Change and Forced Migration: Canada's Role," Parliamentary Information and Research Service,Ottawa, Feburary 9, 2010.
[117] Moore, "Land Use and Distaster Planning in an Age of Climate Change."
[118] Campbell, *Age of Consequences,* p. 40.
[119] Campbell, *Age of Consequences, p.* 41; A. De Sherbinin, A. Schiller and A. Pulsipher, "The Vulnerability of Global Cities to Climate Hazards," *Environment and Urbanization* 19, no. 1 (2007), p. 40.
[120] Sherbinin, Schiller and Pulsipher,"The Vulnerability of Global Cities to Climate Hazards."
[121] Campbell, *Age of Consequences,* p. 57.

ethnic tensions that already exist in the region.[122] Many other areas, such as inhabited islands, will be vulnerable to the sea-level rise and potential cataclysmic storm surges in predictions of climate change.[123] Some low population growth models predict between 7 and 70 million additional people migrating to potential flood areas each year by the year 2050 - high population growth estimates have this figure balloon up to 20-300 million.[124]

Not only will this devastate the people, infrastructure, and local economies of such areas, but stress (or damage) to these hubs have growing implications in the modern world of globalization. Global networks of trade, commerce, and the like will have effects felt far away from their epicentres, affecting the security of countries across the globe - an insight from the idea of network security that allows us to connect environmental change and threats abroad to the security and well-being of one's own nation. Because of the scale of these migrations and the globalized world, Canada can recognize that this is a potential security threat relying on the ES situation of other countries. In some cases, these foreign occurrences can erupt in conflict that affects Canadian security.

Conflict Abroad

If ES is not maintained across the world, environmentally-related conflicts could arise. Environmental changes act as threat multipliers, exacerbating social factors and leading to more imminent conflict. While the environment does affect Canadian security, it is most certainly a more crucial threat for developing countries that have populations that are directly sustained by the local environment. Also, such areas have very little infrastructure to adapt and compensate for environmental changes and thereby mitigate tensions. Infrastructure is threatened in such cases as developing

[122] Nicolas Frankom and Civitas International, "Climate Change, Security, and Sustainable Development", in *From Bali to Poznan: New Issues, New Challenges.* (Brussels: Institute for Environmental Security, 2008), p. 26.

[123] Campbell, *Age of Consequences,* p. 42; Frankom and Civitas International, "Climate Change, Security, and Sustainable Development," p. 11.

[124] Becklumb, "Climate Change and Forced Migration," p. 3.

countries have less capacity and finances to adapt to environmental changes - changes that are likely to be much more severe than those seen in Canada. The federal government has made a small acknowledgement of the vulnerability of developing countries to environmentally-induced insecurity by supporting environmentally sustainable development.[125]

The two most likely sources of conflict, discussed below, include the scarcity of vital elements for human survival - water and food.[126]

Water scarcity will likely trigger violent conflicts across the globe. Because of the vital nature of fresh water for its survival value, states must actively secure water resources and will take any recourse necessary. The disappearance of glaciers around the world will likely mean droughts for many areas dependant on their melt-off. Bolivia and Peru have been earmarked as areas where a substantial reliance has developed on glaciers that are already disappearing. Their complete disappearance will likely result in conflict without proper mitigation. It is also well-known and discussed that the Middle East and North Africa's climate and political situation has long set them towards the potential of "Water Wars."[127]

Another key resource that will likely endure environmental change is food. Food production is highly reliant on the environment - methods of irrigation, fertilization, and the whole human impact on growing food is still only a factor that changes the yields of land. Land degradation, water availability, and other natural factors will be strained in the future from an array of forces including climate change. Such changes to a vital requirement for life are bound to cause conflict, more so than other resources such as oil or gas.[128] As covered earlier, global food stocks are at risk from dangers of biodiversity; or more accurately, the lack thereof.

All four models of environmental security can give us ideas on the security implications here. Many areas will experience simple scarcity in food. The Toronto School of thought shows examples of how the scarcity of such a key resource means

[125] Minister's Office (MINE), "Canada's International Policy Statement," http://www.acdi-cida.gc.ca/acdi-cida/acdi-cida.nsf/eng/JUD-2107401-GV3#al61e (accessed January 16, 2011), p. 9.
[126] Frankom and Civitas International, "Climate Change, Security, and Sustainable Development."
[127] Joyce R. Starr, "Water Wars," *Foreign policy*, 1991.
[128] Frankom and Civitas International, "Climate Change, Security, and Sustainable Development," p. 24.

drastic implications for populations and political institutions. The ENCOP idea of environment scarcity will also have high relevance as food stocks are likely to be controlled by particular actors seeking to secure their own position, both regional and domestically. Yet, as some areas lose food production capacity, others will experience an increase in agricultural output, although this increase may only be relative in character to the world or region. This will possibly cause conflict, both inter- and intra-state, from actors seeking to secure access to food as a necessity or for its economic value. Lastly, network security draws the same conclusion, but expands the discourse. The reduction or loss of food means widespread implications for any societal network: capacities must be shifted to secure food production, likely in drastic manners, while an overall stress on the system occurs due to the disruptions of a fundamental input.

How conflict abroad affects Canada is a well-discussed issue, one that is almost constantly on the political agenda as Canada engages in multiple roles involving peacekeeping and other military commitments. The Canadian government has issued documents recognizing the importance of maintaining environmental stability abroad.[129] Conflict abroad could cause a number of effects. The first would be the commitment of (already stretched) Canadian forces and facilities overseas. Because of the widespread potential for violent conflict around the world from environmental change, the military could be stretched even thinner than it is now: not only is this a logistical/strategic nightmare, but a major concern for diplomacy if Canada has to choose between commitments. Aid would also be increasingly targeted towards strategic interests, as Canadian aid can only reach an effective amount or be spread too thin and too far. Retired Major Cameron Ross pointed out in a recent discussion that our military will preoccupied with more internal issues in the future and is already stretched near its limit in current obligations.[130]

The second effect conflict abroad could have on Canada would be disruptions in trade and commerce - potentially in vital areas for Canadian security and economy. A most simple fact of war is that the economies of an area become less productive, especially in regards to trade. Despite Canada's endowment of natural resources, many goods found in Canadian markets are foreign while we also find a significant amount of

[129] Brown, Crawford, and Campeau, *Environmental Change and the New Security Agenda, p.* 19.
[130] Ross, "Future Security Challenges - a Military Perspective."

our economy relies on exports. The disruptions from war abroad therefore have domestic implications with Canada, especially if a vital trade partner becomes involved in conflict (directly or possibly indirectly).

Conclusions from Global Environmental Change

Canada's ES actually transcends its borders. Canadians will face many global environmental effects domestically, yet many others that occur elsewhere will have consequences for Canadian interests. The global commons reaches everyone – Canada will share in this primarily through the effects of climate change, likely in the form of increasingly commonplace and amplified natural disasters. Climate change's effects will be felt much harder abroad than at home, causing migrants and refuges to come to Canada while environmentally-induced conflicts rage abroad over degraded resources.

Canada does acknowledge the ES dangers from problems in other countries. In fact, this is recognized by Johannah Bernstein and Laura Leland in their assessment of Canada's ES efforts.[131] However, the government acknowledges the difficulty in predicting the course of such a complex subject[132] – perhaps a good measure to allow for umbrella agreements and comprehensive responses. Still, as events progress we should be aware of the potential outcomes and debate the pragmatic course for security actions.

Final Conclusions

Canada's ES situation provides useful insights for the broader application of ES methods. Since Canada is dissimilar to most case studies in ES, the types of conclusions came to be more abstract and predictive than immediate and realised. But, this is still useful as prevention is less costly than adaptation. Prevention can only be pursued through the accumulation of concerned scholarship.

[131] Bernstein and Leland, "Canada's Profile in IESPP."
[132] Bernstein and Leland, "Canada's Profile in IESPP," p. 1.

In terms of the use of the Four Schools method, a number of insights are apparent. It may be common opinion that our developed society is unlikely to endure immediate and direct effects of environmental change. This is completely false. A number of the security implications mentioned directly affect the well-being of Canadians, ranging from extreme weather events to food supply, among others. Still, it is no apocalyptic scenario, just another concern for the security of our country.

Each of the four schools had some uses in the analysis. However, it seems network security was more applicable in this study than it has been in previous literature. This was somewhat suspected from the fact other ES studies look at areas with simpler, smaller-scale networks where the other schools hold more explanatory power. Due to Canada's size, complexity, and the globalized context of statecraft, network security seems to be much more relevant for industrialized societies.

The Toronto School – which looks at scarcity and its social effects – did hold some use, especially when put in conjunction with the ENCOP ideas of environmental discrimination. But as much of the evidence holds, there will likely not be much scarcity within Canada. Yet, internationally, there could be many conflicts over resources between countries (namely, in the Arctic).

The ideas of insecurity generated from resource bounties also point to this risk for Canada. Our wealth of natural resources will increase, possibly in an absolute sense but certainly in a relative sense.

Finally, the network approach of ES had a surprisingly constructive function for these issues. This might be due to several factors of Canada that contrast the usual case studies, which are primarily developing countries. First, Canada has a massive and complex geography, which means effects are less direct as would be seen in smaller areas – the security implications require multiple steps rather than immediate effects on social institutions. Second, Canada's vast natural resources, advanced infrastructure, and enormous ecosystem means we are far less vulnerable to direct environmental changes – the type of changes we need to think about are less discernable and cause widespread, chronic consequences. This second conclusion can apply to other industrialized nations, whereas the first is primarily due to Canada's nearly unparalleled size and wilderness.

Hopefully this research provides some useful data on applying ES methods on industrial nations that face unique issues as Canada does. But what do these conclusions mean for Canada? While this research is useful for ES as a whole, this study concentrates on implications for Canada specifically.

Canada is facing some tough environmental security issues. Some are likely to come up on the national agenda quite soon: the Arctic issue is gathering steam (and losing ice) and becoming one of the top foreign affairs priorities. Other problems are long-term problems that we must recognize and take measures to avoid and prevent. Some lie beyond our borders and can only be solved through international cooperation. Truly a part of Canada's security lies far beyond our own borders, in some sense every country has a implications for Canada's ES on the issue of global environmental change.

It seems on both the Arctic and GEC issue that good diplomacy and international cooperation are needed. To abate militarization and resource races in the North, agreements of territorial, economic, and environmental character must be enacted. Failure to properly attain such relations with Arctic countries could cause serious, unnecessary detriment to the North for all actors. On the GEC side of things, it would be prudent for Canada and other countries to seek good environmental legislation, though the issue of environmental cooperation has long been an unachieved dream of many scholars and policy-makers alike. Maybe with the recognition of the true state goal, security, will countries find the impetus needed for coordinated action on the environment.

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