USA CLUB OF ROME REPORT 2012.

The Future of the Arctic. A Key to Global Sustainability.

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1) Legal and Political Issues.

I. Political status of the Arctic.

Throughout its entire history, the Arctic has been a relatively peaceful region. Prior to World War II and the Cold War, the Arctic's political and economic development was primarily influenced by Indigenous peoples as well as European explorers and colonizers.

The Arctic Council (founded in 1996) has sought to increase cooperative efforts among the member states of Canada, Denmark (representing both Greenland and the Faroe Islands), Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States.[1] The Nordic Council has also addressed and worked on similar issues as the Arctic Council.[2]

Both the Arctic Council and the Nordic Council have worked to improve cooperation among its members in the areas of environmental protection and sustainable development. However, the Nordic Council focuses its efforts on economic development and trade, education and scientific research, legal and justice issues, as well as regional defense and diplomatic cooperation.[3] The Arctic Council is more focused on environmental climate, biodiversity, ocean sustainability, and pollution issues, and it has not focused on establishing formal working groups on topics such as regional defense and economic development.[4] In 2011, the Arctic Council member states signed the Arctic Search and Rescue Agreement, the first binding treaty concluded under the Council's auspices. This year the Arctic Council member states are negotiating a second binding agreement on oil spills in the Arctic.

The members of the Arctic Council have created a set of strategic planning documents, which indicate their positions on a number of topics that are being addressed by the Council's working groups.[5] These strategies represent the formal positions of the member states toward

[1] http://www.arctic-council.org/index.php/en/about-us/members
[2] http://www.norden.org/en/about-nordic-co-operation/countries-and-territories
[3] http://www.norden.org/en/about-nordic-co-operation/areas-of-co-operation
[4] http://www.arctic-council.org/index.php/en/about-us/working-groups
[5] http://www.arctic-council.org/index.php/en/about/documents/category/12-arctic-strategies

issues that directly reflect their foreign policy objectives. The following includes a very general overview of the strategic approaches of some of the members of the Arctic Council.[6]

The Russian Federation's declared strategy is based on its participation to the United Nations Convention on the Law of the Sea of 1982 (UNCLOS, or Montego Bay Convention) and the application of such convention to the Russian maritime space. Russia claims that its continental platform and therefore its exclusive economic zone extend to the North Pole and has presented its claim to the United Nations.[7] The issue on how Russia participates within the Arctic Council in the future could be a major factor for future cooperation and sustainable development within the region.[8] Yakutia has great mineral resources that the Russian Federation wants to expand. Russia is also supporting the construction of a tunnel and railway across the Bering Strait to enhance cooperation between Asia and North America. The proponents of the Bering Strait tunnel, such as the Inter-Hemispheric Bering Strait Tunnel and Railroad Group, point out that the distance between Chicago and Beijing by road is half than by sea and therefore shipping of goods from China, Korea, Japan and Russia to North America would be faster. However, the high cost of the project, estimated at 65 billion dollars, and the absence of roads and railways connecting the city of Nome (on the U.S. side of the Strait) to the other major cities in Alaska, constitute substantial obstacles to the project[9].

The United States declared that it would pursue a policy of promoting American interests in the Arctic regarding national security, sustainable economic and resource development, enhancing scientific monitoring and research of the Arctic Circle, protecting the Arctic environment and the Indigenous peoples that live there. This policy has been little altered since January 2009, but a recent study by the Congressional Research Service has highlighted major issues that have yet to be resolved by the Arctic Council, the Nordic Council, or the Conference of Parliamentarians of the Arctic Region (CPAR). Among these issues are the increasing losses

[6] http://www.arctic-council.org/index.php/en/about/documents/category/12-arctic-strategies#
[7] http://www.economist.com/blogs/americasview/2011/02/arctic_politics
[8] "Russia's Energy Sector between Politics and Business", Edited by Robert Orttung, Jeronim Perovic, Heiko Pleines, Hans-Henning Schröder, Forschungsstelle Osteuropa Bremen Arbeitspapiere und Materialien, No. 92, February 2008
[9] "Russia wants a rail link to North America," *Der Spiegel*, April 20, 2007.

of Arctic sea ice, various territorial and sovereignty issues, the U.S. non ratification of the UNCLOS, increased pollution and environmental degradation in the Arctic, U.S. diplomatic relations with other Arctic countries (including the need to improve relations with Russia), and American military and maritime force posture in the Arctic.[10]

The strategy of the European Union coincides with Canada, in calling for enhanced regional cooperation through the Arctic Council, and for enhanced relations with Russia and the United States.

The position of the European Union on the Arctic Region is expressed in a communication from the European Commission to the European Parliament dated November 20, 2008, entitled, "The European Union and The Arctic Region," which sets out the EU interest in "protecting and preserving the Arctic in unison with its population, promoting sustainable use of resources and contributing to enhanced Arctic multilateral governance."

In contrast the United States maintains that Arctic policy is to be carried out in a manner "consistent with the Constitution and laws of the United States, its obligations under existing treaties, and customary international law as recognized by the United States."

While other organizations exist to provide regional cooperation and stability, the Arctic Council has the greatest potential to act as a forum for future economic development and trade, security cooperation, and diplomatic resolution of territorial sovereignty issues.

Also non-Arctic countries have expressed interest in participating in the activities of the Arctic Council, in particular China that presented a formal petition to become an observer to the Arctic Council.

II. Disputes in the Arctic.

A significant gap exists in terms of governance over the protection of the Arctic environment and the mitigation of climate change. In particular, a study by the World Wildlife Fund in 2010

[10] "Changes in the Arctic: Background and Issues for Congress", Ronald O'Rourke, Coordinator Specialist in Naval Affairs, Congressional Research Service, December 23, 2011

highlighted the need for a "legally binding instrument" to protect the marine environment of the Arctic.[11] Such an instrument, in enhancing and expanding the treaty regime that supports the Arctic Council, would benefit all parties by providing a strong international organization that can create and enforce mechanisms to protect the biodiversity and climate of the Arctic, provide for mutual security among all member countries, oversee the sustainable economic development of the Arctic's resources and trade, as well as protect the Indigenous peoples of the region. Current scientific understanding regarding climatic change highlights the fact that the environmental degradation in the Arctic is accelerating, and this rate of increase has been observed within our own lifetimes. The future of the Arctic requires a political solution, both within the members of the Arctic Council and in cooperation with the United Nations. Sustainable resource development and trade, sovereignty and territoriality issues, security cooperation, and the protection of Indigenous people and cultures requires a greater level of cooperation and binding agreements than are currently in place.

Boundary disputes between sovereign nations of the Arctic currently pending include disputes: 1. Between Canada and the United State over a pie-shaped area extending from the eastern side of Prudhoe Bay into the Canadian Basin; 2. Between Canada and Greenland/Denmark over the boundary from the northern end of Baffin Bay northward from the Canadian Ellesmere Island and the north shore of Greenland towards the southern edge of the Lomonosov seabed ridge; as well as over Hans Island in the Nares Straits, a sea passage between Canada's Ellesmere Island and Greenland. 3. Between Denmark/Greenland and Norway over the boundary between the Greenland and Iceland seabed, east of Greenland/Denmark through the Greenland Sea and west of the Norwegian Svalbard Archipelago

The Svalbard continental shelf controversy revolves around the conflict between the 1920 Svalbard Treaty and the extended continental shelf claims put forth by Norway. The Treaty while conferring sovereignty over the archipelago to Norway, reserves exploitation rights to the surrounding sea-bed in the signatories, which signatories includes China, Russia, Spain, Iceland, France, Germany, Netherlands, Denmark, Great Britain, the United States and others. Norway filed a claim to establish its sovereignty over the extended continental shelf surrounding Norway

[11] "International Governance and Regulation of the Marine Arctic", Timo Koivurova and Erik J. Molenaar, WWF International Arctic Programme, Oslo, Norway, 8 February 2010

and the Svalbard archipelago with the United Nations Commission on the Limits of the Continental Shelf in 2006. Norway bases it claim on the theory that UNCLOS and CLCS have superseded the 1920 Svalbard Treaty, while signatories to that treaty maintain to the contrary.

A number of boundary disputes have been resolved. The dispute between Denmark and Norway over the continental shelf boundary between the Faroe Islands, Denmark, and mainland Norway was settled in a bilateral agreement in 1979. The controversy over the seabed boundary between Iceland and Jan Mayen, Norway, was settled through an international conciliation panel in 198l. The dispute between Iceland and Norway over the continental shelf between Jan Mayen, Norway, and Greenland/Denmark was resolved by the International Court of Justice in 1993. On September 17, 2010, Norway and the Russian Federation resolved a decades-old conflict over the disputed area in the Barents Sea, between Svlabard archipelago and the Novaya Zemlya archipelago. The agreement divided the disputed territory equally with plans to jointly develop boundary resources, which include an estimated 38 to 40 billion barrels of oil.

The Lomonosov Ridge controversy illustrates how a number of jurisdictional factors can interplay in a single dispute. In 2001, the Russian Federation submitted its claim to the extended continental shelf, including the Lomonosov Ridge, an under-sea protuberance that runs from the northern edge of the New Siberian Islands across the North Pole to the northeastern edge of the Canadian Ellesmore Island and the northwestern border of Greenland/Denmark, just north of the Amundsen Basin. The Commission on the Limits of the Continental Shelf has, at this writing, not decided the issue, but has referred the Russian Federation, back to collecting scientific data that will be used to support or to deny their claim. The Russian Federation is in the process of submitting an amended claim by 2013.

Denmark/Greenland and Canada have also submitted claims to the Lomonosov Ridge and are in the process of collecting data.

Thus both a boundary dispute and a determination of the limits of the continental shelf issue underlying different aspects of the same controversy, moreover, the shelf boundary to be determined in accord with Part VI of the UNCLOS, under the auspices of Annex II of the UNCLOS, defines the limits of the Area of International Waters. Thus non-arctic states take an

eager interest in this determination, because it is in the International Area of international jurisdiction that the non-arctic states and corporations can make their claims to resource extraction, not only in the subjacent waters, but also in the seabed.

In the case of the Lomonosov Ridge dispute, UNCLOS Part VI Article 83 states that "the delimitation of the continental shelf between States with opposite or adjacent coasts shall be effected by agreement on the basis of international law as referred to in Article 38 of the Statute of the International Court of Justice." If no agreement can be reached within a reasonable period of time, the States concerned shall resort to the Procedure provided for in Part XV of UNCLOS, "The settlement of Disputes." Article 38 of the statute of the International Court of Justice describes the competence of the court in terms of the application of law stating that the court shall apply, a. international conventions, b. international custom, c. general principles of law recognized by civilized nations, subject to the provisions of Article 59, which states that the decision of the Court "has no binding force except between the parties and in respect of that particular case." Clearly the claims of the Russian Federation and Denmark/Greenland and Canada are between States with opposite and adjacent coasts and so the settlement of this dispute will fall under the rubric of the above sections and articles.

The Northwest Passage Dispute is in some sense a boundary dispute, but more profoundly is a dispute over sovereign rights versus international rights in the various classes of maritime regions described by UNCLOS, and indeed a referendum on the legitimacy of UNCLOS itself. Specifically, the Northwest Passage dispute concerns the extent to which the waters of the northern Canadian Archipelago are international and the extent to which Canada is entitled to exercise its sovereignty over the waters of the Northwest Passage. Interestingly in this dispute the antagonist are the United States and Canada, two close allies. Historically the United States as a marine power, has plied the waters of the Northwest Passage as international waters. With the advent of UNCLOS and the extension of sovereign boundaries into what were once high seas, Canada has claimed sovereignty over the water between the islands of its northern archipelago. Never the less, under the terms of Parts II, III, IV and V of UNCLOS, the vessels of all nations have rights of innocent passage, not only through Straits, sovereign Exclusive Economic Zones and Contiguous Areas of coastal nations, but also through the twelve-nautical-

mile Territorial Seas. However, if the northern boundary of Canada is taken to be the furthest extent of its most remote archipelago islands, then the enclosed waters become Internal Waters and so subject to the absolute sovereignty of Canada.

The issue came to a head in 1985 with the incident surrounding the *Polar Sea*, a U.S. Coast Guard Icebreaker, which navigated the Parry Sound and Prince of Wales Strait, without obtaining permission from the Canadian Government, on the legal theory that the waters were an international strait. In 1970 Canada had enacted the Arctic Waters Pollution Prevention Act, which strengthened their regulatory control over their territorial and internal waters. President Reagan articulated the position of the United States on the Law of the Sea saying that the United States would not "acquiesce in unilateral acts of other states designed to restrict the rights and freedom of the international community in navigation and over flight and other related high seas uses." On January 11, 1988 the *Agreement on Arctic Cooperation* was signed in which the U.S. agreed that navigation by US icebreakers within waters claimed by Canada would be undertaken with the consent of the Canadian Government, however the agreement contained the disclaimer that this agreement would not prejudice the future positions of the United States and Canada on the findings of jurisdiction by under the Law of the Sea with regard to third parties. This of course was after the first signing of the Law of the Sea but before that final UNCLOS in 1994.

Although Reagan's position remains the view of the majority in Congress, and expresses the view held by a number of non-Arctic States, gradually this rift between these two close allies, with much to gain from cooperation and much to lose from antagonism, has mended and continued diplomacy has resulted in expanded cooperation between Canada and the United States including joint military operations and the development of a Canadian–American Northwest Passage Coast Guard Patrol.

This brings us to another aspect of the Arctic disputes, namely military presence in the Arctic. Traditionally the settlement of boundary and resource disputes has been through war and or the threat of military force. The United Nations Convention on the Law of the Sea is an evolution in international relations that provides an alternative to war and shows of military force as a means to resolve conflicts among and between sovereign nations. Never the less there is an instinctive reaction to threat that entails the display of force.

During the Cold War, the Arctic was of strategic importance for both the United States and the Soviet Union. With the transformation of Russia into a democracy, the Russian Federation and the United States increasingly have become partners and allies, which evolution is necessary and desirable in terms of the security of both nations, the wellbeing of both peoples, and the protection of the Arctic. We believe that it is only a matter of time before the Russian Federation is included as a full member of the North Atlantic Treaty Organization.

In the Arctic, the Russian Federation, which claims the Northeast Passage and the Northern Sea Route as their internal waterways, possesses the greatest capability in terms of navigation and military force, operating 20 icebreakers and 3 new double-ended icebreaking cargo ships with a capacity of 70,000 tons each, through the state owned Sovcomflot company. The Russian Federation navy bases its fleet of nuclear submarines on the Kola Peninsula and has organized the Federal Security Service Coastal Border Guard, which will work in conjunction with the Russian Federation's Northern Fleet to protect and defend their sovereign territory and its resources, with a variety of military capabilities including cruise missiles and sophisticated surveillances superstructures.

The United States by contrast has 3 aging Coast Guard icebreakers and no Coast Guard base in the Arctic Circle, the closest base being some 1000 miles to the south.

Demark has air bases at Thule and Station Nord and has stepped up its use of combat aircraft for surveillance with a $117 million dollar injection intended to make its sovereign presence felt in the Arctic, with their combined Greenland and Faroe Island Commands now joined into an Arctic Response Force. In terms of icebreakers, the Danish RDN Vaedderen, a high performance frigate specifically designed and built to withstand Arctic winters, presents an impressive presence.

Norway has purchased 48F-35 fighter jets and air-to-sea missiles, and has moved a substantial part of its armed forces north into the Arctic Circle. The nation has also launched a satellite to track ship movement in the Arctic.

An exchange of force among the Arctic nations would be an unnecessary tragedy for all concerned. The importance of building trust and of establishing working relationships among the

Arctic nations cannot be overstated. To that end a number of joint military exercises have already occurred including the joint Canadian-Danish-American Northern Deployment 2009; the joint U.S. Marine/NATO amphibious operation "Cold Response," in Norway, 2010; the Norway-United States joint naval training operation in 2010; the supplying of medical equipment to remote Arctic villages by the Alaska Air National Guard in operation "Arctic Care in 2011; the U.S. and Canadian North American Aerospace Defense Command continued cooperation; a Scandinavian Alliance to "enhance security in the Arctic"; the North Atlantic and North Pacific Coast Guard Forums, which have sponsored the "ship riders initiative" in which law enforcement agents from participating nations serve on one another's ships.

Perhaps the most inspiring demonstration of good will and trust has resulted in the Aeronautical and *Maritime Search and Rescue in the Arctic Treaty,* which stems from the 1944 Convention on International Civil Aviation, and the 1979 International Convention on Maritime Search and Rescue. The Treaty, which deals exclusively with the Arctic, and the first negotiated under the auspices of the Arctic Council, was signed by the eight members of the Arctic Council on May 12, 2011, and signals an evolving role for the Arctic Council.

III. The Future of Greenland.

A substantial development in the field of mineral exploitation can be found in Greenland. Over one thousand years after the Viking explorer Erik the Red gave it its current pleasant name to attract settlers, Greenland is becoming an important strategic land for both North America and Europe.

In 2000, the U.S. Geological Survey (USGS) has estimated that there may be as much as 47 billion barrels of oil offshore Greenland, starting a new wave of oil exploration in the world's largest island. In 2008 the USGS reported that the Arctic could contain about 22% of the world's undiscovered oil and natural gas resources.

In 1985 the National Oil Company of Greenland (NUNAOIL) was founded to generate new interest in oil and gas exploration. The Government of Greenland and DONG, the national Danish Energy Company, jointly own the Company. Although NUNAOIL has a share in all hydrocarbon licenses in Greenland, oil exploration is open to foreign companies.

So far Greenland has issued 13 oil and gas licenses to American, Canadian, Malaysian, and British corporations. This year the Bureau of Minerals and Petroleum is scheduled to start auctioning the next round of 14 more licenses for energy companies to drill in Baffin Bay[12].

Oil production in areas not controlled by OPEC is highly beneficial for countries with a strong demand of energy, such as the United States and the European Union, because it contributes to lower the price of crude oil.

Oil and natural gas are not the only strategic commodities found in Greenland. According to Greenland Mining Services, a private mining company based in Nuuk, rocks from Greenlandic mines sent to laboratories for analysis have in most cases been shown to contain traces of uranium. The tests have revealed that the radioactive substance is present all over the country.

Another important resource present in Greenland is drinkable water. A recent USGS report states that the largest source of freshwater on Earth, 7 million mi^3, is stored in glaciers and icecaps, mainly located in the Polar Regions and in Greenland, in contrast with 2 million mi^3 stored in aquifers below ground, and just 60,000 mi^3 stored in lakes, inland seas and rivers. The Ilulissat Glacier in Western Greenland is one of the fastest and most active glaciers in the world and produces 10% of all Greenland's ice fields, corresponding to around 35 billion tons of ice a year.

Greenland is renegotiating its relationship with Denmark, which has ruled the island since 1775. A non-binding referendum on Greenland's autonomy was held on November 25th 2008 and was passed with 75% approval. There are two main obstacles to the island's

[12] http://247wallst.com/2010/05/20/greenland-offshore-drillings-next-frontier. Accessed May 5, 2012.

independence: Greenland's need for Danish economic subsidies and the percentage of Danish royalties on Greenland's resources. Greenland has full control over the issuance of mining licenses but Denmark currently receives half of the revenue from oil and mineral resources, a percentage that Greenland is trying to reduce.

Denmark remains responsible for foreign affairs and defense of Greenland but Greenland's claim over Hans Island against Canada is an issue of foreign policy dealt directly by Greenland rather than Denmark[13].

There is a high likelihood that Greenland will become a new independent country within 5 or 10 years.

But Greenland's independence also constitutes an important step towards the American hemisphere. The United States' energy demand and the decline in oil production from OPEC countries will turn the focus of oil companies to new sources such as Greenland.

The island's independence and its potential ability to supply North America with essential resources such as oil, water and uranium are good arguments in favor of its access to the North American Free Trade Agreement. Because environmental protection is one of Greenland's main concerns, NAFTA would extend to Greenland the benefits of the North American Agreement on Environmental Cooperation (NAAEC). Greenland would become a member of the North American Commission for Environmental Cooperation, a mechanism for addressing trade and environmental issues, and the North American Development Bank that assists and finance investments in pollution reduction.

Free trade with NAFTA countries would produce dramatic benefits to the Greenlandic population in terms of access to low cost medicine and technology manufactured in the USA and Canada, as well as inexpensive textile products from Mexico. Greenland has been so far reluctant to enter free trade agreements to protect its fishing industry. For this reason, it withdrew from the

[13] http://www.spiegel.de/international/europe/0,1518,592880,00.html, Accessed May 5 2012.

European Economic Community in 1985. But the new mineral discoveries have the ability to transform the ice capped island in the Saudi Arabia of the Arctic, an economic phenomenon that would inevitably increase its population and economic dimension. In this case, the current protectionism would be replaced by free and fair trade policies that are more appropriate to foster Greenland's economic development. If this happens, Greenland can either join NAFTA and enter a bilateral free trade agreement with the European Union (as Mexico did) or establish bilateral free trade agreements with both the NAFTA countries and the European Union.

Another important issue is security. As an independent country, it would be Greenland's interest to join NATO and the Arctic Council. Denmark positions in the Arctic Council would not automatically transfer to Greenland therefore Greenland would have to join both organizations as a new member.

Article 10 of the North Atlantic Treaty describes how non-member states may join NATO. A member country would have to formally invite Greenland to join. Because of Greenland's geostrategic importance the United States would have all the interest in inviting Greenland to be a member of NATO and maybe in negotiating the installment of a missile defense system in the island.

IV. The application of the U.N. Convention on the Law of the Sea to mineral exploitation in the Arctic.

A common definition of the Arctic policy is fundamental to establish the rights for mineral exploitation in the region.

In 1970, United Nations General Assembly Resolution 2749, the *Declaration of Principles Governing the Seabed and Ocean Floor*, was adopted by 108 states, including the United States, declaring that the deep seabed is the "Common Heritage of Mankind". In 1982 the United Nations Law of the Sea Treaty (UNCLOS) codified this Common Heritage of

Mankind customary law concept, applying it to "the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction" under Article 136. The International Seabed Authority was created by UNCLOS to administer access and exploitation of this common heritage. While the concept of the deep seabed as common heritage is established custom, the establishment of an agency to administer that heritage is not. While mostly focused on mineral exploitation, the ISA is the agency charged with regulating seabed resources in deep sea, including oil and gas. However, because oil and gas reserves generally are found on the continental shelf, and the EEZ is generally defined as up to and including 350 miles of actual continental shelf[14], the International Seabed Authority's regulatory infrastructure is almost completely geared towards the exploitation of minerals.

All Arctic littoral states define their jurisdictional rights to the Arctic Ocean area using the general framework of UNCLOS according to the Ilulissat Declaration of 28 May 2008. Currently U.S. companies cannot submit applications to the International Seabed Authority for drilling and exploration in deep sea until the U.S. ratifies the convention and the new binding tribunal elements of UNCLOS won't apply to the U.S. without U.S. accession to UNCLOS.

The five surrounding Arctic states --Russia, the United States, Canada, Norway and Denmark (via Greenland) — currently have an exclusive economic zone (EEZ) of 200 nautical miles (370 km; 230 mi) adjacent to their coasts, which is provided for by both UNCLOS and modern custom. Those with broader continental shelves than 200 miles who are signatories to UNCLOS, can apply to the Commission on the Limits of the Continental Shelf for an extension of the EEZ up to 350 nautical miles (the so called "outer continental shelf") if they can make a good case for it, and Russia already has[15].

All companies drilling within the U.S. EEZ are bound by U.S. environmental law; there are fewer laws beyond the EEZ and even less monitoring and enforcement.

While drilling in the high seas beyond the United States 200 mile EEZ in deep sea is controlled by the International Seabed Authority, other treaties apply to the deep sea as well. As both exploratory drilling and commercial extraction can be messy business, numerous

[14] When proper claims are approved by the Commission on the Limits of the Continental Shelf

environmental treaties that address pollution in relation to commercial fisheries must still be consulted by those conducting operations in the deep sea. Additionally, the oil rigs themselves, if they are mobile units, fall under the jurisdiction of the International Maritime Organization and provisions regulating pollution from ships.

The U.S. Government has argued, time and again, that deep seabed mining is a freedom of the high seas under customary international law. This position is based in article 2 of the High Seas Convention of 1958 that states:

"The High Seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty."

Under this view, the U.S. contends that its companies enjoy a right of access to seabed minerals and that this right can only be altered by the U.S.'s acceptance of a different legal regime through the processes of conventional or customary international law.

The 1980 Seabed Act of the United States affirms that "it is the legal opinion of the U.S. that exploration for and commercial recovery of hard mineral resources of the deep seabed are freedoms of the high seas' pursuant to article 2 of the High Seas Convention 1958". While deep seabed mining is not expressly provided for under the 1958 High Seas Convention, it is not prohibited by that treaty either.[16]

There are two ways through which provisions of the 1982 Law of the Sea Convention can be avoided by countries that are not parties to the convention: the first ground of avoidance is the regime on the continental shelf which provides that the shelf extends to a breadth of 200 miles from the baseline from which the territorial sea is measured. This regime permits non-parties to the UNCLOS to claim a greater extension of the Continental Shelf based on the 'exploitability test' under the Continental Shelf Convention of 1958.
The second way to avoid the provisions of the UNCLOS is the assertion that the legal framework governing the International Seabed Authority is only found under the Law of the Sea Convention

[16] USACOR author Lockey White's opinion is that the ISA or other substitute authorization by the international community is required for all nations to exploit the deep seabed, including countries that did not ratify the UNCLOS because, under emerging peremptory norms, unilateral exploitation would not be appropriate under international law."

1982 and this entails that non-parties to the convention are not bound by decisions of the International Seabed Authority[17]. Although art. 137 of the UNCLOS provides that no nation can explore and exploit resources in the deep sea without a prior authorization of the International Seabed Authority, such provision is subject to criticism and may not be valid. In fact, a convention is an agreement that is binding among the signatory parties and cannot bind non-parties.

The UNCLOS was strongly opposed by the United States and many other industrialized countries, which characterized the regime as so interventionist, centrally planned, and bureaucratic that it would discourage investment and prevent development of the seabed resources. The US Government objected specifically that, among other things, these provisions would:

1) Require the US Government to fund 25 percent of the cost of the ISBA but without guaranteeing the United States a seat on the Council of the ISBA.

2) Allow amendments to be adopted without US consent that would nevertheless be binding on the US Government.

3) Permit distribution of revenues from seabed mining to national liberation movements.

4) Require the transfer of proprietary seabed mining technology to the Enterprise and, indirectly, to other nations.

5) Impose limits on the quantities of minerals produced from the seabed, in order not to disadvantage land-based producers.

6) Force commercial miners to pay the Authority large initial and annual fees well before production had commenced, indeed, well before the feasibility of their operations had been established.

The UNCLOS Implementing Agreement reached in 1994 weakened the provisions to which the United States most objected (guaranteeing it a seat on the Council and Eliminating the

[17] http://www.murdoch.edu.au/elaw/issues/v7n2/mwenda72.html. Accessed 04-15-2012.

provisions compelling the transfer of technology), but retained the framework in which mining in international waters would be conducted under the authority of the International Sea-Bed Authority[18].

The Arctic can play a key role in global sustainability if the exploitation of resources such as oil, natural gas and water will be conducted in a manner that does not prejudice its ecosystem. The mineral resources in the Arctic can supply a large portion of the increasing world demand for energy and water. It is the duty of all Arctic nations to establish clear criteria for the exploitation of the resources in the region for the benefit of mankind.

V. **Recommendations**.

We believe that it is vitally important for the Arctic nations to continue to augment their cooperative efforts and to solidify the junction of their joint Search and Rescue and Military capabilities with a view to expanding an Arctic Nation Task Force that continues to bring the Russian Federation and the United States into a working relationship with each other and with the military capabilities of the other Arctic Nations in a cooperative endeavor.

It is our opinion that disputes in the Arctic shall be resolved either by the International Court of Justice (when the parties agree to give the Court jurisdiction over their dispute) or by a new dispute resolution body created and administered by the Arctic Council.

We believe that the role of the Arctic Council shall also be extended to guarantee safe navigation and environmental protection. We propose that a special fund shall be established by the members of the Arctic Council to cover the expenses to purchase icebreakers and the personnel that would assist the commercial navigation in the Arctic region. The Arctic Council shall also issue environmental rules that would be applied to mineral exploitation in the region to ensure that the wildlife is protected.

[18] National Intelligence Council, http://www.dni.gov/nic/special_endgame.html, March 1996. Accessed 04-18-2012.

2) Energy and Resources.

The Future of Natural Resources and the Arctic Oceans and Lands: the Maelstrom of Development 2012-2052 and into the Future.

I. What is the Arctic?

What do we mean when we speak of the Arctic? The precise limits and definition of the Arctic region may be defined differently for different purposes. 19 Lawmakers and policy analysts for example may use a political definition of the Arctic (i.e. the member states of the Arctic Council), whereas cartographers may define the Arctic in terms of latitude (i.e. the area north of 66°30'N latitude, the Arctic Circle). For the consideration of resource and environmental issues, however, it is useful to refer to an ecological definition of the Arctic, conventionally understood as that part of the extreme polar region of the Northern Hemisphere where the mean July temperature is less than 10° Celsius. Restated in more intuitive terms, it is the region "where the soil is permanently frozen and where trees cannot grow".20 This definition of course only collaterally refers to the fact that inside this terrestrial tundra perimeter the largest spatial portion of the arctic region is oceanic. However, this latter definition conveys the real limitations that the extreme conditions of the Arctic impose on both environmental and human economic activity and is used herein.

Defining the Problem of Sustainability in the Arctic.

The Arctic is a fragile, irreplaceable environmental area easily degraded. The Arctic is chiefly an oceanic area with fluctuating extremes of natural conditions (climate, light availability) which reflect processes both planetary and anthropogenic. Since the end of the last Ice Age in the Arctic, the inhospitable conditions have limited Homo sapiens, to a very few

[19]See discussion in Sater, *The Arctic Basin*. Washington, DC: Arctic Institute of North America, 1969.
[20] Pielou, *A Naturalist's Guide to the Arctic*. Chicago: University of Chicago Press, 1994.

human groups, living in very small numbers over millennia by hunting and gathering, with settlements chiefly along and/or near coastlines Presently, growing demands for the resources and access to other ocean basins through geographical features contained in the arctic region, will bring about human expansion; rapidly changing climate in the Arctic leads us to predict that technology will accelerate the process of resource extraction over the next 50 years. There are specific problems to overcome as well as interactions of natural forces with mankind's efforts that must be considered.

Our goal in this paper is to warn against the potential loss of sustainability of arctic natural resources during this coming maelstrom of environmental changes while the process of human resource development occurs.

II. The Arctic Ocean and Seas.

This is the first time that the world has attempted to develop an oceanic area as a whole, so that the planning and the stages of development will likely be different from any land-based developments, most of which were undertaken gradually over hundreds of years.

Perusing an oceanic relief map it is clear that the Arctic Ocean is composed of surrounding land masses creating a central and deep geological oceanic basin, basically separated into two by the Lomonosov Ridge. This ridge forms the North American basin and the Eurasian basin. The surrounding land masses of the Eurasian continent contains four Arctic nations, the North American Continent has two nations and the island nations of Iceland and Greenland sit on or near the mid-Atlantic ridge from which especially Greenland extends northward into the Arctic. On the Eurasian side the submerged coastal shelves are very wide and, particularly in the eastern part, are shallow. On the North American side the continental shelves are narrower and many islands are found offshore of Canada on the shelves.

The basic physical processes of global axis tilt and wobble, the earth's precession, solar flares, atmospheric occurrences, and orbital shift around the sun are all important influences on the Arctic climate. The axis of rotation of the earth is at an angle (about 23.5 degrees) to the axis of

rotation of the earth about the sun21. This tilt is why there is seasonal variation of weather. Because of this geometry, at the North Pole (90° N latitude), the sun does not set for six months a year (between the vernal and autumnal equinoxes), and doesn't rise for the other six months; there are shorter periods of constant winter darkness and constant summer sunlight at all latitudes north of the Arctic Circle (66.5° N latitude). But even during the summer, at high latitudes, the sun remains low in the sky, and delivers only weak solar heating; during the part of the year that the sun doesn't rise above the horizon, of course, there is no solar heating at all.

The geographic distribution of temperature coupled with the spinning of the earth on its axis influence global atmospheric and oceanic flows. The global atmospheric circulation creates a vortex22 over the Arctic, which varies in strength seasonally and moves around, influenced in part by what is called the Arctic Oscillation23. Both atmospheric and oceanic flows transport heat from low latitudes to high latitudes year-around, where more heat is lost to space through infrared radiation to space than is gained from sunlight. Arctic oceanic currents (shown below24) vary as a function of depth. Warm water is transported to the Arctic at and near the surface from low latitudes, and sinks as it cools at high latitudes, more so in winter when sea ice is forming, than in summer, when sea ice is melting. This sinking at high latitudes drives the global ocean currents. These currents strongly influence weather and climate worldwide, since the atmosphere and ocean strongly interact. These flow patterns are not immutable. There is evidence that at various times in geological history, oceanic current patterns were quite different from present.

The Arctic Oceanic Circulation.

"The main connection between the Arctic Ocean basins and the North Atlantic is via the deep Fram Strait between northeast Greenland and Svalbard" (Arctic Research Council Report, 2011). The chief inflows are through the Bering Strait from the northwest Pacific and through the Norwegian Sea along Norway. The chief outflows are the Arctic Current between Newfoundland

[21] http://www.physicalgeography.net/fundamentals/6h.html
[22] http://uvs-model.com/WFE%20on%20landmasses.htm
[23] http://nsidc.org/arcticmet/patterns/arctic_oscillation.html
[24] http://www.whoi.edu/page.do?pid=12317&tid=282&cid=23446

and Greenland and deep ocean waters. The Arctic region is essentially a large oceanic water mass circulating around and under a surface floating ice mass. According to predictions of IPCC this ice surface is now unstable and is in transition to a new phase. Russia has the longest navigable coast, while the second longest coasts are the islands and coastal areas of northern Canada, which create a complex current flow with Hudson Bay as its largest embayment.

Water flows into the Arctic Ocean from the Atlantic through the relatively warm waters of the Nordic seas and Fram Strait plus via the Barents Sea. By volume this is five times more than Pacific inflows. Flows from the Pacific, driven by higher sea levels in the Pacific than Arctic or Atlantic occur through the Bering Strait. Waters exit through the Fram Strait along East Greenland, and around the Labrador Sea and Baffin Bay and through the Canadian Archipelago, forming North Atlantic waters. Once in the Arctic Ocean, the warmer Atlantic waters, create a layer (200-1000 m) depth over the Ocean below which are cold bottom waters (about -1oC). Lighter Pacific inflow overlies the Canadian Basin. Ice melt, river input, and ice formation create a surface Layer which is less dense, Circulation features within the Arctic Sea include the Canadian clockwise Beaufort Gyre and the Eurasian Transpolar Drift Flows which exits the Fram Strait. Wind plays an influential part in these surface currents. Coastal surface currents for both continents are counterclockwise. The Subsurface circulation is counterclockwise.

Sea Ice.

Seasonal temperature change in the Arctic above and below the freezing point of sea water leads to an advance in sea ice coverage in late autumn and winter, and then a retreat of sea ice in late spring and summer. There is an important feedback mechanism involved with sea ice melting: when the ice melts, it uncovers dark ocean water, which absorbs sunlight much more effectively than ice, which reflects most sunlight. This leads to a greater seasonal ice advance and retreat than one would otherwise predict. Minimum sea ice coverage typically occurs in September, and the level of coverage at this September minimum has been shrinking for decades.

A similar phenomenon occurs on land with snow cover25. The land surface warms and cools more rapidly than the ocean, however, so the snow disappears in spring earlier than the sea ice, and reappears earlier in late summer or autumn. The land surface itself freezes in winter, and melts in summer. However, the mean temperature in the Arctic has been below freezing for a long time. The result is that in winter, the ground is frozen to a considerable depth – in some places to a depth of several thousand feet. Because the thermal conductivity of soil is low, only the surface layer (the active layer) melts in summer, leaving a thick frozen layer below year around. This is called permafrost. In summer, if the soil has high water content, the terrain becomes bog-like. By late summer, the surface mat of vegetation may dry, but the water-saturated mud still remains below the vegetation. Very different construction techniques are required on permafrost as compared with elsewhere.26. The impedance of drainage by permafrost is also responsible for the bog-like character of tundra vegetation. The melting of permafrost, either as a result of development-related soil disturbance or climate change, may result in large-scale destabilization of Arctic soils, with dramatically increased erosion. This erosion results in increased turbidity in rivers and estuaries, cutting off light to aquatic and marine plants growing below the water surface, with deleterious results for arctic fisheries and marine food webs.

River Flows into the Arctic Ocean.

Major riparian inflows to the Arctic Ocean include the Pechora, Ob, Yenisei, Pyasina, Khatanga, Anabar, Lena, Yana, Indigirka, and Kolyma rivers in Russia (which contains the predominant number of rivers in the region), and the Colville, and Mackenzie rivers in North America. Numerous rivers of the adjacent sub-Arctic are also noteworthy, such as the Yukon River flowing into the Bering Sea. All of these rivers traverse low-lying coastal plains to form large estuaries, important in the biological productivity of the Arctic, which contain both marine and terrestrial wildlife in intense abundance.

[25] http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MOD10C1_M_SNOW
[26] http://eusoils.jrc.ec.europa.eu/library/maps/Circumpolar/download/137.pdf

III. The Biological Arctic Resources.

A. Seas and Oceans.

The areas of inflow from other oceans contain massive plankton communities, acknowledged to be the basis of the arctic food chain, with associated prolific fish populations. The largest areas of the open water, including on or near the continental shelf and shorelines, are predominantly within the Law of the Sea limits of Russia, Greenland, Iceland, Norway, Canada, Finland, and the USA. Much of the central area of the ocean has been covered for millennia by ice.

"Ecologically the arctic area with the Arctic Ocean and the surrounding Bering and Nordic seas span a very wide range of conditions. Broadly the arctic area can be subdivided into high, low and sub-arctic zones, corresponding roughly to areas with permanent ice cover, seasonal ice cover, and no ice cover but with cold water stemming from ice formation in adjacent areas. In terms of productivity, the high Arctic has a short growing season and low production overall, while the sub-arctic seas are generally rich with relatively high production."27

"There are four basic Arctic fisheries: three in the Atlantic (the Norwegian and Barents Sea,: Iceland-east Greenland, and Newfoundland-Labrador), and one in the Pacific (the Bering Sea). "Warmer Arctic surface and water temperatures, reductions in sea ice coverage and thickness, reduced salinity, increasing acidification and other oceanographic and meteorological changes are all factors that are certain to affect arctic marine ecosystems, so that accurate predictions cannot be made. The anthropogenic effects will also bring large changes. "28

The species include “those few circumpolar species including: capelin (Mallotus villosus), Greenland halibut (Reinhardtius hippoglossoides), northern shrimp (Pandalus borealis), and polar cod (Boreogadus saida)) and those of commercial importance in specific regions the Atlantic cod (Gadus morhua), haddock (Melanogrammus aeglefinus), Alaska pollock (Theragra

[27] R. Corell et al., The Arctic Council's Assessment of the Arctic by the Pew Charitable Trust. http://www.arcus.org/witness-the-arctic/2005/2

[28] R. Corell et al., The Arctic Council's Assessment of the Arctic by the Pew Charitable Trust. http://www.arcus.org/witness-the-arctic/2005/2

chalcogramma), Pacific cod (Gadus macrocephalus), snow crab (Chionoecetes opilio)", "as well as include herring, salmon and (red) king crab."29

Arctic Fisheries as percent of global fisheries stocks (from Lindholt, 2006).

Wild marine fish 10.1

Crustaceans 5.3

Salmon and trout fish farming 7.7

Marine mammals that are abundant in coastal and oceanic areas include seals, walruses (Obodenus rosmarus), and whales, especially the bowhead whale (Balaena mysticetus). On the sea ice and in coastal terrestrial areas, the food web also includes bears (Ursus maritimus and U. arctos); scavenging fox (Vulpes spp.) populations are associated with these bears. Large seasonal birds populations include the rock and the willow ptarmigans (Lagopus muta and L. lagopus), puffins (Fratercula spp.), ravens (Corvus corax), ducks and geese such as the greater white-fronted goose (Anser albifrons), Ross's gulls and ivory gulls (Rhodostethia rosea and Pagophila eburnea), redpoll (Carduelis spp.), gyrfalcon (Falco rusticolus), snowy owl (Bubo scandiacus), the little auk (Alle alle), and guillemots (Uria aalge), some of which are endangered.

At the northernmost areas, due to harsh conditions at the shoreline including frequently heavy fetch, ice flows, high salinity fluctuations, and long periods with no or minimal incident sunlight, the shoreline vegetation is sparse and low in productivity. The macro-algae found in the middle to sub-arctic latitudes exhibit much greater abundance and productivity. Plankton productivity on the other hand is very high in many coastal areas and furnishes a major base for the food web. The entire marine system is fragile, and has not experienced major pollution events nor was required to be resilient to anthropogenic changes except in small selected areas.

[29] R. Corell et al., The Arctic Council's Assessment of the Arctic by the Pew Charitable Trust. http://www.arcus.org/witness-the-arctic/2005/2

B. The Terrestrial Environment (Forests and Tundra).

As the southern edge of the arctic region corresponds to the northern limit of forest cover, so the terrestrial ecosystems of the Arctic are of two general types: forest and tundra. In basic terms, where the climate permits trees to grow there is forest, but where it is too cold for trees there is tundra. This is not a well-defined boundary however, and these cover types exist along a continuum. Forest and tundra vegetation intergrade with one another across a broad transition zone (ecotone) sometimes several hundred kilometers in width, in which elements of both cover types are present. This transition zone is known as the latitudinal tree line. Depending on location and climate, the tree line may be located at latitudes well north of the Arctic Circle (e.g. at 70°N in Norway), or far to the south (e.g. at 56°N on the Labrador Peninsula, Canada). Whether classified as forest or tundra, the determining characteristic of all terrestrial ecosystems in the Arctic is the presence of permanently frozen soil (permafrost). Permafrost not only limits plant growth but also impedes the vertical movement of water through the soil, thereby creating the boggy surface conditions that are so characteristic of the Arctic during the summer growing season. It is largely a result of this frozen soil that the terrestrial Arctic represents one of the largest repositories of fresh water on the surface of the earth.

The forests of the Arctic (synonymous with "boreal forests" or the Russian word taiga) are the largest terrestrial biome on Earth.30 Almost exclusively coniferous in composition, they are dominated by extensive pure stands of spruces (Picea glauca and Picea mariana in North America; Picea abies in Eurasia), larches (Larix decidua, Larix sibirica, and Larix gmelinii in Eurasia; Larix laricina in North America) and pines (Pinus sylvestris and Pinus sibirica in Eurasia). Russia and Canada contain the largest areas under forest in the Arctic, with smaller (but still significant) forest areas in Alaska and Fennoscandia. Though overall levels of biodiversity are low, they represent an important center of diversity for mosses (bryophytes), lichens, and fungi.31 The forests of the arctic region are also a critical seasonal habitat for numerous

[30] Pielou, *The World of Northern Evergreens*. Ithaca: Cornell University Press, 2011.
[31] Esseen et al., *Ecological Bulletins* 46: 16-47, 1997.

migratory bird species, and birds represent the most numerous form of vertebrate animal life present on the landscape.32

As in all coniferous forest types, catastrophic wildfire is a major ecosystem process in the taiga even under natural conditions, and any increased frequency of forest fires as a result of climate change (e.g. due to increasing temperatures and higher evaporation rates leading to drying) will represent a real risk to the continued integrity of the ecosystem and its potential for carbon storage. Likewise, the accelerating human exploitation of the forest resources of the Arctic in the next 50 years can be expected to increase habitat fragmentation and degradation.

To the north of the forest zone is the tundra, a boggy plain dominated by grasses, sedges, and turf-like dwarf shrubs, with mosses and lichens covering areas of exposed rock.33 The tundra is especially important as a habitat for wildlife, including such charismatic vertebrate megafauna as caribou/reindeer (Rangifer tarandus) and musk ox (Ovibos moschatus), but also Arctic hare (Lepus arcticus), Arctic fox (Vulpes lagosus), snowy owl (Bubo scandiacus), and lemmings (rodents of the subfamily Arvicolinae). In addition, the tundra is the breeding ground for many migratory bird species such as the tundra swan (Cygnus columbianus) and the greater white-fronted goose (Anser albifrons). The importance of the tundra as a habitat for these and other waterfowl is largely a result of the great abundance of fresh water in the tundra environment in the summer season

The terrestrial ecosystems of the Arctic are of relatively recent origin, having formed only since the retreat of continental ice sheets at the end of the Pleistocene epoch approximately 12,000 years ago. As such, they are not yet in a state of long-term equilibrium with their environment and are considered highly fragile. Arctic ecosystems exhibit low biodiversity and low productivity, but low temperatures mean the rate of decomposition is very slow, so the accumulated carbon storage of the Arctic forests and tundra (mostly in the form of peat) is the largest of any region in the world. The preservation of this terrestrial carbon store in the face of

[32] Schmiegelow and Mönkkönen, *Ecological Applications* 12: 375-389, 2002.
[33] Bliss et al., *Annual Review of Ecology and Systematics* 4: 359-399, 1973.

climate change and development pressures in the coming decades is a matter of critical global concern.34

The effects of climate change on the forests and tundra of the Arctic have already been dramatic. These include increased frequency and intensity of forest fires, expanding multi-year outbreaks of spruce beetle (Dendroctonus rufipennis) with resulting mass mortality of trees in Canada and Alaska, and northward migration of tree line (which is manifest in incipient form on the tundra landscape in the form of increased shrub growth).35 In the coming 50 years we can only expect these trends to accelerate.

IV. The Arctic Mineral and Energy Resources.

A. Energy Resources.

The Arctic's total global share of gas and oil production is presently about 16%. The Arctic Council has estimated that up to one-fifth of the world's undiscovered petroleum resources can be found in the Arctic. Also they state that the Arctic's share of the world's presently-known petroleum resources is 12%. It is well-known that Russia is the most important gas and oil producer in the Arctic and the bulk of proven Arctic oil and gas reserves are located in Northern Russia. (Note that together the production from arctic Russia and Alaska result in 97% of the total Arctic oil and gas. Russia is predicted to contain the bulk of the undiscovered petroleum reserves while significant regions of petroleum are predicted in Alaska, Canadian offshore and the Norwegian Sea. Predictions include future, new oil-producing states occurring within Greenland and Iceland territorial waters.36

[34] Schulze et al., *Science* 289: 2058- 2059, 2000; Myneni et al., *Proceedings of the National Academy of Sciences* 98: 14784-14789, 2001; Gorham, *Ecological Applications* 1: 182-195, 1991.
[35] Soja et al., *Global and Planetary Change* 56: 274-296, 2007; Parmesan, *Annual Review of Ecology and Systematics* 37: 637-669, 2006.
[36] Information summarized from the Arctic Council webpage (http://www.actic-council.org).

B. The Arctic Mineral Resources (Other than Petroleum-related).

Estimated Arctic Share of Global Production of Selected

Raw Mineral Materials[37]

2002.

Iron and ferro-alloy minerals	Per cent
Iron ore	2.3
Nickel	10.6
Cobalt	11.0
Chromite	4.2
Titanium	0.3
Tungsten	9.2
Non-ferrous minerals	
Bauxite	1.9
Zinc	7.8
Lead	5.6
Copper	3.8
Palladium	40.0
Precious metal ores	
Gold	3.2

[37] Lindholt (2006), *'**Arctic** natural resources in a **global perspective**', in Glomsrød, S. and Aslaksen, J. (eds) The **Economy** of the North, Oslo: Statistics Norway.*

Silver 3.6

Platinum..... 15.0

Industrial minerals

Diamonds - gem 26.8

Diamonds - industrial 23.3

Phosphate 3.7

Vermiculite 5.8

Forestry

Wood 2.2

1 Some Arctic shares are estimated and must be considered as approximate figures. Consequently, the findings in this table should be treated with caution.

2 The Arctic share of global wood reserves is estimated to 8.2 per cent.

It can be clearly seen that given the small aerial extent of the terrestrial arctic surface, extensive mineral deposits are found in the Arctic environment. In addition, glaciation has cut into the crust in many places so that many mineral deposits lie fairly close to the surface and are therefore accessible.

V. What will occur in the next 50 years? How will the arctic environment be affected, and what will this mean for its environmental sustainability?

A. Potential built structures and activities in the future.

1) Ports, wharves, moorings, buoys, runways, roads, passage ways, channels, and terminals; coupled with far more vessel movement in the Arctic Ocean, spills and accidents, bilge and vessel waste streams.

2) Mining and energy extraction encampments (near resource locations);

3) Urban settlements (these could be a strategic sites, or at ports, or large-scale extraction areas;

4) Temporary work areas as communication towers, construction of other built spaces, buoy placement, and other work areas;

5) Fisheries encampments;

6) Indigenous camp or village expansion;

7) Military bases, weather stations, and other government structures;

8) Hotels and other facilities catering to tourism industry.

B.) Exploitation of Fisheries.

If commercial fisheries in the Arctic are open to all nations (beyond the sovereign territorial limits) without catch limits or closed breeding seasons, this overexploitation is likely to lead to a degradation of target species. The by-catch should be severely limited and dealt with ecologically rather than as wastes. Both species populations and fishing operations should be monitored for sustainability. The food webs leading to these target species could also be altered through predator-prey relationships and other links. Benthic species also should also have limits, seasons and careful monitoring. The fisheries agreements on these species are highly imperfect and need to be addressed, especially EU-US-Russia fishing agreements as well as third party agreements. Obviously, the 30 groups of indigenous fisher folk will be held under other rules appropriate to their traditional fishing.

C.) Decreased Salinity.

Salinity of estuarine and ocean waters will be affected by melting of glacial and sea ice, construction, and outflow from urban centers. This can be expected to occur in association with siltation from soil disturbance and melting permafrost on land. This can be expected to be damaging to the productivity of marine food webs and fisheries.

D.) Acidification.

Increased oceanic and estuarine acidification with changes in shell formation and calcium relations, will likely affect the general physiology of marine plants and animals. This will result from the carbon dioxide balance in the oceans and the changing pH which potentially effects marine mammals and birds.

VI. Recommendations for Planning to Develop and Exploit the Resources of the Arctic Area in a Sustainable Manner.

A.) Management.

Management of ecosystems and landscapes should follow natural cycles. Sensitivity to sustaining natural ecosystem processes is the key, even if it may sometimes lead to the use of counterintuitive practices. One example is that the major cycle of natural disturbance in arctic forests is catastrophic wildfire, so that regional coniferous tree species are adapted to seed and grow under these conditions. The most sustainable mode of silviculture in this context (ensuring the regeneration of the forest) is one that mimics the massive tree mortality caused by catastrophic fire, removing large numbers of mature trees at one time rather than the selective cutting of smaller numbers of trees.38 Similarly, movement of vehicles and heavy equipment across tundra as part of petroleum exploration or extraction should be strictly limited to the winter season, when the fragile tundra vegetation and soils are frozen and snow-covered, and

[38] Bergeron et al., *AMBIO* 33: 356-360, 2004.

therefore protected from damage, despite the additional expense and danger to personnel that winter operations may represent.39 That these recommendations may seem surprising serves only to underscore the importance of further scientific research to determine the tolerances and resilience patterns of arctic biological systems.

B.) Waste Streams Into Surface Waters.

Zero emission policies should be implemented throughout the area for water emissions into the seas, rivers, or estuaries and ocean[40]. Waste depositories should be self-contained and soil and pollutants eliminated for municipal, port, extractive industries, mining, and shipping. Negligible waste emissions policies into bodies of water can presently be implemented by technologies such as plasma waste technology, present sewage treatment technology, and many various municipal waste technologies. Mine tailings and other byproducts of extractive procedures should be designed to be carefully reburied, not left in uncovered slag heaps on land for strip and deep mining. These principles should be set forth at the outset of development.

The small size and circulation patterns of arctic waters mean that unless all eight nations agree and implement these principles, the sustained ecological integrity of the ocean and seas will not occur for all. Oceans should not be dumping areas for solid waste, sewage, vessel or wastes from mining or energy-extraction. The inevitable spills by vessels, and during extraction should be cleaned by surrounding, re-filtering, evaporation or combustion technologies. In addition, vegetation, physical barriers and other buffers should be maintained to prevent the

[39] http://dnr.alaska.gov/mlw/tundra/exec_summary.htm

[40] USACOR author Bernard Zak's opinion is that "zero emissions" must be understood as the goal, rather than to be taken literally. He states that if there is any flow of wastewater to natural surface water, no matter how extensively treated the wastewater, it's not possible to assure that contaminants in it have a true zero concentration. That leaves physically preventing any wastewater flow into natural surface waters as the only possibility for fully satisfying this recommendation as written. Given the low evaporation rate in the Arctic because of the low temperatures, and given that impoundments collect meltwater as well as wastewater, impoundments typically cannot be prevented from overflowing into natural surface waters for at least part of the year. Enhancing evaporation by supplying additional heat is, of course, an option, but one that is seldom economically feasible. So adequate treatment of wastewater before it flows into natural surface waters is the only practical option for minimizing water contaminant emissions in the Arctic.

seaward movement of eroding soils from climate-change related coastal erosion in development areas.

C.) Factory Fishing Vessel Ban.

The operation of factory-fishing vessels of any nation, including those of the encircling nations must not be allowed in Arctic waters for the foreseeable future including the Bering Sea. The marine ecosystems of the Arctic are fragile and presently there is a very low level of knowledge of arctic marine ecosystem resilience or recuperative ability once degraded. The recommendation for well-executed mariculture growth of fisheries would create a far more sustainable investment than factory ship "Hunting-gathering" with extremely technological capture devices. Present regulations are inadequate and need revising immediately.

D.) Ecosystem Management.

Ecosystem management should be adaptive. Although ensuring the stability of existing natural systems and habitats is a critical aspect of sustainability, we must acknowledge that we are living in a period of accelerating global change in which climate is changing, species are migrating, and the ecosystems of the past may not be those we will be able to maintain in the future. Centers of breeding for marine mammals and birds should be protected, as should breeding centers for endangered species, but we must be realistic in our assessments and willing to consider new options for arctic management including fisheries hatcheries and releases.

E.) Coastal Habitat Impacts.

Coastal habitats should be restored after development or industrial/extractive activities rather than leaving areas barren and degraded. Ecological restoration and stabilization should be an integral component of planning, budget and design. Projected coastal erosion (as permafrost melts) and sea level rise need to be taken into account in planning all facilities. In various Arctic areas, the coast is presently receding at more than 16 m per year with a sea level rise of only 3

mm per year. Projections of sea level rise and coastal erosion range, but could accelerate sharply so that habitat restoration and sea level rise need to be taken into account in future development projects.

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F.) Mariculture and Algal Culture.

High-quality fisheries mariculture should be considered in the management of marine systems. Care must be taken dealing with no release of polluting substances from these facilities. Algal mariculture should also be undertaken. Mariculture has the potential to be much more sustainable than capture fisheries that result in the depletion of wild fish stocks food webs, and can alleviate the need for a major protein source otherwise necessary as food transport from outside the Arctic region.

VII. Consideration of Interactive Effects Among Major Factors.

A.) Mining and Energy vs. Environment.

Mining and energy development will increasingly interact with the environment to [potentially compromise sustainability. This much is obvious. Novel solutions must be found and sound management practices developed and adhered to to minimize risk and maximize sustainability.

B.) Physical Arctic processes vs. development and transportation.

Climate, ocean processes and hydrology will impact developed space and shipping routes. The catastrophic risk posed by accidents, oil spills, flooding, changes in sea level and the response of materials to naturally-occurring processes (low temperatures, low light, high winds, high wind pressures, extremes of weather, no food growth in arctic except fish and algae, etc.) must be planned for and taken into account for all projects large and small.

C.) Population, environment and culture vs. development.

Population, energy, environment and culture (both indigenous and industrialized) must be respected and accounted for in planning and execution of projects. We fully expect the population to minimally triple in size with imported workers, who have not adjusted to the extremes in arctic environment, nor been educated in the environmental sustainability of the Arctic.

D.) Preparedness vs. development.

The extremes of climate will interact with human safety and well-being, inevitably resulting in accidents and incidents that will impact ecosystems, both terrestrial and marine. Emergency response capability, which presently is extremely limited in the Arctic, will need to grow ahead of development so it is in place as needed in the development process. It will need to be developed in parallel but slightly ahead of the various utilizations of the Arctic, since the problems of dealing with the arctic will be faced at the outset.

E.) Legal instruments revisited for interactive environmental issues.

Present legal instruments are too conflicting and/or inadequate to handle all these above problems and need legal and national as well as Arctic Council revisiting. Especially the intermediate zone beyond the 200 mile limits, wherein fishing and extractive efforts may occur. These zones all need the same regulations, monitoring, and regulation to be sustainable.

VIII. Conclusions: Sustainability of Arctic Ecosystems and Economies.

As defined by the 1987 United Nations World Commission on Environment and Development (The Brundtland Commission, Ms. Brundtland, Prime Minister of Norway in

1987), "sustainable development" is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”[41]

The extreme conditions and fragile and sensitive ecology of the Arctic mean that sustainable management and development of the region in the next 50 years will require a thoughtful approach to planning and regulation that considers not only the needs of future human generations, but the stability of the ecosystems that make the human economies of the Arctic possible. The exploitation of Arctic fisheries, forests, plus petroleum and mineral resources and increased shipping and tourism must not be allowed to compromise the integrity and function of natural systems and landscapes, which may well prove to be irreplaceable and of critical import to the health of the planet.

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[41] http:// www.un-documents.net/a42r187.htm

3) Religion, Population and Health.

I. Religion in the Arctic.

In the case of the Arctic indigenous religions, the geo-climatic conditions that the Arctic population endured through millennia had prevented the development of more elaborate religious structures that would entice power and membership enlargement. As a result, doctrinal sophistication, elaborated forms of worship, and the building of elaborated sanctuaries are considerably absent, with the exception of the presence of various "sacred grounds," some protected by law today.[42] The Arctic forms of religiosity were simply limited to one's survival in relationship with the harsh nature, and thus focused exclusively on survival and healing, as seen in various forms of *animism*[43] and *shamanism*[44] still in practice today.

Although during the 18th and 19th centuries, Christian missionaries have largely converted the Arctic indigenous population to *Russian Orthodoxy* (e.g., Siberia, Alaska and parts of Finland), to *Protestantism* (e.g., northern Fennoscandia, Iceland, the Faroe Islands, Greenland, Alaska and parts of northern Canada), and even to *Roman Catholicism* [Alaska, Greenland (missions to the Norse), and parts of Canada],[45] the indigenous religion survived Christianity in the form of myths, superstitions and legends that rule one's daily life, as well as one's harmony

[42] Mikhail Todyshev, Tamara Semenova, et al., "The conservation value of sacred sites: a case study from northern Russia," in Einarsson, Níels; Joan Nymand Larsen, Annika Nilsson, Oran R. Young. (Eds) *Arctic Human Development Report*. Reykjavik: Stefansson Arctic Institute & Oddi Printing Co., 2004, 57-58.

[43] From numerous studies insist on defining Arctic religions as predominantly animistic and shamanistic, a recent collection of papers were presented on this subject during the Second International Conference of the Northern Studies Association at Hokkaido University in Japan, in 1995. These papers were edited by Takako Yamada and Takashi Irimoto and published into a volume titled *Circumpolar Animism and Shamanism*, published by Hokkaido University Press in Sapporo, in 1997. This volume featured several ethnographic traditions from Siberia, northern Canada, and Hokkaido on the nature of "circumpolar" ritual through on a phenomenological approach to northern societies. The authors focus on the concept of animism as to identify the "primitive" belief that objects could have spiritual essences.

[44] Mircea Eliade, Willard R. Trask, Wendy Doniger. *Shamanism: Archaic Techniques of Ecstasy*. Princeton: Princeton University Press, 2004.

[45] Einarsson, Níels; Joan Nymand Larsen, Annika Nilsson, Oran R. Young. (Eds) *Arctic Human Development Report*. Reykjavik: Stefansson Arctic Institute & Oddi Printing Co., 2004, 57. See also, David C. King *Cultures of the World: Greenland*. Cavendish, Marshall Corporation, Tarrytown, NY, 2009, 91-96.

with the universe itself. This is because the adoption of the Christian faith was not necessarily a replacement of religion, but a synergic combination and a merger of faiths that preserved key elements from the animist and shamanist outlook on life. For example, in the case of Russian Orthodoxy, not only the general concept of the universe as a perfect harmony, but more so the conceptual symbiosis between the concept of "ecclesia" (church community viewed as a family unit), and the Arctic family lifestyle had eased the missionary's work of conversion. Additionally, the view of the Orthodox priest as one endowed with the spiritual power to heal the soul (and even the body) by faith alone, found additional symbiosis between the two faiths. While animism was concerned with man's harmonious relationship with the environment, shamanism represented a restorative intervention as an attempt to reestablish order in the face of catastrophic events such as illness, bad hunting, starvation, bad weather, death, and so on.

Arctic animism is visible in man's worshipping of nature, whereby the human being is the nature's child, and man's behavior, whether good or evil, determines the relationship with the nature itself.[46] The nature is sacred, it has its soul, and everything is allegedly in full harmony. For example, for the Inuit, life was eternal, and death was understood as man's gradual departure from one world to another. Death was a transformative journey to a world situated under the water and earth; a world rich in seal meat and berries. Because man has more than one soul (each soul governing a part of the human body), illness, or "the small death," happens when one or more souls have left the body, and the departure of such soul is often necessary to serve as a messenger to the other world.[47]

Arctic shamanism was practiced as a restorative instinct toward healing, and toward the (re)establishment of man's harmony with the universe through preventive and curative measures. Preventive measures involved the use of amulets (e.g., small bones, teeth, wooden figures, stones, bird wings, dried intestines, etc.), that were as much revered as kept in secret to protect against illness and death. As for curative measures, it often depended on shaman's ability to interpret the will of the gods and spirits to ensure the survival of the community and of the individual. As ritual leader, the shaman was the only one credited with the power to interpret the

[46] Pamela R. Stern. *Daily Life of the Inuit*. Santa Barbara, CA: Greenwood An Imprint of ABC-CLIO, LLC: 2010, 104-105.
[47] David C. King. *Cultures of the World: Greenland*. Tarrytown, NY: Cavendish, Marshall Corporation, 2009, 94.

mystery of illness, cure the sick, control the nature and predict the future. After years of training, the shaman's ritual itself implied going into a trance as to communicate with the souls of the deceased.[48]

Arctic Cultural and Religious Landscape.

The current religious and cultural landscape of the Arctic population includes several nations. A mapping of subdivisions according to language families was compiled by W.K. Dallmann of the Norwegian Polar Institute,[49] and this includes the following: Na'Dene (Athabaskan, Eyak, Tlingit, Haida), Penutan, Macro-Algonkian (Algonkian, Wakasha, Salish), Macro-Sioux (Sioux, Iroquois), Indo-European (Germanic), Eskimo-Aleut (Inuit, Yupik, Aleut), Uralic-Yukagiran (Finno-Ugric, Samodic, Yukagiran), Altaic (Turkic, Mongolic, Tunguso-Manchurian), Chukotko-Kamchatkan, Ket, Nivkh, Ainu.

Concerning religious demographics, both the *World Christianity Database*[50] as well as the *World Religions Database*,[51] provide the following data. (Table 2)

4)

People Name	Country	Popul. 2010	Popul. 2025	Christian	Non-Christian
Eastern Arctic Eskimo	Canada	16,481	18,694	100%	0%
North Alaskan Eskimo	Canada	6,803	7,717	100%	0%
South Baffin Eskimo	Canada	2,381	2,701	100%	0%
Tunungayualok	Canada	3,402	3,858	100%	0%

[48] Christina Pratt. *An Encyclopedia of Shamanism: Volume 1.* New York: The Rosen Publishing Group, 2007, 27.
[49] http://www.arctic-council.org/~arctikar/images/maps/indig_peoples.pdf (Last accessed: June 9, 2012)
[50] Cf. http://worldchristiandatabase.org (Last accessed: June 9, 2012)
[51] Cf. http://www.worldreligiondatabase.org (Last accessed: June 9, 2012)

Western Canadian Eskimo	Canada	10,498	11,907	100%	0%
Greenlander (Eskimo)	Denmark	7,548	7,914	90%	10% Agnostics
Kalaallisut Eskimo	Greenland	34,378	33,660	97.20%	0.8% Baha'i 1%Ethnoreligion 1%Agnostic
North Greenland Eskimo	Greenland	10,944	10,715	97.20%	0.8%Baha'i 1%Ethnoreligion 1%Agnostic
Naukan Eskimo	Russia	429	417	20%	80%Ethnoreligion
Siberian Eskimo (Aiwanat)	Russia	1,730	1,682	18%	80%Ethnoreligion 2%Agnostic
Bering Eskimo (Siorarmiut)	United States	1,397	1,574	96%	4%Agnostic
Eskimo	United States	21,416	24,133	96%	4%Agnostic
Eskimo Creole	United States	3,104	3,498	98%	2%Agnostic
Ingalik	United States	435	490	90%	10%Ethnoreligion
Arctic Lapp (Ume)	Norway	488	541	95%	5%Agnostic
Arctic Lapp (Ume)	Sweden	1,126	1,222	94%	6%Agnostic
Dolgan	Russia	7,148	6,952	70%	30%Ethnoreligion
Even (Lamut, Ola)	Russia	18,785	18,269	4%	6%Agnostic 90%Ethnoreligion

Yakut	Russia	437,095	425,096	66%	4%Agnostic 30%Ethnoreligion
North Alaskan Eskimo	United States	9,312	10,493	98%	2%Agnostic
Northwest Alaskan Eskimo	United States	8,691	9,793	96%	2%Atheist 2%Ethnoreligion
South Alaska Eskimo	United States	3,104	3,498	96%	4%Ethnoreligion
West Alaskan Eskimo	United States	24,396	27,491	96%	4%Ethnoreligion

Table 2 | religious demographics of the Arctic peoples

Religious and Cultural Implication for the Future.

Given the raise of the trend of internal identity awakening,[52] the recreation of tradition and symbols, as well as in light of various efforts for cultural preservation made by the Arctic Council, and other entities,[53] it is highly unlikely that Arctic religious spiritualities would disappear. Yet, emerging challenges will be triggered by global competition over resources,[54] which, for the Arctic population and its spirituality, will be nothing more than a "resources curse." Given the resource-driven immigration into the Arctic, missionary activities will most likely parallel resource exploration in line with the common trend of the colonial era.[55] Such activities will most likely reinforce the existing religious organization, attempt to convert the existing agnostics, atheists, and ethnoreligionists to Christianity and perhaps other religions, and even trigger proselyte activities between Protestantism and Orthodoxy.

[52] Einarsson, Níels; Joan Nymand Larsen, Annika Nilsson, Oran R. Young. (Eds) *Arctic Human Development Report*. Reykjavik: Stefansson Arctic Institute, Oddi Printing Co., 2004, 50.
[53] Cf. http://www.arctic-council.org
[54] Richard Labévière. *La bataille du Grand Nord a commencé*. Paris: Librairie Académique Perrin, 2008.
[55] Todd M. Johnson, Rodney L. Peterson, Gina Bellofatto, Travis Myers. *2010Boston: The Changing Contours of World Mission and Christianity*. Eugene, OR: Wipf and Stock Publishers, 2012.

II. Population growth estimates.

About 4 million people live in the Arctic, half of which are in the Russian Federation and about 1.3 million in the Nordic Countries, 130,000 in Canada and 650,000 in the US. The eight Arctic countries are Canada, Denmark with the Faroe Islands and Greenland, Iceland, Norway, Finland, Sweden, the Russian Federation and the United States. Arctic communities and Indigenous people in particular rely on marine ecosystems for an important part of their livelihood and well-being. In the Arctic Council, six indigenous organizations are recognized as parties to the Arctic Council." (Arctic Council Report).

The International Futures Model (see Table 1) states that Greenland and Iceland's population will increase 50% in the next 50 year. The present trend of temperate workers being moved into projects on the Arctic will accelerate as jobs and commerce and industry becomes intensified. It is our first estimate that from 2 to 3 times more people from Russia, USA, and the European nations will move into the arctic region. Between 1.3 million and 2 million from the USA, between 4 and 6 million from Russia and between 2.6 and 3.9 million from Europe, making the population at least double to 8 million or more, up to 12 million. Severe problems with maintaining food and other built spaces will occur. The problems will be encountered in constructing shelter and industrial built space, ridding the area of waste and materials to withstand the winter conditions (Anitra Thorhaug).

The intensity of population growth can be seen to clump around the industrial and commercial ventures, which will be spread according to mineral deposits, fisheries, sea-lanes, and other fixed geological or biological features.

Table 1 Population of Iceland over 20 years (from International Futures, Hughes, 2006).

2010	2015	2020	2025	2030
0.321	0.3413	0.358	0.3711	0.3815

III. Health Issues.

Any discussion of Arctic Health must meet at least two constraints: that it be shorter than Tolstoy's "War and Peace"; and, that it is not a treatment for insomnia.

In past times the Aboriginal health profile depended on naturally occurring parasitic-host relationships. As a result of European colonization and exploration, a plethora of diseases have evolved, eg,: *Trichinella spiralis* from consumption of uncooked polar bear and walrus; rabies from fox and dog, (the original word was "suumuki", now "malukalis", leaving "suumuki" colloqually to imply insanity or intoxication; isolated cases of echinococcosis; diphylobothrium infestation; toxoplasmosis; cystic hydatid disease ; tularemia; pasturellosis; leptospirosis; listerosis; and brucellosis from infected deer.

In the coming decades, the population in the Arctic region is projected to increase significantly due to the expected expansion of exploration for oil, natural gas and other resources. The increasing immigrant population in this region will have to adapt to the environment including weather and limited daylight in the winter. The infrastructure will have to be expanded to accommodate the growing population with access to drinking water, sewage, transportation and healthcare.

Motor vehicles have replaced dog sleds; and modern air and sea transportation have provided an infestation of fleas with their pasturella plague potential.

Processes foods, aged cheeses, and home canning have introduced Botulism and enteric disorders. The advent of wooden buildings with filtered vegetational floorshave also created their share of gastrointestinal disorders. Disease control is once again dependent on education, water purification and improved living standards.

Emerging infectious diseases of the 21st century are raising multieyed medusal heads of drug resistant *Streptococcus pneumonae*, Helicobacter infection, hepatitis, *Haemophilus* bacteremia and meningitis. Coupled with immunocompromised individuals, pregnancy and neonatal demands, comes an exponentially increased incidence of disease in health care workers, clinical laboratory staff and Public Health Officers, who provide the frontline for recognition, treatment and prevention of illness. These, of course, include methicillin resistant

Staphylococcus aureus (MRSA), respiratory syncytial viruses, syphilis, chlamydia, gonorrhea, drug resistant tuberculosis, and Psychiatric disorders.

The evolution of lower ambient temperatures enhances food born disease, gastroenteritis, zoonoses, giardiasis, cryptosporidia, and traveling arthropod vectors.

Future requirements will include increasing management of acute illness and injury from medical, surgical (even robotic and remote) sources, DNA diagnostics, and Stem cell research. Care must be taken to avoid the potentially invasive depersonalization of medical skills dangerously inherent when electronic medical records stand alone, devoid of the major purpose of life - SERVICE. Circumpolar observations by Health Research committees, The Arctic Council and Multinational Governmental Cooperation and Collaboration remain the Gold Standard for Arctic health.

Bibliography.

LEGAL AND POLITICAL

Arctic Council Declaration on the Establishment of the Arctic Council; *Joint Communiqué of the Governments of the Arctic Countries on the Establishment of the Arctic Council*.

"The Polar Sea Voyage and the Northwest Passage Dispute," by Philip J. Briggs; *Armed Forces & Society*, Vol. 16 No.3, Spring 1990.

British Broadcast News United States and Canada August 2, 2010.

Hot Science in Cold Lands by John Carey, *National Wildlife*, Apr-May 91, Vol. 29, issue 3, p4, 10p.

The Arctic: An Opportunity to Cooperate and Demonstrate Statesmanship, an Address at Vanderbilt University February 2009 by Dr. Hans Corell.

NATO and the Arctic: is the Atlantic alliance a cold war relic in a peaceful region now faced with non-military challenges? By Helga Haftendorn; *European Security*; 2011, Vol. 20 Issue 3, p. 337-361.

Contested Sovereignty in a Changing Arctic by Hannes Gerhardt et als.; *Annals of the Association of American Geographers*, 100(4) 2010, pp. 992-1002.

The New Sovereigntist Challenge for Global Governance: Democracy without Sovereignty by Michael Goodhart and Stacy Bondanella Taninchev; *International Studies Quarterly* (2011) 55, 1047-1068.

Who Owns the Arctic by John G. Ikenberry; *Foreign Affairs;* Mar/Apr 2010 Vol. 89 Issue 2, p. 154-155.

World Briefing Europe; Russia-Norway Pact on Sea Border by Andrew E. Kramer *The New York Times* September 16, 2010.

Arctic Energy: Pathway to Conflict or Cooperation in the High North by Nong Hong; *Singapore International Energy Week,* October 4, 2011.

International Law and Politics in U.S. Policy making: The United States and the Svalbard Dispute by Torbjorn Pedersen; *Ocean Development & International Law*, 42: 120-135, 2011.

The Svalbard Continental Shelf Controversy: Legal Disputes and Political Rivalries by Torbjorn Pedersen; *Ocean Development & International Law,* 37:339-358, 2006.

"The Arctic, A New Partnership Paradigm or the Next Cold War?" by Reginald R. Smith; *JFQ* issue 62,3rd quarter 2011 ndupress.nddu.edu

"The Svalbard Continental Shelf Controversy: Legal disputes and Political Rivalries," by Torbjorn Pedersen; *Ocean Development & International Law,* 37:339-358, 2006.

United Nations Convention on the Law of the Sea, Montego Bay, 1982.

U.S. Department of State Diplomacy in Action, http://www.state.gov/r/pa/prs/ps/2011/05/163285.htm.

Charter of the United Nations and the Statute of the International Court of Justice.

"The New Enclosure Movement A Russian claim to Arctic territory starts another international dispute over polar land grabs," by Ding Ying; *Beijing Review*; August 23, 2007.

ENERGY AND RESOURCES

Pielou, *A Naturalist's Guide to the Arctic*. Chicago: University of Chicago Press, 1994.

Esseen et al., *Ecological Bulletins* 46: 16-47, 1997.
Schmiegelow and Mönkkönen, *Ecological Applications* 12: 375-389, 2002.

Bliss et al., *Annual Review of Ecology and Systematics* 4: 359-399, 1973.

Schulze et al., *Science* 289: 2058- 2059, 2000; Myneni et al., *Proceedings of the National Academy of Sciences* 98: 14784-14789, 2001; Gorham, *Ecological Applications* 1: 182-195, 1991.
Soja et al., *Global and Planetary Change* 56: 274-296, 2007; Parmesan, *Annual Review of Ecology and Systematics* 37: 637-669, 2006.

Bergeron et al., *AMBIO* 33: 356-360, 2004.

POPULATION AND HEALTH

AUTHOR: Bjerregaard, P. TITLE: The Arctic health declaration, Journal: International Journal of Circumpolar Health Number: 1 Volume: 70 Year: 2011
AUTHOR: Kondro, W. TITLE: Arctic health research. Journal: CMAJ: Canadian Medical Association journal= journal de l'Association medicale canadienne. Number: 1 Pages: 29 Volume: 180 Year: 2009
AUTHOR: Laurberg, P. and Kleinschmidt, K. and Hvingel, B. and Heickendorf, L. and Mosekilde, L. and others TITLE: Vitamin D changes in an Arctic Inuit society in transition Journal: Bone Pages: S104--S105 Publisher: Elsevier Volume: 50 Year: 2012
AUTHOR: Parkinson, AJ TITLE: Improving human health in the Arctic: the expanding role of the Arctic Council's Sustainable Development Working Group. Journal: International journal of circumpolar health Number: 3 Pages: 304 Volume: 69 Year: 2010