STRATEGIES OF RESOURCES DEVELOPMENT IN THE ARCTIC: A GEOPOLITICAL ANALYSIS

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CERTIFICATE

This is to certify that the dissertation entitled ***"Strategies of Resource Development in the Arctic: A Geopolitical Analysis"***, submitted by **Poonam Keral** in partial fulfillment on the requirements for the award of the Degree of Master of Philosophy, is her own work under my supervision and has not been previously submitted for any degree of this university or any other university.

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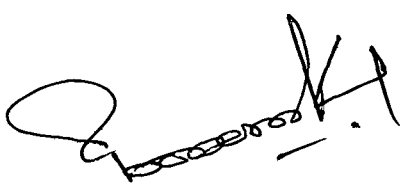

Poonam Keral

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CHAPTER - I

INTRODUCTION:

"Resources issue is likely to affect world affairs significantly in the years ahead. This impact may not always take the form of discord and conflict, but will certainly demand growing attention from policy makers. Whether in the economic, environmental or politico-military area, resource concerns are certain to rise on the international policy agenda".

— Michael T. Clare : *'Resource Wars: The New Landscape of Global Conflict'.*[1]

With passage of time human population increases and with it increases the demand for resources manifold to sustain itself. Natural resources as they 'are not but they become' whether by default or innovation or politico-economic compulsions. For example, natural oil seepages have been known for centuries in the Middle East, Eastern North America and even in Britain until the mid-nineteenth century they were not regarded as useful. A rapidly growing demand for lubricants and lamp oil, hitherto supplied few organic sources or oil shales, led to successful drilling of one such seepage in Pennsylvania. This first underground oil field made all other sources of oil redundant by producing high-quality petroleum with less effort and therefore more cheaply.

[1] Michael T. Clare, 'Resource Competition and World Politics in the Twenty-First Century', Current History, Dec. 2000 P. 403.

Political reasons during the second world war led to he development of synthetic rubber in the United States when natural rubber though required in vast quantities was not easy to procure from the overseas market/sources.

Similarly, when cobalt prices rose in mid-1970s, as supplies from Zaire of this supposedly critical mineral were cut off, the search for new technologies and substitutes was spurred on Cobalt-free magnets were developed and ceramics began to be used for turbine blades.[2]

We are likely to assume that the pressure generated by an ever-increasing demand for material resources would be mitigated by developing new resources of supply - for example by digging deeper into the earth for metals and oil and by inventing alternative materials. Thereby human enterprise and the market demand will continue to generate such solutions however, we cannot ignore the fact that the demand for certain commodities will simply overwhelm the available supply. As the resources dwindle, prices rise, leading to economic strain and societal discord between the 'haves' and the 'have-nots'.

And greater the pressure we bring to bear on the world's existing resource base, the higher the risk of major trauma.[3]

Besides planet earth has silent yet lethal ways of protesting against man's overbearance. The Antarctic-ozone hole, global warming are points in case. However, no sooner the environmental concerns are voiced the biggest culprits get either into silent retreat or in a state of denial. For example the Kyoto Treaty, if ratified, would

[2] Robert Repetto, 'Overview of the book', Living Resources of the Millennium 2000, P 6.
[3] op. cit, Michael T. Clare, Dec. 2000 P. 404.

require the US to reduce its 'greenhouse gas' emission to seven percent below 1990 levels by 2012. Since these emissions are substantially higher now than they were in 1990, compliance with the Kyoto Treaty would mandate massive cutbacks in US fuel usage. Required reductions could bring an unprecedented increase in fuel taxes, which is once again an economic burden that United States could do without.

Prudence dictates that concerned governments should balance environmental concerns against energy requirements, not sacrificing one for the other.[4] However, opinion tilts from hardcore environmentalist perspective to the 'booming economy supporters'. For example the oil reserves in the Alaska wildlife Natural Reserves are not allowed to be opened for exploration and drilling due to the environmental risk it poses, the supporters of the project claims that the US energy from the middle east should be reduced, the reserves in AWNR are equivalent of 30 years of Saudi import and the environmental risk resulting due to tanker traffic necessary to transport imported oil is not lighter.

Although the global stocks of most vital materials are sufficient for current requirements, the consumption of many of them is growing at such a rapid pace that serious scarcities could arise in the years ahead. This is particularly true for oil and water, two of the world's most vital resources particularly in areas like middle east where fresh water is in short supply and population growth rates are amongst the world's highest. Unless the existing sources of supply are used more efficiently, or the desalination of seawater proves more affordable, competition over access of

[4] Mackubin Thomas Owens, 'The Political Economy of Oil' (available at http://www.ashbrook.org/publicat/oped/owens/qo/oil.html.)

water will intensify in these areas and could lead to war so much so, that some scholar foresee the likelihood of a third world war over the possession of water.

To put it in more specifically one may say that the international relations study today, carries the hangover of the cold war era when military and ideological consideration were prominent, moving from there to the disarmament phase we now have arrived at the stand point when international relations are pivoted on the world's natural resource base, they are the future carriers of war and peace.

The worst aspect of steadily increasing resources consumption is not just its shortage in the future, but the irremediable damage being done to the global environment by their usage. There is no authoritative and widely respected world organization which would monitor the state of the world environment, since ailments like pollution do not follow political boundaries.

Corrective measures would undoubtedly require sacrifices and self denials on the part of many nations, which will not be forthcoming, until nations individually see themselves threatened.[5]

Since, 'Limits to Growth' doctrine is not easily excepted, as shortage of natural resources is seen as a major constrain on unrestricted economic development of the world.

In the quest of fulfilling our need of essential resources we constantly go deeper into our oil-wells and mines or try to locate new sources on explored territories, the obvious targets are the virgin lands like the polar region or the seabed

[5] Robert Dorfman, 'Natural Resources and Environmental Problems', 2001, P 94.

mining or even space i.e. the necessity to exploit all possible resources that are available to mankind.

Ocean floors or the deep seabed are one such source of natural resources, till now untapped, the future holds immense possibilities of extracting mineral resources from the ocean floor. However the world level is not yet prepared to make use of seabed minerals.

We are speculating about the possibilities of mining the moon and the asteroids that approach the earth. There is every possibility that such activities would one day become commercially viable.[6]

In the quest of resources the focus has shifted northwards as most temperate, equatorial and tropical resources have been tapped, utilized or exhausted. The Arctic ring is seen as the promising land with its vast natural resources including coal, oil and gas, besides it has strategic and military significance too.

Until recently there has been a tendency to ignore the importance of the polar regions in the development of many global models. This is not surprising, since most of us grew up looking at the maps of the world on Mercator's projections that by constructions does not include the poles. Computers have found it difficult to handle the rapid convergence of the lines of longitude close to the poles, most of these technical problems have now been resolved.[7]

The Arctic ocean comprises of the circum-polar North. Lands bordering this region include those of Alaska (U.S.A.), Canada, Greenland/Denmark, Iceland,

[6] Rajeev P.V., 'Exploration of Space, *The World Marches Towards 21st Century,* 1992, P. 85.
[7] Robert H. Rutford, 'Polar Research: Status and Prospectus', *AAAS selected symposium: Polar Research to the Present and the Future,* 1978, P. 263.

Norway, Sweden, Finland and Russia. It's vast areas with hostile climatic conditions and scant human population promise immense natural wealth, most significant being coal, oil, natural gas and substantial reserves of metallic minerals such as iron, zinc, nickel, tin, gold and copper and lead & silver.

The fishery resources of the Arctic region are amongst the richest in the world because of high oxygen content of the water, merging ocean currents and presence of nutrients and plentiful plankton.

Marine mammals are aplenty such as whales, seals, and walrus along with immense stock of fisheries abundantly supply species such as cod, herring, haddock, tunny, shrimps, etc.

Besides there is surprisingly abundant animal wealth most of which have been domesticated over the centuries most prominently reindeer and musk ox.

The Erstwhile Soviet Union has already developed many of these mineral resources, including gold throughout its Arctic Zone.

Western nations are also eyeing the Arctic sea route, which with the help of their state-of-the-art navigation technology, would provide the shortest route of transportation between the two major land masses. Considering the promising resource potential of the otherwise hostile Arctic, development of superior technology such as remote sensing, etc. has enabled economically sound method of resources exploration in the region. However, to make resource exploitation and extraction economically viable all over the Arctic, it may require some more time.

In spite of extremely harsh climatic conditions the resource treasure of the region has already led to several conflicts between the 'Arctic-Rim' countries. The main interest of these nations in the arctic are :

1. National security.
2. Oil and gas.
3. Scientific research.
4. Freedom of navigation.
5. Preservation of the environment.

United States are separated from Russia by a mere two miles of the Bering straits, so much for the geographical proximity between the two former cold war rivals. Thereby, the Arctic region holds military significance as well, the American missile-carrying submarines still ply the arctic waters as the Russian missile-carrying submarines. Besides other military activities including modernizing radar, laser oriented detection facilities, airborne warning and control system aircraft are stationed to protect mineral resources, such as Prudhoe Bay Petroleum Complex on Alaskas' northern coast and the gas fields on Yamal Peninsula in Northwest Siberia.

However, these economic and military endeavours have not gone unchallenged Environmental organizations like the Natural Resource, Defence Council in the United States, Social Ecological Union in Russia, and the large international associations, such as 'Greenpeace' all have national and regional offices with lobbying staff. Whether operating separately or in coordinated efforts with indigenous groups, these organizations regularly challenge government, corporations

or military appropriation that is perceived as threatening to the vulnerable and fragile Arctic region.[8]

Among the Arctic Rim States, the UN Convention holds the deciding guidelines in regards to thing such as the territorial sea, the contiguous zone, the Exclusive Economic Zone, and the continental shelf. However significant problems such as boundary delimitation (Beaufort, Sea, Chukchi sea etc.) and ambiguity over innocent transit and archipelagic sea lanes passages (Eg. North West Passage) have caused considerable friction between the concerned states. Thus we sea in the Arctic regions Security interests of the nations have taken four principal themes: military security, economic security, environmental security and scientific security.

The tussle for resources and military endeavours have led to an adverse impact on the lines of the indigenous population. With the over exploitation of ocean fisheries, the development of forest mining, metallurgic industry, petroleum exploitation, tourism and military activity is taking it's toll on the fragile arctic ecosystem. Furthermore, the changing life-styles of the indigenous inhabitants, infrastructure development, urbanization and local waste problem are additional presence.[9]

The last pristine wilderness on the planet has attracted attention of tourists from all over the world. Tourism in the North appears to be a fast growing industry.

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[8] Norman Chance, (available at http://arcticcircle.com.edu/intro.html)
[9] 'Willy Ley, 'Polar Regions', *Life Nature Library: The Poles*, 1974-76, P. 115.

"Wildlife tourism", or "explorer" tourism, is a part of the "green wave", and customers are prepared to pay large sums for seeing native wild-life.[10]

Under present circumstances the effort to limit economic activity damaging to the Arctic, comes in direct conflict with the requirements of continued growth, essential to the capitalist development.

The international threat of terrorism is also showing its impact in the Arctic. In Arctic Russia and elsewhere, the cold war legacy survives in the form of stored nuclear, biological and chemical weapons, nuclear waste and nuclear fuel. The focus is on the threat these substances pose to human life and also to the long term threats they pose to the environment.[11]

In 1992 Inuit Circumpolar Conference, a comprehensive Arctic Policy was outlined which emphasized that "Northern Development must refer to more than economic growth. It must allow for and facilitate, spiritual, social and cultural development.[12]

However there is no derth of the problems or conflicts emerging between Arctic Rim status be it economic, political, military, ideological or environmental in nature. There have been constant negotiations, co-operations and resolution of such conflicts at the international level.

Most Arctic nation dwell in the conflicts emerging largely due to lack of unambiguous, universally binding laws and adequate enforcing agency in the world.

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[10] Sigbjorn Eriksan, 'Government Structure of the Arctic – the rights and duties of the Northern People' – 2000-01, Pp 153-154.

[11] Samantha smith, 'The Arctic and the world', WWF Arctic Bulletin. No. 302, 2002, P. 3.

[12] Norman Chance, 'Northern Development and the Global Economy: An Introduction' (available at file ://A:\Northern Development and the Global Economy.html)

The UN Laws of the Sea and several such international documents and international policies have been doctrined, which credibly resolved various problems, but several international conflicts that have emerged over the sharing of the northern bounty still remain unresolved.

Not that international cooperation is totally absent in the Arctic, there are several extensive international Arctic co-operative programmes, most of them are to safeguard the Arctic Environment. Such as the Arctic Council estd. in 1996 March AEPS (1991), Protection of Arctic Marine Environment (PAME), Arctic Monitoring and Assessment Program (AMAP). Thus we see that Arctic region is a unique eco-bio-geo-socio-system, not replicated elsewhere and with it's special natural endorsement it requires special attention from the world.

The objective of the study is to understand the Arctic region, and analyse its position as a coveted resource region of the north inspite of a rather vulnerable and fragile ecology. How these natural resource reserves have led to emergence of several international conflicts and how several such conflicts have been resolved.

Chapter two seeks to explain the arctic land in great details including its physical climatological, geological, geomorphological and its marine and land flora and fauna.

Chapter three considers each of the eight arctic rim states and described crisply there geologic, anthropologic and climatological characters. This chapter gives details of the peopling of the arctic regions and an exhaustive resources inventory of the arctic land and resources. The potential they promise and how are they being

exploited, and economic-military and ecological plausibility of extraction of these resource. This chapter also deals with environmental concerns and controversies that have emerged in the Arctic in recent years due to economic development of the region and the international cooperation to compact the problems that have emerged as an after effect.

This chapter also examines the disputes that have cropped up due to indigenous people's protest against their alienation from their own land and resources and how the developmental agencies have dealt with such controversies.

Chapter four dwells in the controversies, conflict and co-operation that have been staged in the Arctic region over its mineral and material resources.

The work takes an indepth analysis of the nature and potential of the Arctic region, how various countries are making conflicting claims over the resources of the northern region and how they have been resolved and what do the future trends indicate.

CHAPTER II

THE ARCTIC REGION

"When you wish to know what people seek in this land, or why men go there with such a danger to their lives, there is a three fold nature of man which attracts them there. One part is competitiveness and a desire for fame, because it is man's nature to go where there is danger, and become famous by that. Another part is a desire for knowledge, because it is man's nature to want to know and see those parts he has been told about, to see whether they are as described or not. The third is a desire for material gain, because people search for wealth everywhere".

— Fridtjof Nansen (1861-1930) *(early arctic explorer – quoting from medieval Norwegian treaties, 'The Kings Minor' in his work 'In Northern Mists'.)*[1]

The Arctic region have long been a challenge, remote and forbidding, to man's sense of venture and curiosity. Today, in the sweep of technological advances it has become a big source of oil and gas, and tomorrow both Arctic and the Antarctic region is likely to be exploited for goods and minerals to support the earth's steadily expanding population. Already nine out of every ten human beings live on continents bordering the North Polar Basins, and the most powerful nations of the earth now form a ring around the North Pole. The cross roads of transportation have shifted

[1] Geir Hestmark, Fridtjof Nansen and the Spirit of the Northern Wilderness', *Arctic Wilderness – The 5th World Wilderness Congress,* 1995, P. 114.

since man has taken to the air, and today the North Polar Basin has become the new Mediterranean and 'the Middle Sea' of the earth, Aircraft traverse in it flying the transpolar route, the shortest distance between continents. Tankers have begun to break their way though the frozen passages of the region. The Arctic is central to the 21st century world.

DEFINING THE ARCTIC REGION

Although there is no consensus over the definition of the Arctic region, the expert who see things in botanical terms will bind the Arctic by the northern limits of trees.

The natural tree line is a boundary of considerable moment in the Arctic, Although there are obvious problems in deciding where trees end and give way to tundra vegetation, on a broad scale there is a relatively sharp zone between the two. There are several advantages in accepting the tree line as the southern land boundary of the Arctic. Not only does it represents a fundamentally important vegetation boundary, but it is important in terms of animal distribution. It coincides approximately with a mean July temperature isotherm of 10°C and thus is also of climatic significance. It causes an additional climatic contrast in that winters are more exposed north of the tree line than to the south; one result of the more structured conditions among the trees is that snow tends to lie more thickly in the winter. Above all, the tree line is an important human boundary, especially in North America where it separates remarkably clearly the arctic Inuit people from forest Indians. It also

effectively represents the northern limit of outdoor agriculture. If the tree line is accepted as the land boundary of the Arctic then this includes western and northern Alaska and a wedge of northern Canada which progressively widens towards the east, in addition the whole of Greenland is included along with a thin strip of the Former Soviet Union which also widens towards the east, this boundary however effectively excludes Iceland.

The climate specialist will draw his border along the widely shifting lines that marks a 10°C/50°F average temperature for the warmest month[2] i.e. the Arctic can be described as the region north of the 50°F (10°C) isotherm. The isotherm is a line on climatic map between points with the same mean temperature. The 50°F isotherm marks the southern limits of the region where the average monthly temperature never goes above 50°F and the average for the coldest month is below 32°F (0°C). The 50°F isotherm roughly follows the line of Arctic circle, except in Canada, where it dips down to the northeastern coasts of Newfoundland and across the southern part of the Hudson Bay. It also makes a loop around the Bering Sea as far South as the western tip of the Aleutian Islands. Within these limits Arctic conditions prevail over the land areas.[3] Not much land is included within the area defined as the Arctic. The northern coast of Siberia, most of Iceland, all of Greenland, north-eastern Canada, and the north coast of Alaska are the Landmasses, above the 50° isotherm. But peripheral to the Arctic is the sub-arctic, which is almost entirely land. The sub-arctic is the region where the average temperature is not higher than 50°F for more than

[2] Willey Ley 'The Cold, Far Frontiers', 1974-76, P. 10.
[3] John E. Sater, 'Arctic' The Encyclopedia Americana International Edition, 1983, P. 243.

four months of the year (unlike the Arctic where the months average is never above 50°) and the coldest month is not more than 32°F (like the Arctic). The sub-Arctic includes most of Siberia, Western Russia north of Leningrad, most of Scandinavia and Canada and all of Alaska, except the Arctic Coast and the Aleutian Island.

The geologist tends to fix polar boundaries by continental limits – adequate for the Antarctic region but not so helpful for the Arctic, for its most notable feature is a small ocean surrounded continents extending far to the south.

To an oceanographer, the Arctic is the region where the temperature of the ocean water remain near the freezing point of salt water, i.e. about 29°F (-1.7°C), and its salt content is above 32 parts per thousand.

However, these definitions are particular, not general, scientific viewpoints and are based on factors that keep changing. Worse, they tend to define a condition rather than a place.

There is another kind of Arctic Boundary to which none of these criticism applies. A natural boundary that is fixed as the stars in their courses and just as little subject to influence by changing climate, vegetation or terrain. That permanent boundary for both polar regions is lights. Because of the way earth's axis is tilted, each geographical pole is tipped 23½ from a plane vertical to the earth's orbit around the sun. The 23½ lines are marked upon globe as the Arctic and Antarctic circles, 66½ North and South latitude respectively. The relation between these two astronomically determined boundaries to the lighting of the poles is as follows: upon each circle for one 24-hour day in winter the sun never rises, and conversely for one

24-hour day in summer the sun never sets. Polewards from each circle the winter darkness increases and the summer light increases, until at the poles there is just one "day" in the year – six months when sun is continuously below the horizon and six months when it is always above its. The dividing times for this prodigious long polar "day" are the vernal and autumnal equinoxes, the two day on which the duration of sunlight hours is same over the entire globe.

Thus we understand that no single definition for delineating the Arctic shall suffice and a broad range of characteristics have to incorporated for the purpose of demarcation of the Arctic region.

For the purpose of this study we consider three major ways to define Arctic region – first, as the area north of the Arctic Circle (66° 30'N), second, as the region north of the 10°C (50°F) summer isotherm; and third, to the regions north of the tree line. The second and the third definition enclose roughly the same territory, which is somewhat longer than the region. Bounded by the Arctic Circle, this includes large parts of northern Canada, the Russian north, Greenland, Scandinavia, Iceland, Alaska, Svalbard and the other Islands.[4] (See Map - I)

Instead of putting more effort on reaching an acceptable definition of the Arctic region, it is clearly more acceptable that boundaries are not the key issue; it is the characteristics of the bulk of the area rather than its boundaries that are of most importance.[5]

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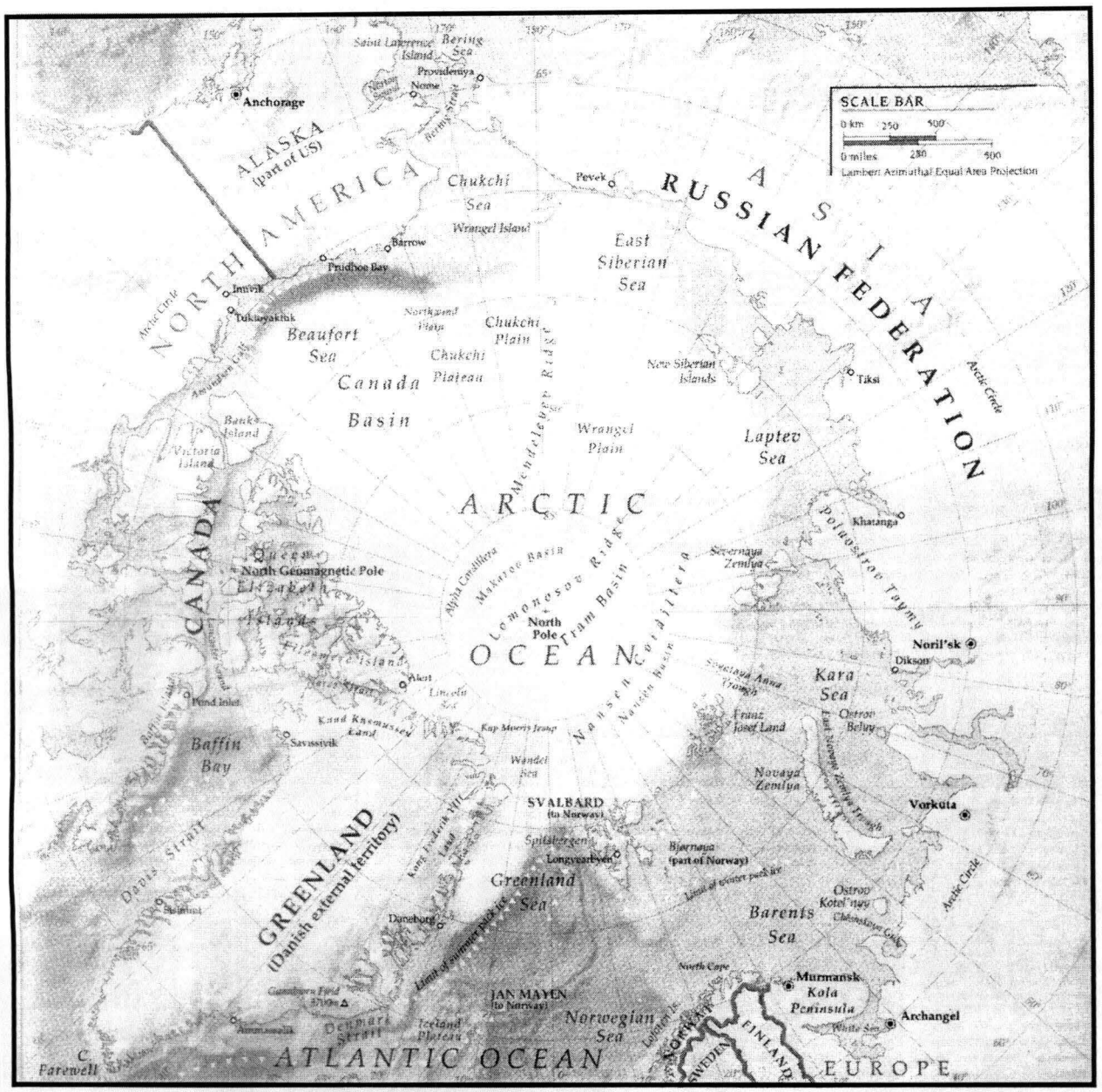
[4] Bruce Coleman, J.P.P. 'Arctic', *Funk and Wagnalls New Encyclopedia,* Vol. 26, 1982, P. 290.
[5] David Sugden, 'Arctic and Antarctic – A Modern Geographical Synthesis', 1982, P. 27

Map - I: PHYSICAL MAP OF THE ARCTIC REGION.



(**Source:** *'Longman School Atlas'*, 2002.)

In total the land mass accounts to 14.8 million square kilometers, and the Arctic marine area covers approximately 20 million square kilometers. Maximum sea ice covers an area of approximately 23 million square kilometers in March and minimum area of 8 million square kilometers in September.[6]

CLIMATE OF THE ARCTIC REGION : The annual climatic rhythm.

To most people the Arctic is simply a cold, bleak region – monotonous, inaccessible and unproductive. However, these stereotypes are contradicted when we consider the region carefully.

The Arctic is much milder and much less hostile to life.[7] It is cold enough in winters; temperature of - 50°C are common in many places. But at the very polar caps, the Arctic has the moderating presence of the sea just under the ice pack. As a result the coldest spot in the north is no where near the geographic pole but some 2,400 kilometer south in north-eastern Siberia, in an area centering around two town, Verkhoyansk and Oymyakon – There it has touched – 68°C.

In Greenland winter is long, cold, still and dark, the sun does not rise above the horizon for a period of about 9 weeks. The darkness is far from absolute however, and twilight exists as long as the sun is not more than 6° below the horizon. Temperatures in still clear weather can fall to – 50°C. Nor surprisingly all sounds of running water and waves are absent. Snow cover is patchy and thin.

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[6] Polar Regions, 'Global Environment Outlook, *UNEP*, 1997, P. 115.
[7] op. cit, Willey Ley, 1974-76, P. 14.

Spring is a time when the days become increasingly light and sunny. Temperatures are still low until April with a monthly mean below – 10°C, and the snow and ice cover remain intact. The time between spring and early summer is messy. Under bright and weak sunshine the snow first heats up and then only when all the snowpak has reached freezing point, does it disappear. Most low – lying areas become snow-free in late June on the first half of July.

Summer months are short but delightful temperature are suitable for sunbathing for days on end. In the continuous sunlight air temperature may exceed 22°C while rock surface temperatures even exceed 33°C.

The air is filled with noise – the sound of breeding birds up for the season, the rushing water of brooks and glaciers melt water streams, the sound of grinding pack ice in the fjord and the rumble as ice bugs melt and crumble.[8] The idyllic weather occasionally broken by spells of rain, while in fjord strong winds can suddenly develop in the clearest weather.

In late August, the first nights frost occurs, and in a space of a few days autumn arrives. One of the remarkable features is the change as vegetation transforms itself from summer green to vivid autumn tints of red and yellow in a matter of days.

In September open water in the fjord between the larger ice floes freezes over each night only to melt the following day, while geese gather noisily and begin to fly south in vast straggling skeins. By late September winter is fast approaching again.

[8] op. cit, David Sugden, 1981, P. 34

However this annual climatic rhythm faces several anomalies in the arctic. The marine coastal areas of the Arctic experience warmer winters and cooler summers while the extreme continental climates of north east Siberia experience cooler winter and longer warmer summer. Also the length and darkness of the winter increases towards the Pole. On ice-sheets in interior Greenland winter is more severe and summer non-existent.

The overwhelming characteristic of the polar region is the cold, both in intensity and in durations, several reasons are cited to explain the cold. The first is that the polar region receives less solar radiation then the rest of the world because of the low angle of the sun in relation to the ground surface. Secondly, this region reflects most of the solar radiation it receives, average absorption of solar radiation on earth is about 40 percent, whereas snow and ice have an albedo of 80 to 90% therefore only 10-20% of the solar radiation is absorbed. Thirdly, the clarity of the atmosphere because of lack of dust and water, air holds ten times less moisture and water and is clear of solid particles. Therefore little long-wave radiation takes place from the earth's surface.

Also polar regions suffer a loss of net radiation, however heat is transferred from the lower latitudes by way of transfer of sensible heat usually in form of cyclones, by way of latent heat and thirdly by way of oceanic circulation. Therefore,

on a world scale the polar regions are heat sinks, which help the world atmosphere to remain in equilibrium.[9]

ATMOSPHERIC CIRCULATION OVER THE POLES

The temperature difference causes air over the poles to be dense and in effect this means that lines of equal density in the atmosphere focus a bowl over the poles high at the perimeter and low at the center. As the air flows down the gradient towards the poles, it is directed by the rotation of the Earth, so that it flows roughly parallel to the contours, forming an anti-clockwise vortex over the North Pole. Surface air movements closely reflect such overall wind directions but are interrupted by irregularities associated with the distribution of land and sea. In the Arctic the alternation of continent and ocean breaks up the continuity and strength of the Westerlies and introduces a more pronounced meridional circulation. The waves associated with each continent introduce cold north westerly winds in winter over the east of each continent, while in contrast warm air over the Atlantic is directed towards the north.[10]

TEMPERATURE

One characteristic of climate is the presence of a temperature inversion above snow or ice surfaces which results from strong radiational cooling. This inversion may be only 10-100 m thick and yet represents a temperature difference of 30°C. It's

[9] Weller, G. and Bowlings A, 'Climate of the Arctic' *Proceeding of the 24th Alaska Science Conference - 1975,* 1975, P. 127.

[10] Ibid. Willy Ley,1985,P. 142.

development is commonly associated with cyclones. The inversion is especially intense and persistent where the cold air is trapped in valleys such as Yukon and north-east Siberia, and this helps to account for the extremely low temperatures in these situations in winter. The Arctic temperature patterns are largely explained in terms of distribution of land and sea. To winter the pole is kept anomalously warm in comparison to the surrounding land by the existence of Arctic ocean water below a relatively thin sea-ice cover. The ocean temperature is within a few degrees of freezing and heat is conducted through the ice in winters. The surrounding land areas have no such heat reservoir and temperatures plummet, particularly where cold air drainage leads to the buildup of stable inversion.[11]

PRECIPITATION

Precipitation in the polar regions is light and indeed most of the zone is arid. Totals in the Arctic basins are generally less than 130 mm while the arctic coasts have less than 260 mm on the whole. The lowest land values are around 140 mm and occur in eastern Siberia and northern Canada and Greenland. Totals generally rise from these areas towards the Atlantic and Pacific to above 600 mm. The precipitation contrast here reflect the distribution of land, sea and high topography.[12]

The main spatial precipitation pattern in the Arctic can be explained in terms of proximity to maritime sources of moisture. There is a decline in all directions from the northern Pacific and Atlantic coast, although it is accentuated in a west-east

[11] op. cit, David Sudgen, 1981, P. 53.
[12] Besnon, C.S. 'The Role of air movement in Arctic Planning and Development, *Polar Record*, 1969. P. 787

direction across the continents in the direction of movement of most cyclones. The decline in precipitation inland is more rapid in the case of the North American Arctic then in the Russian Arctic and this reflects the blocking role of the western American Cordilleras.

EFFECT OF ARCTIC CLIMATE ON HUMAN LIFE

Climate is an important constraint and independent variable affecting the operation of many smaller-scale system in the Arctic region. The links between climate and the various geomorphic, oceanographic and bio-geographic systems are quite fundamental. The limits to vegetation productivity are determined ultimately by climate. Low temperatures create problems for normal industrial society and their solutions inevitably involves special design and extra cost, conventional water supply, sewage and heating all would freeze and be inoperable in polar winter and they require extensive and expensive modifications, such as insulation.

More dangerous than absolute cold is the effective cold produced by a combination of wind and low temperatures, this is called as wind chill, combination of wind and exceedingly low temperatures makes Greenland one of the coldest place on earth.

Visibility is limited due to ice-fog, common in arctic towns in valleys. Fairbanks is a notorious example; more serious than fog is the pollution associated with fog, lead and carbon dioxide concentration exceed those in any other urban

center on earth. They are a growing problem in smaller Canadian Arctic town such as Whitehouse, Inuvik and Forbisher Bay.

Persistent fog and low clouds is characteristic of areas of melting sea ice in summer. Arctic ocean stations experience more then 100 days of such fog a year. The fog is caused by the movement of warm air across the cold melting ice-surface.

Blizzards are another surface phenomenon which restricts surface visibility in the Arctic, blizzard are also associated with the passage of cyclones.

A white-out is commonly mistaken in the popular mind for a blizzard, however, white-out refers to a situation when a person's vision loses perception of depth. The situation occurs commonly when the surface is uniformly snow covered and when the light is diffused.[13]

Visibility problems concern surface transport and air flights which depend on air-strips. Such visibility difficulties increases costs and introduce delays, sometimes quite prolonged if the sea fog does not lift for a week.

After 9 months of snow, ice, cold and relative darkness, there are a few weeks of thaw. When the ground is awash and boggy, and then a summer period of heat and insects prevails.

The geographic location of the North Pole is as difficult to pin-point, as it is to reach. It lies amid a clashing, grinding jumble of pack-ice which drifts haltingly clockwise, round and round. In the Arctic Ocean, an ice formation that identifies the

[13] Bairy, R.G., 'Arctic Climate', *Arctic and Alpine Environments,* 1974, P. 35.

North pole one week may float two kilometers away the next, the only means of locating the pole exactly is by instruments.

On certain nights in spring and autumn, ghostly veils and streamers of various coloured lights shimmer in the sky. These awesome auroras are caused by atomic particles, protons and electrons which are ejected in an unsteady steam from the sun. As the solar particles enter the earth's magnetic field they are pulled towards the geo-magnetic pole and they collide with particles of nitrogen and oxygen in the atmosphere causing them to glow in hues of red, blue, green and yellow depending on the altitude of the collisions.[14]

Thus we see, that the unique phenomena associated with Arctic atmosphere and marked seasonal contrast of the region provides two dramatically different environment and these provide a constraint and challenge to human systems, whether of a hunting type, like the traditional Inuit or of a modern industrialized type.[15]

THE ARCTIC GEOLOGY AND GEOMORPHOLOGY

The Arctic region is a 'Mediterranean' in the continental hemisphere of the world, In the center is the Arctic ocean, the world's smallest ocean encompassing a region of some 12,257,000 Km^2.[16] However, it is five times larger than the Mediterranean sea. Approximately 36% of the total area is underlain by continental

[14] op. cit, Willey Ley, 1981, P. 23.
[15] Hare, F.K. and Thomas M.K. 'Climate Canada, 1974, P. 192.
[16] Funk and Wagnalls, New Encyclopedia, 1982, P. 143.

shelf.[17] Although the shelf is only 100-200 km wide north of Alaska, north of Siberia it extends over 1,600 km in some places.

The Ocean basin itself has two main components which are separated by the Lomonosov Ridge, a submarine mountain range rising 3000 m above the surrounding ocean floor within the space of a few tens of kilometers. One component is the Eurasian Basins, which is over 4000 m deep and bisected by the narrow Nansen Cordillera. The other component is the American Basin, which is larger and has a uniform depth of about 3800 m in the south and depths of over 400 m near the pole. It too is transected by a ridge in the north, the Alpha Cordillera, which runs parallel to the Lomonosov Ridge and 500 km distant from it. (See Map – II)

The Arctic land areas surrounding the Arctic ocean are general low lying. The flattest areas in Siberia are associated with the valleys of some of the world's longest rivers such as Ob, Yenisey and Lena. There are distinctive uplands, particularly in Greenland and the eastern Canadian Arctic where mountains and plateau exceed 200 m in altitude over wide areas. Also the Greenland ice sheet rises above an attitude of 2500 over much of its extent, with a maximum near the centre of around 3200 m. Other less continuous uplands occurs east of Lena delta and in the peninsula of north-eastern Siberia. Narrower but higher mountains occur in Alaska range which includes summits like Mt. McKinley (6178 m) while the rugged Brooks ranged includes many summit 2000-28 in altitude.[18]

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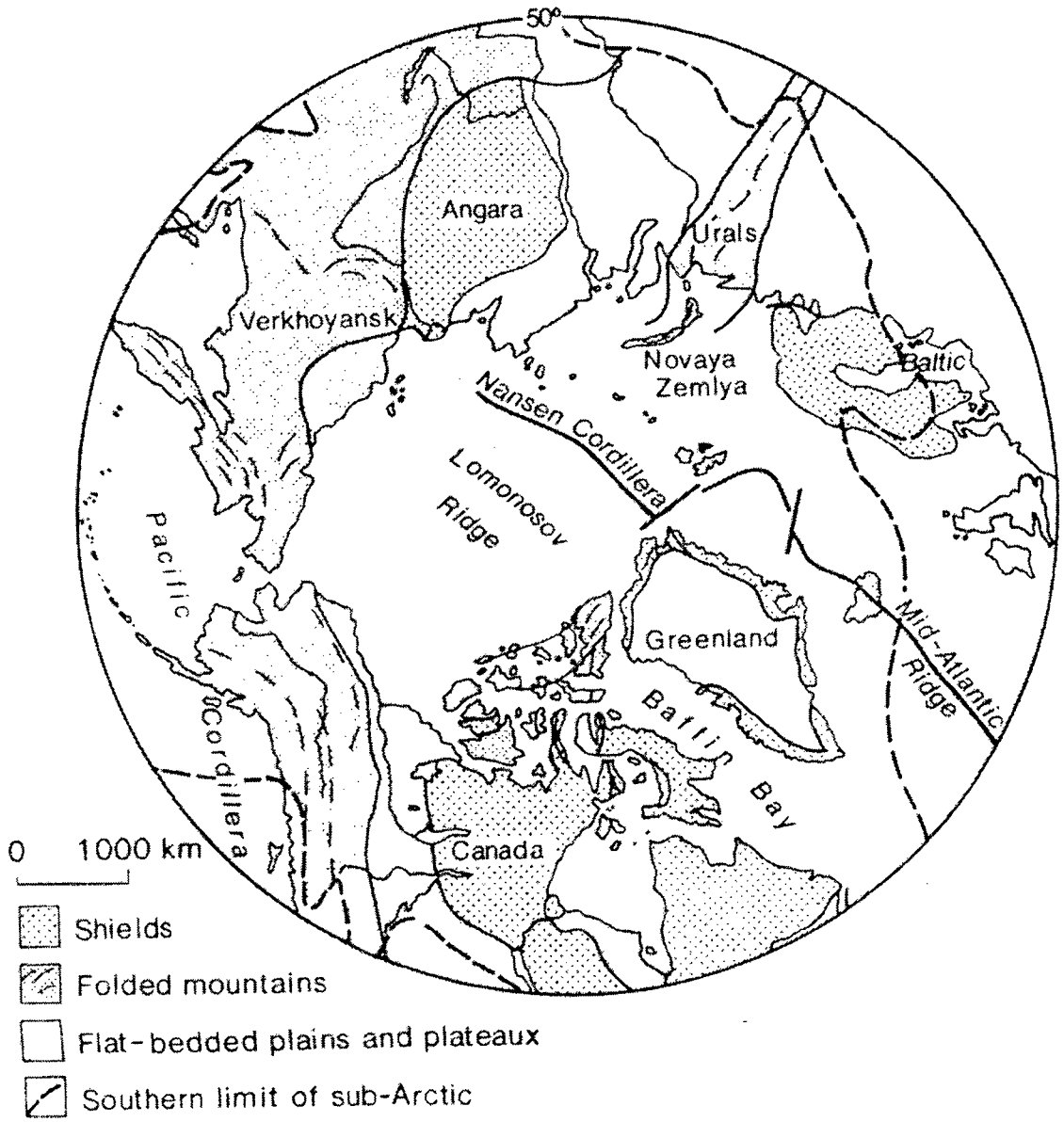
[17] Stephanic Pfirman & Kim Kane, 'The Arctic at Risk: A Circumpolar Atlas of Environmental Concern. (available at http://rainbow.ldeo.columbia.edu.edu/edf/text/environment.html

[18] Clapperton, 'Arctic & Antarctic, 1981, P. 26.

Map - II: MAJOR GEOLOGIC FEATURES OF THE ARCTIC.



(**Source:** Y., Human, *'Maine Geology and Oceanography of the Arctic Seas'*, 1974.)

The main tectonic features of the Arctic are three shields, formed predominantly of Precambrian granites and gneisses, are the main structural features, namely the Canadian-Greenland shield, the Baltic shield and the Angara shield.

The Canadian and Green shields are separated by an ocean basin in Baffin Bay and the flanks of Greenland eastern Baffin Island are overlain by Tertiary volcanic rocks. Shield rocks are commonly covered by flat-lying Palaeozoic sedimentary rock nearer the peripheries, for example in the north European plain in Russia and the Mackenzie lowlands in the western Canadian Arctic. Whereas shield rocks are extensively exposed in the Canadian Arctic and Greenland. In Scandinavia, only in small areas the Angara shield outcrops at the surface. The shield areas are fringed by orogenic belts of sedimentary rock of Palaeozoic and younger age.[19]

Siberia is tectonically chaotic and difficult is understand. The Cordillera of southern Alaska is a tectonically active region, it's a part of the mountain belt which rims the pacific and the mid-ocean Nansen Cordillera and its north Atlantic continuation which includes Iceland. Apparently there are earthquakes in the Verkhoyanks mountain area which is a continuation of the line of Nansen Cordillera.[20]

According to the plate tectonic theory the Eurasian part of the Arctic basin is an extension of the north Atlantic. Spreading has taken place from the Nansen Cordillera which is a continuation of the mid-Atlantic Ridge. Spreading began about 81 million years ago along the Labrador Baffin axis and then about 60 million years

[19] Herman, Y., Topography of the Arctic Ocean', *Marine Ecology and Oceanography of the Arctic Seas, P. 75.*

[20] Ibid. Herman Y., 1974, P. 89

ago along both axis, to the accompaniment of uplift and volcanoes which spilled lavas on to the flanks of Greenland and Baffin Island as well as Western Scotland and the Faeroe Island.[21]

About 30-40 million years ago in the middle of the Tertiary North America successfully annexed Greenland, and the Baffin Bay spreading centre ceased to operate, while that in the Atlantic and Emasian Arctic basin continued to be active.

A major problem in the Arctic is the mode of formation of the Amerasian Basin, few scholars suggest that Alpha Cordillera is a relict spreading centre and it represents an early phase of spreading prior to the tertiary, others believe that the Alpha Cordillera is an incipient island arc reflecting compression, as the North Atlantic began to open in Cenozoic time. Whatever the origin and there seems general agreement that the Amerasian Basin is old and has been relatively stable for a long period of time.[22]

GLACIERS IN THE ARCTIC REGION: The Glacier in the Arctic Region

The Glacier-covered areas comprise one of the three sub-zonal environmental systems in the arctic region. In the Arctic, glaciers are rather limited in their distribution. Apart from the overwhelmingly important Greenland ice sheet, Arctic glaciers are mainly restricted to the eastern uplands of the Canadian Arctic, and the maritime islands and peninsulas off northwestern Eurasia, for example Svalbard, Franz Josef Land and Northern Novaya Zemlya. Outside these areas glaciers occur in

[21] Herron, E.M. Dewey, J.F. and Pitman, W.C., Plate tectonic for the evolution of the Arctic ecology, 1974, p. 375.
[22] op. cit, Herman Y., 1974, p. 82.

isolated uplands such as the Ramanz Mountain of the Brooks Range in the north eastern Alaska and some mountains in eastern Siberia, but they are very limited in areal extent. Glaciers in the Arctic are restricted today when compared to their maximum extent which is thought to have been approached on several occasions in the last few million years. (See Fig. – I)

Most glaciers in the Arctic are on uplands and close to ice-free oceans and winter storm tracks. This is most clear in the case of the Atlantic borders and the decline over oceans is relatively gradual. This is particularly true of the northern coast of Eurasia which is the favoured track for winter storms. In the case of the Pacific the change is more abrupt. Whereas the Cordillera of southern Alaska supports many glaciers, little precipitation penetrates over the mountains into northern Alaska and thus the high Brooks Range is largely free of glaciers. The least favourable places for glaciers in the Yakutsk area of Siberia where winter snowfall is light.[23]

Glaciers to elaborate are dynamic features of the earths surface which flow, and it is this characteristic above all else that account for their importance as an environmental system. Glaciers flow because ice is a relatively weak solid which deforms under its own weight. If the rock slope is sufficiently steep the glacier will flow down the rock surface by internal deformation and / or sliding. If the rock is flattish, then the glacier builds up until its surface slope is sufficiently steep to cause internal deformation and/or basal sliding.[24]

[23] Nansen, F. 'The first crossing of Greenland 1890', Pg. 214.
[24] Armstrong, T.E., Roberts B. ' Illustrated Glossary of Snow and Ice', 1973, P. 147

Figure - I: THE PRESENT DAY GLACIER EXTENT IN THE ARCTIC REGION.

Region	Area (km^2)	Total
Northern Polar Region	1726400	
Greenland Ice Sheet	76200	
Other Greenland Glaciers	153169	
Canadian Archipelago Svalbard	58016	
Other Arctic islands	55658	
		2069443

(**Source:** After Plint, 1971.)

Ice sheet and ice caps built up on a flattish land area superimpose a roughly radial outflow of ice over the area. The difference between an ice-sheet and Ice cap is usually accepted as being one of scale, Ice caps are smaller generally less than 50,000 km^2 in area. The ice dorms build up over the underlying relief and may completely submerge mountain rangers and basin, e.g. is an ice dorm of altitude of 32000 m in Greenland.[25]

Outlet glaciers are a component on the peripheral parts of ice dorms and may drain the bulk of ice from the dome. Outlet glacier from the Greenland ice sheet are similar, only they seem to flow at considerably higher velocities. Rivers Icebare is one of several fast-moving outlet glaciers in west Greenland contributing icebergs to the sea.

An ice-shelf is a floating-sheet of ice derived from snow falling on its surface or from land-based glaciers discharging into the shelf. In the Arctic small ice-shelves occur along the northern coast of Ellesmere Island and in northern Greenland.

Periodically, calving removes huge tabular icebergs from the front of the ice shelf, forming ice islands. The ice islands used as based by the U.S.A. in the Arctic are derived from the ice shelves of northern Ellesmere Island and Greenland.[26]

An ice field is an approximately level area of ice which is distinguished from an ice cap because its surface does not achieve the characteristic domelike shape, and

[25] Ibid. Armstrong, T.E., 1973, P. 152.
[26] Hattelsley Smith, 'Present Arctic ice cover', *Arctic and Alpine Environments*, 1974, P. 87.

because flow is strongly influenced by the underlying topography, thin ice-fields are common on uplands of northern Canada.[27]

THE PERIGLACIAL REGIONS IN THE ARCTIC

The second sub-zonal arctic environment is peri-glacial. The peri-glacial environment is extensive in the Arctic and is virtually uninterrupted by glaciers except in Greenland and the higher parts of northern Canadian Arctic Archipelago[28]

Permafrost is fundamental in affecting peri-glacial geomorphology and polar biogeography; permafrost may be defined as ground where the temperature is continuously below 0°C in both winter and summer. At one extreme this includes any dry ground which freezes in the winter and survives through the following summer into the next winter, at the other extreme its includes ground. Which has been frozen for million of years.[29]

In the Arctic, Permafrost has developed in the outer areas whereas it is continuous under land areas, in North America most of the arctic area north of the tree line lies in the zone of continuous permafrost, it is only absent where there are water bodies that are sufficiently deep to escape freezing each year. The second type is patchy and discontinuous such as in the Russian Arctic region, continuous north of the tree line east of the mural mountains permafrost is continuous but west of murals it is discontinuous.

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[27] op. cit, Sugden D.E., 1981, P. 77.
[28] op. cit, Sugden, D.E., 'Glacial Erosion', *Journal of Glaciology*, 1987, P. 364.
[29] op. cit, Armstrong T.E., 1983, P. 417

About four-fifth of the permafrost volume consists of ice, segregated ice is extremely common in the unconsolidated sediments of the arctic coastal plains of Alaska and northwest Canada and in the lower reaches of the big Russian rivers like the Ob and Yinisey. Where ice forms the pole space between soil particles, its known as pole ice.[30]

Ice-mounds are characteristic areas of fine-grained soils where there is sufficient moisture. They come in many sizes and forms, they are formed due to grow of ice lenses which force the ground above into a boil or mound as they grow. The mounds generally have limited lines. Smaller ones may last a few years, large ones several thousand years. Eventually, the uplifted ground surface is eroded away, or the mound crack to expose the ice lens, which then melts.[31]

They occur frequently enough in the coastal places of the Russian Arctic region and Alaska and in the Mackenzie areas.

In terms of areal coverage ice-wedge polygons are more extensive, 20-40 percent of the polar land areas are marked by ice-wedge polygons. The polygons nromally measures 15-40 m across. They may have three to seven sides. Their borders are marked by an uplifted rim separated by a narrow ditch. In summer their centres may be marshy or even covered by a pool of water.[32]

Although the term ice-wedge polygon is widely accepted, they are a part of the family of contraction – crack polygon. As such the cracks need not necessarily be

[30] op. cit, Armstrong T.E., 1973, P. 154.
[31] French, H.M., 'The Peri-glacial Environment', 1976, P. 114.
[32] Ibid. Frenchman, H.M., 1976, P. 184.

filled with water, but with sand or other debris. Such a situation is common in dryer areas, such as in northern Arctic Canada.

Thaw lakes are another common peri-glacial landforms they originate when an underlying mass is exposed and melts. Sometime they may be caused ay an ice lens growing till it becomes exposed at the surface. More commonly it is some chance factor which exposes segregated ice to melting. The lake quickly assumes a circular form as it melts and undercuts the lake adjacent ice-rich permafrost.

The density of thaw lake depressions and evidence of their evolution is dramatically brought out from Point Barrow Area, Alaska. Similar morphology occurs throughout the peri-glacial zone whenever there is a flat alluvial plain with excess ground ice. The coastal plain of the northeastern Russian Arctic is an extensive example of such a situation.[33]

In the early summer the surface snow and ice in the upper few meters or centimeters of the ground melts. Drainage is usually impeded by the underlying permafrost table and regolith may be saturated, seperating ground from the active layer.

One of the most common active-layer landforms in the Arctic is a hummock of vegetation with a core of ice or mineral soil which may or may not be exposed to the surface. Hummock may vary from a few centimeters to several meters in height with all gradations in between. Perhaps a typical force is a hummock which is 30 cm across, 20 cm high and speed with 1 m of its neighbours.

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[33] Washburn, A.L., Geocrology: A survey of Peri-glacial Processes and Environments, 1979, P. 167.

Another distinctive active-layer landform is sorted patterned ground, perhaps 10-20% of the arctic land areas are covered with frost sorted grounds Frost sorted ground is best developed in wet sites and common occurrences are on gently sloping valley floors or in depressions on plateau uplands, especially where snow patches linger through the summer and provide an abundant moisture source.[34]

Gelifluction is described as a process associated with summer thaw. As such it is used to describe the slow flow downslope of regolith, which has been saturated by melting snow and ice within the active layer. However, the term gelifluction also includes the process of frost creep whereby, the displacement of regolith on a slope by repeated freezing and thawing will cause pentacles to migrate downslope.

The most common features associated with gelifluction are sheets. Sheets are uniform monotonous expenses of regolith often with angles as low as 1-3° which may be continuous over several sq. kilometers. They are characteristics of high arctic regions in Canada, where there is low-lying topography covered with water-retentive unconsolidated sediments.[35]

The third sub-zonal environment is the Arctic marine system, the distinguishing features of the polar marine system is the presence of a thin lid of cold surface water and floating sea ice for at least part of the year. There are several stages of freezing of sea water and fountain of sea ice in the cold polar regions. The first stage in freezing is for fragile ice to form as individual crystals in the water. These platelets are often 2-15 cm across and 2 mm thick, next these crystals float to the

[34] op. cit, Frenchman, H.M., 1976, P. 117.
[35] op. cit, Mackey J.R. 'The world of underground ice', *Annual of the Association of American gerographers,* 1972, P. 21.

surface where they collect to found a soupy layer which gives the sea a matt appearance and is known as grease ice. The ice layer is flexible and it is uncanny to see the bowwave of a boat passing through the ice cover with little impediment, subsequently these crystals freeze together to form a brittle ice skin known as ice rind, at this ice cracks and shears when disturbed. Some ice grow on the sea bottom where it s shallower that 33 m to form anchor ice; infiltration is formed above the congelation ice when the snow pack on the ice depresses its below sea level and the seawater saturates the snow below freezing.[36]

One of the most helpful ways of classifying sea ice is the environment of its formation. Landfast ice occurs in embayment or shallow areas protected by shoals and as a result horizontal movement is negligible. It is common in fjords and also off shallow coasts. In the Laptev sea it may extended upto 200-400 km from the shore.

Pack ice describes sea ice, which floats free and subject to the influence of winds and currents. By mid of January all the Arctic and Bering sea are arc ice-bound by September. Open water exists off the Alaska/Canadian shores west of the Mackenzie and off most of the Siberian coast, where the only ice clusters remain in the vicinity of Taimyr Peninsula and the East Siberian Sea. Around this time of the year North Greenland and the Northern exists of the straits of the Canadian archipelago are ice bound, west Greenland, southeast Greenland and the Hudson Bay are clear of Ice.[37]

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[36] Coachman, L.K. and Agaard, K. 'Physical Oceanography of Arctic and Sub-Arctic seas', *Marine Geology and Oceanography of the Arctic seas'*, 1974 P. 153.

[37] Ibid. Coachman L.K, and Agaard K., 1974, P. 157.

The two components of ice movement, the Amerasian gyral and the flow from Siberia across the Pole to the East Greenland are the two major ocean current in the Arctic, the important implications of these currents is that because of it, ice in the American cell is old and often exceeds 10 years in age, while that off the coast of Siberia is generally less than a year old. The Greenland ice may contain ice from both sources and therefore consists mainly of multi-year ice. While most Siberian ice tends to move offshore.[38]

There are numerous ways in which glacial and periglacial zones affect or otherwise constraint other physical and human systems. Glaciers provide both a constraint and a resource.[39] (See Figure – II).

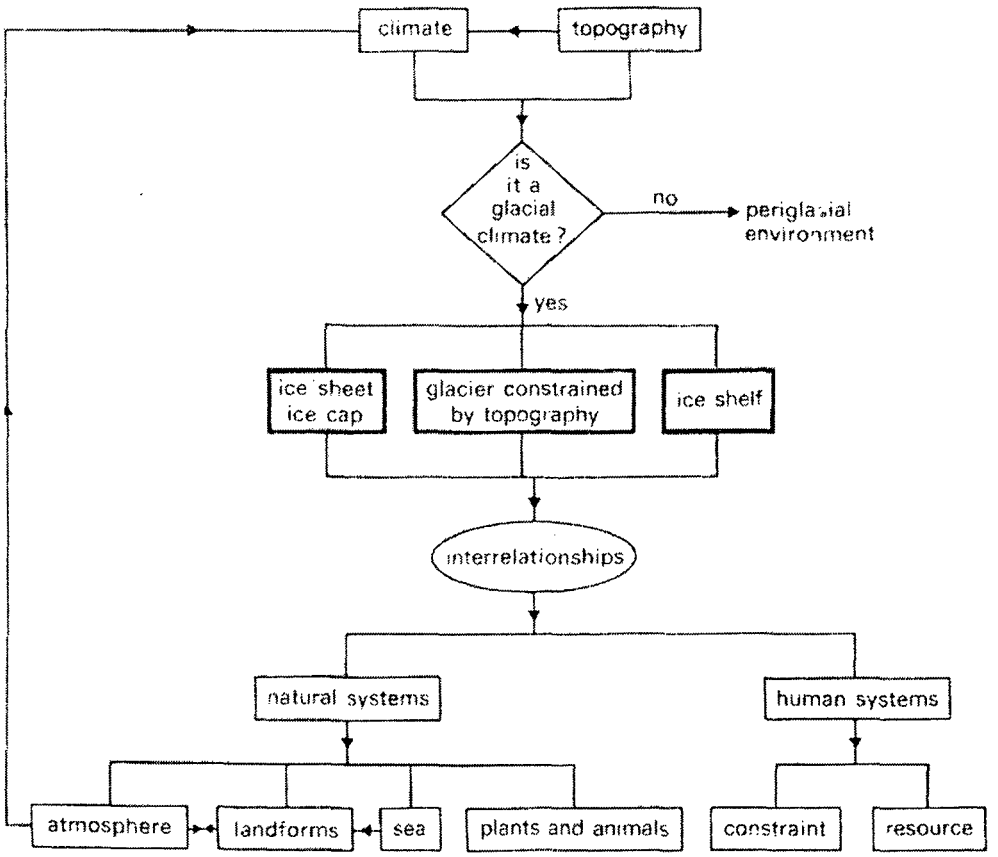
Glacier provides uniform surface, thereby the easiest land surface for travel in the world, it is at the same time one of the most difficult to maintain more permanent features such as settlements and physical communications.

Ice surface conditions present special problems for ground travel. Crevasses form when the ice accelerates too quickly for the tension to be taken up by deformation within the ice. The morphology and the strength of the surface snow is an important constraint on surface movement. Snow dunes, are hard packed and play havoc with tractor tracks. Such dunes are most common in windy peripheral areas of ice sheets.

Ice edges are dynamic environment with their own particular problems. On land, ice edges present problems if disturbed. One potentially interesting example is

[38] Lewis, E.L. and Weeks W.F. Sea Ice; Some Polar Contrasts, 1978, P. 184
[39] op. cit, Sudgen David, 1981, P. 85.

Figure - II: THE GLACIER SYSTEM AND SOME INTERNATIONALSHIPS WITH OTHER NATURAL AND HUMAN SYSTEMS.



(**Source:** Bliss, L.C. Cragg, *'Tundra Ecosystems: A Comparative Analysis'*, 1981.)

of Isua Iron ore deposit in southwest Greenland which lies partially beneath the ice edge. A plan for open-cast mining by removing the ice overburden has been proposed and will involve the removal of around 172×10^6 m^3 of ice in order to expose the ore. The resultant steepening of the ice edge will accelerate ice flow and a further 7.9×10^6 m^3 of ice will need to be removed each year to keep the ice from advancing into the pits. Even if undisturbed an ice edge may advance over the years.[40]

Glacier ice in the Arctic provide one very real world resource – fresh water. Nearly 75 percent of the world's fresh water resources are contained in the polar regions. Glaciers are compact reservoirs of fresh water conveniently stored in solid form which have yet to be utilized.[41]

The idea of using glaciers for long-term cold storage for food has also been considered. The Peri-glacial system on the other hand is a resource that provides good land access to minerals beneath the ground. In many areas the abundance of lakes makes summer travel by float plane possible, whereas the absence of trees allow winter travel over frozen tundra. The presence and alignment of long rivers like the Mackenzie Ob', Yenisey and Lena is an important resources. In summer they can be used as roads for tracked traffic.[42]

There are limitations too, for example, buildings erected over grounds containing excess ice, tends to sink or buckle as the heat from the building melts the permafrost in a few years, similarly a hot pipeline, whether filled with oil, hot water or

[40] Armstrong, T.E., Roberts B. ' Illustrated Glossary of Snow and Ice', 1973, P. 234.
[41] Weeks W.F., Iceberg Water: An assessment. Annals of Glaciology, 1980, P. 7
[42] Macklay J.R. The World of underground ice. Annals of the Association of American Geographer, 1972, P. 20.

sewage will thaw a cylinder in permafrost around it, again differential thawing and settlement in ice-rich sediments could lead to fracture.

Sometimes wittingly or unwittingly disturbance of vegetation by man's activities can upset the thermal regime of the permafrost and can cause slumping along the lines. Such tracks makes common drilling exploitation for oil in the arctic and many are visible from the air some 20 years later.[43]

Another constrain provided by permafrost on northern development concerns frost, heaving in the active layer can lift piles outs of the ground. Areas particularly vulnerable to this occur beside large rivers where there may be abundant water for ice lens to build up. Bridge piers and particularly susceptible.

Services are difficult to provide in permafrost water pipes and sewers cannot be laid underground without special protection and insulation. Water supply present difficulties of freezing and bursting of pipes. Waste disposal is a problem because rubbish does not decompose in permafrost.

The same problem applies to corpses. It is as common to unearth perfectly preserved human corpses in permafrost as it is to find mammoth corpses several thousand years old.[44]

[43] Dunbar M.J., Stability and Fragility in the Arctic Ecosystem Arctic, 1973, P. 179
[44] Bliss, L.C. Crag, J.B. Heal, D.W. & Moore J.J., *Tundra ecosystems: A Comparative Analysis*, 1981, P. 147.

THE RESILIENT FLORA OF THE FREEZING ARCTIC

"I'm in love with my country.
Here my father was born and died.
Here the graceful reindeer comes to put
the dawn on the sky.
Birds and beasts find freedom here; each
tree gives them shelter and peace."

— Steven Banon (*a navigator from western Europe quote about Neneth people in his book English travels, in Moscow state, in the sixteenth century).*[45]

The Arctic unlike common perception, is not a frozen desert devoid of life on land or sea, even during the cold, dark winter months, spring brings a phenomenal resurgence of plant and animal life. Here low temperatures are not always the critical element but, moisture, the type of soil and available solar energy are also important. So much so that the Arctic is home to about 900 species of flowering plants.

North from the limit of trees to the shores of the Arctic ocean, the wide plains and moors of the tundra stretch around the North Pole. The world "Tundra" is an ancient Finno-Ugrain one, taken by the Russians from the Lapps, and is understood by all northern people to refer to the 8 million square kilometers and a tenth of the earth's land surface. This is typical arctic land, an exotic life zone at once barren and abundant.

This is a land of the little plant, few species growing more than ankle-high. There are few species north of timber line mostly willows, alders and birches – they

[45] Source: Evdokija Telekova's article on the concept of wilderness among the indigenous people of the north – 1995, Pp. 2-3

are stunted. Only near the tree line in sheltered valleys along flowing streams do many of the trees get head-high. These dwarf plants often live to an old age. An Arctic willow may have 400 annual rings crowded into two and a half centimeter "trunk".

There are three broadly concentric vegetation and soil zones in the Artic. Low arctic tundra vegetation occurs in the most favoruable part of the Arctic and includes northern Alaska, southern Baffin Island, the southern coastal areas of Greenland and a strip in the Russian Arctic which broadens out in the mountainous north eastern Siberia. Unless bare rock one word at the surface, tundra vegetation may completely cover the ground and consist of dwarf shrubs, mosses, sedges, grass and lichen. The appearance of the vegetation at any one place depends on micro elements and soil moisture variations. Thus on well-drained sites the vegetation consists mainly of dwarf shrubs like Willow and Birch, berry-bearing members of the Vaccinum family, Arctic Heather (Cassiope) and a carpet of moss. This is the attractive and much – photographed tundra community which is full of colourful flowers in summer and which dramatically changes to vivid autumn tints of red and yellow in a few days upon the arrival of autumn.[46]

In damper areas grasses and sedges dominate, one of the characteristic summer sight is the fluffy cotton balls of Eriophanum often giving the landscape the appearance of being dusted with snow.[47]

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[46] Dunbar M.J., Stability and Fragility in Arctic Ecosystem, Arctic, 1973, P. 181.
[47] Green S.W., 'Plants of the Land'. Antarctic Research, 1964. P. 248.

Towards the pole is the high arctic tundra which consist of a more or less continuous cover of herbs and moss with occasional prostate species. Sedge-moss bogs occur mostly on poorly drained sites. Plant cover is frequently less than 80 percent and bare rock is frequently exposed at the surface, much of this zone is characteristically underlain by sub-polar soils.[48]

Polar desert vegetation is sparse and consist mainly of scattered cushion plants covering less then 10 percent of the ground surface. With moss and lichens the plant cover may rise locally as high as 80 percent but considerably low percentages are typical. The intervening rock areas have many characteristics of deserts such as a surface stone layer or desert pavement and efflorescence of salts at the surface.

Reindeer moss which actually is a many branched lichen growing to a height of 15 centimeters or more. Often entwined into, dense mats over large areas, making winter pastures for the caribou. A lichen is actually not a plant but two, one half is fungus and other half is a green or blue green algae. The fungus anchors itself to a rock and generates a mass of spongy tissues which hold large quantities of water. The algae lines inside this moist shelter produces food by photosynthesis and shares its nourishment with the fungus. Together this successful partnership survives cold, dry and rocky tundra and furnishes food for grazing animals and gradually produces new soil in which other plants can gain hold.[49]

The distribution of vegetation is zonal and reflects the progressive changes as the climate becomes drier, cooler and the summer shorter towards the pole. Plant

[48] op. cit, Dunbar M.J., 1973, P. 182.
[49] Machdonald Ronald, St. J. 'The Arctic Frontier, 1966, P. 203.

here becomes less complete and plant height decreases towards the pole. This is reflected by the decreasing number of species which can survive in severe polar climates. As an example, a transact from the mainland Arctic in northwest Canada to northern Canadian Arctic archipelago reveals 600 species of flowering plants in the Mackenzie delta area, 469 species on Banks Island, 100-111 in Melville Island and 49-81 species on the high arctic prime Batnick and Ellef Ringers Islands.[50]

The vegetation in Arctic has some general characteristics which are well adopted to climatic environment, there are many physiological adaptation, for example Sea Bluebell, a relative of the forget-me-not, blooms on the ocean shores, it grows in a compact cushion to conserve precious warmth. There are only eight weeks in July and August when temperature stays above freezing point, therefore herbacious perennial are common with large underground root-structure which store food over winter, reproduction often takes place in form of Rhizome, bulks or layering in order to avoid completing flower buds in a few plants which enable maximum time for seed production. A Whiplash saxifrage growing in moist moss, thrust out half a dozen runners which mature into new plants.

Lichens are extremely hardy and can have immense longevity some may live for several thousand years.

[50] op. cit, David Sudgen, 1981, P. 112.

Hybrid varieties of crops are being developed for sub-arctic areas like Fairbanks or Whitehouse in the Yukon Territory and large areas of the sub-arctic will someday be used to produce crops and food but the process will be slow.[51]

[51] The Encyclopedia Americana International, Edition 1983, P. 248

FAUNA OF THE ARCTIC:

"The Arctic, which is hostile to most kind of life, are hospitable to a few. The seas and shores support sizeable populations of warm-blooded animals. Many of these creatures are odd - flightless birds, mammals that swim like fish, aquatic beasts that crawl on land. Focus are various, some gentle, some assuring and each has its own special ways to survive in the bitter polar cold".

— David Sudgen, *author of the Arctic and the Antarctic.*

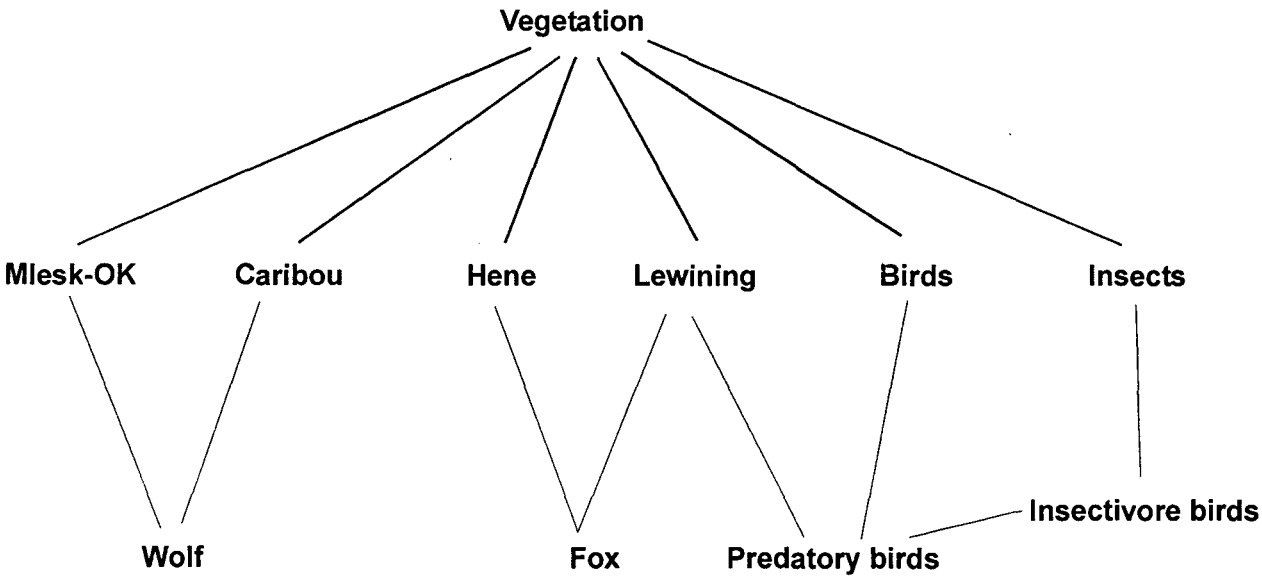
It is noticed that vegetation and geomorphological conditions affect the Fauna of the arctic in many ways. The low productivity of the arctic vegetation provides a relatively low upper limit of the food supply. The zonal decrease in vegetation northwards is mirrored by a decrease in faunal densities and also by a decrease in the number of species.[52] (See Fig. - III)

Most common and significant arctic animal is the Caribou, there are three chief varieties: the mountain caribou, the woodland caribou and the barren ground caribou, the only true tundra type

The main characteristic of the arctic land life is its simplicity, very few species are involved for example, at Point Barrow in Alaska there are only brown and collared lemmings Caribou and 18 species of birds and insects. Out of 8600 birds

[52] op. cit, David Sudgen, 1981, P. 89.

Figure - III : COMPLEX VERTEBRATE FOOD WEBS IN THE ARCTIC.



(**Source:** David Sudgen, *'Arctic and Antarctic'*, 1982.)

species in the world and 70 breed in the Arctic and while out of 3200 mammals in the world only 23 occur in north of the tree lines and there are no reptiles.[53]

Some 70,000 wild caribou still roam over the North American tundra. Half a million domesticated reindeers are cared for by Lapp or Eskimo herders. The caribou do not spend the entire year on the tundra. They migrate in winter south of the tree line and hurry northward with the coming of spring, seeking forage and trying to avoid the clouds of mosquitoes and flies.

The Arctic animal's primary heat preserving mechanism is not size or shape but insulation: It in two forms, a layer of fat or of tissue heavily impregnated with oil, just under the skin, and a layer of fur or feathers just over the skin.[54]

The other native animal that offers a potential food source is the Musk-Ox. However, hunting is decimated them to 1,700 and now it is slowly increasing its number under government protection.[55] Musk-Ox bears a prime commercial asset, under its long coarsc outer hair is a thick undercoat of wool called quivet that surpasses cashmere in soft-lightness and strength, efforts are being to domesticate them.

The most fabled and perhaps the most misunderstood Arctic animal is the Lemmings It a small mouse like animals that live on grasses and roots and a large part of the diet of most carnivorous birds and animals of the region. They have a 3-7 year population cycle which has dramatic repercussion for their predators. The legend of lemmings committing suicide actually stems from the fact that under favourable

[53] op. cit, David Sudgen, 1981, P. 140.
[54] op. cit, Willey Ley, 1974-76, P. 49.
[55] op. cit, The Encyclopedia Americana International Edition, 1983, P. 341

conditions lemming population grows extremely fast causing population explosion and lemmings cannot stand overcrowding, thereby, they out-migrate from crowded areas across the water bodies, as they swim in the water body which is not too wide, to new areas.

Carnivores include the snowy owl, the Arctic wolf and Arctic fox and the polar bear, which is in demand for its white 'winter coat, the fur traders dealing with Arctic fox fur know of population cycle in foxes, the causes of which is not completely understood but it seems to be an inherent characteristic of simple ecosystem.

The abundance of insect and plant food on the tundra in summer has made in the nesting ground for many species of birds. In the grasses of marshy areas, the pin-tails teal, bold-pates, scaups, golden-eyes, secolers mergansas and squaw-duck are found, harlequin and eider duck are generally found near a pond.

The Canada Goose are common near a big river, snow geese and sandhill cranes are common near mud flats.

Gye falcon, raven and snow owls are common in the tundra belt and are carnivorous by nature. The pegion-sized birds Ptarmigan is most truly a tundra bird and lives in the north all year round, when all other arctic birds migrate such as Snow-bunting, the snow-bird, the arctic Tern, Jaeger, golden plover, etc. migrate to great distances with the change of seasons.

The Marine Polar Cohorts:

With low level of phytoplanktons, mostly diatoms, in the arctic ocean. The marine population is rather limited to certain regions only. (See Fig. – IV)

After the phytoplankton the next link in the marine eco-system is zoo plankton which depend on phytoplankton. The Arctic Ocean is poor in zoo plankton while sub-arctic waters are rich.

It is the staple food for marine mammals, fish, birds and molluscs. There are numerous species of fish in the sub-arctic. In Alaska alone 50 species are fished by man towards the poles the variety of species fall away abruptly and the polar cod is the only fish that has been caught in the high Arctic.

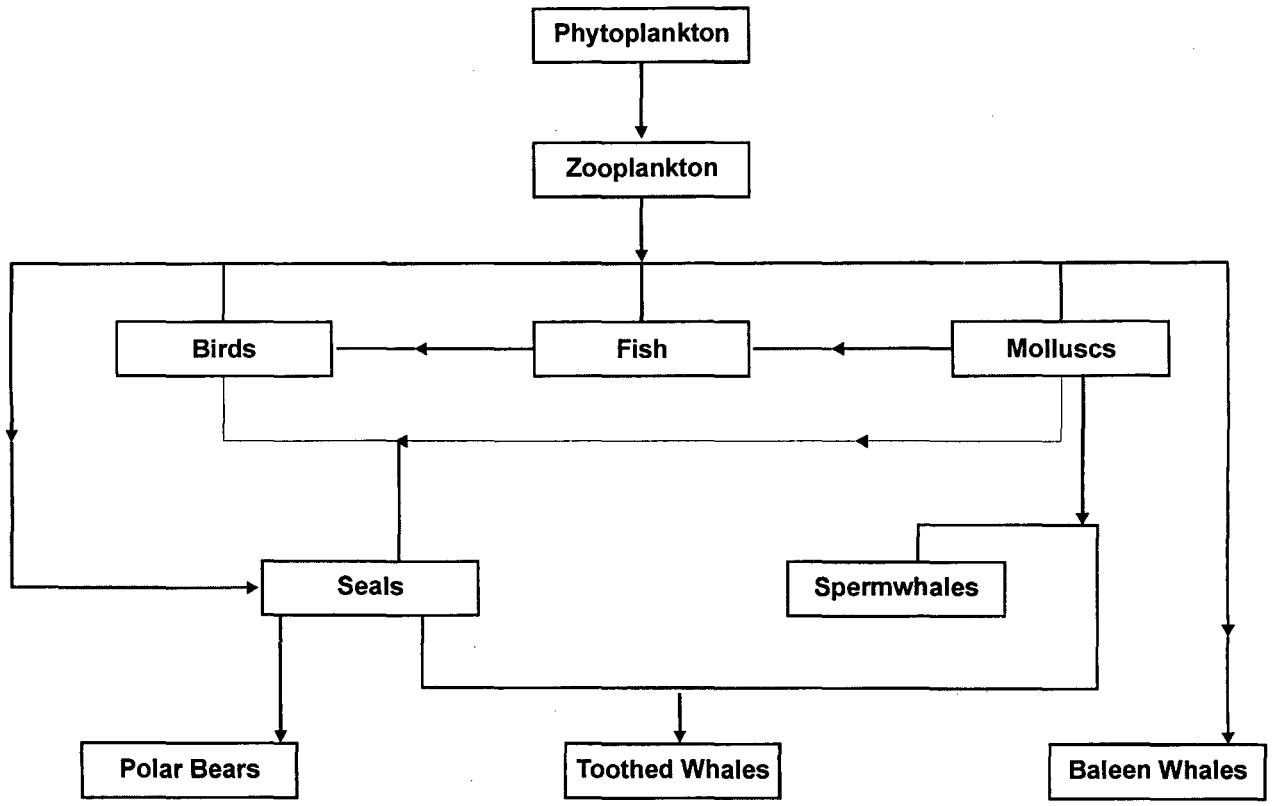
The large mammals are the most conspicuous element of the polar marine environment, the sub order Pinnepedia, meaning fin-footed involves three groups of seals, namely the Fur seal, Walrus and Hair seal. Fur seals spend most of their time at sea but haul onto selected sites for breeding in summer. The northern fur seal breeds in the Pribilof and Komandorski Islands of the Bering Sea.

The elephant seal is the largest, and full-grown males can weight upto 5 tons. It is a seasonal migrant and spend summer hauled up on convenient raised beaches in packed herds.[56]

The Walrus occurs only in the Arctic and consist of an Atlantic and Pacific species. It feeds on marine molluscs and other bottom fauna and is highly prized for

[56] op. cit, Willey Ley, 1974-76, P. 92.

Figure - IV : A TYPICAL ARCTIC MARINE ECOSYSTEM.



(**Source:** David Sudgen, *'Arctic and Antarctic'*, 1982.)

their tusks, hides and blubber. Once common in far north, the walrus has now retreated to small areas of northern Greenland, the Bering Sea and the Arctic ocean.

The Nahrwal is a warm-blooded mammal that swims like a fish, has a blow-hole and emits shrill bristles and horse-bellows, is called as the unicorn of the arctic. It is hunted by Eskimos for oil, flesh, hide and ivory.

The Wedder seals prefers landfast ice. The Arctic the harbours Ring and Bearded seals are year-round. The breeding ground for harp seal are on the sea-ice off eastern coasts and notorious for the annual cull in summers when they fatten up on ample food supplies but in winter most migrate to warmer climates. The main arctic species are the Fin whale, Blue whales, Humpback whale Sperm whales, Sei and Nink whale.[57] Besides there are a sub-order of whale, mainly the toothed whales such as Grey-whale, While whale and one tusked Nahrwals.[58]

Finally in polar marine ecology there is polar bear, its diet comprises of ring seal and fish, bear is adapted to life on ice floes and is wholly dependent on the sea for its food. In recent years it has broadened its diet and scavenges on garbage dumps-near settlements.

[57] Waws, R.M., Seals and Whales of the Southern ocean – Philosophical transactions of the Royal Society, 1977, P. 85.

[58] Cullard, J.A.,Antarctic baleen whales: history and prospects, Polar Record, 1976 P. 10.

CHAPTER III

THE ARCTIC-RIM

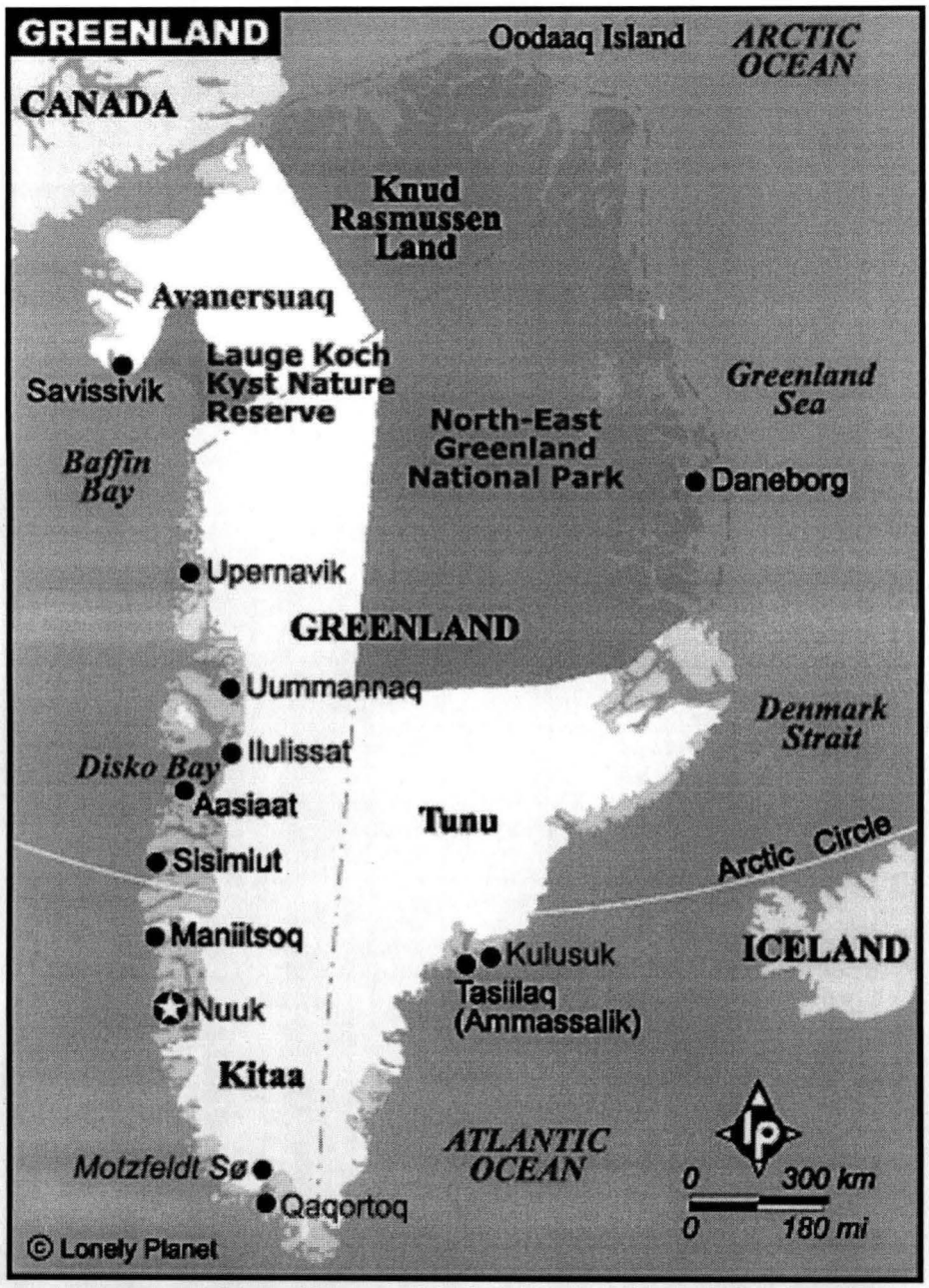
1. The Danish Greenland and Faeroe Island.

Greenland is an island which is in the north east of Canada and its an integral part of the Kingdom of Denmark, but is largely self governing. It has an area of around 2.2 million square kilometers making it the largest island in the world. The inland ice which covers approximately 1.8 million square kilometers is the second longest ice cap in the world. In some places, the ice is upto 3.5 kilometers thick. The northernmost point of the island, Cape Morris Jesup, is the northernmost land area in the world and is situated at 730 kilometers form the north pole. The southern point, Cape Farewell, is located at the same latitude as Helsinki[1]. (See Map – III)

The coast of Greenland typically have long, cold winters and short, cool summers, there are however great variations between different parts of the country, however, apart from a few protected valley in southern Greenland, the inland ice affects the whole country resulting in a polar climate in which the average temperature never exceeds 10°C, even in the warmest month of the year. The whole Greenland landscape is affected by the presence of the ice which has left sharp cliffs and carved out long, rounded glacier valleys. There are countless islands both large and small in the Greenland. There are large number of fjords, many of which cut deep into the landscape. The variation in the climate once clearly mentioned in the

[1] Peter A. Friis, Rasmus Ole Ramussen, 'Denmark-Greenland and Faroe Islands – Greenland, available on http://www.un.dk/english/denmark/denmarks.org/kap7/7-1.

Map - III: MAP OF GREENLAND.



(**Source:** www.lonelyplanet.com)

vegetation. Southwest Greenland is characterized by dense vegetation which can develop into thicket and woodland in the sheltered areas. Generally, however, the island is devoid of trees and is covered by sparse vegetation. The number of plants species dwindle as one moves further north and east and the lack of rain means that large areas of Greenland are covered by naked rock.[2]

Greenland and the Faeroe Island are a part of the Kingdom of Denmark. Legislation formally comes under the Danish Folketing (Parliament) which includes two representatives from Greenland, but in practical terms the Greenland, Lansting administers almost all legislative matters. This does not apply to the country's foreign policy, Greenland's mineral rights, the police and judicial system, all are under Greenland's command in Gr□nnedal the most senior Danish representative in the area is a commissioner appointed under the Royal Seal.[3]

About 56,000 people are currently living in Greenland, out of which about 48,000 were born there. The rest mainly come from Denmark. The rate of natural increase of population is 12 per thousand.

Majority of the population, about 45,000 people live in 6 towns, namely Nuuk (the Capital town), Qaqortoq, Manistsoq, Sisimut, Aasiaat and Ilulissat, out of these Nuuk is the largest town with population close to 13,000.

In 1960, approximately 42% of the population lived in settlement, now most have moved to the town. More than 2/3 of the population live on the west coast in the Disco Bay area and the central region.

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[2] op. cit, J. Brian Bird, 1982, P. 458.
[3] op. cit, Peter A. Friis, Rasmus Ole Ramussen, P. 4.

Fishing plays a huge role in the economy of Greenland more than 5000 people are employed in fishing and other associated industries. The public administration sector however provides over 8000 jobs, making it the biggest employer.

The main constraint placed upon human affairs is ice, Greenland's central heart is an ice sheet, while her coast is surrounded by permanent or seasonal sea ice. Since most Greenlanders live in the west it has a western Greenland bias so the North and East Greenland are remote, ice-olated' and unimportant.[4] (as seen in Map – IV)

The inland ice sheet and sea ice in Greenland provides firm constraints upon a self-supporting way of life. The ice sheet offers no realistic resources and thus rules out, effective use of some 84 percent of Greenland's land area.

Faeroe Islands

The Faeroe islands are located in the Atlantic ocean, almost midway between Norway, Iceland and Scotland and consists of 18 islands separated by narrow sounds and fjords. The nearest land to is the Shetland Isles to the southeast at a distance of 162 (nautical miles 300 kms).

The Faeroe islands are also a part of the Kingdom of Denmark, the islands have self governing Home Rule Act. However Defence matters and Foreign Policy are not included in it.

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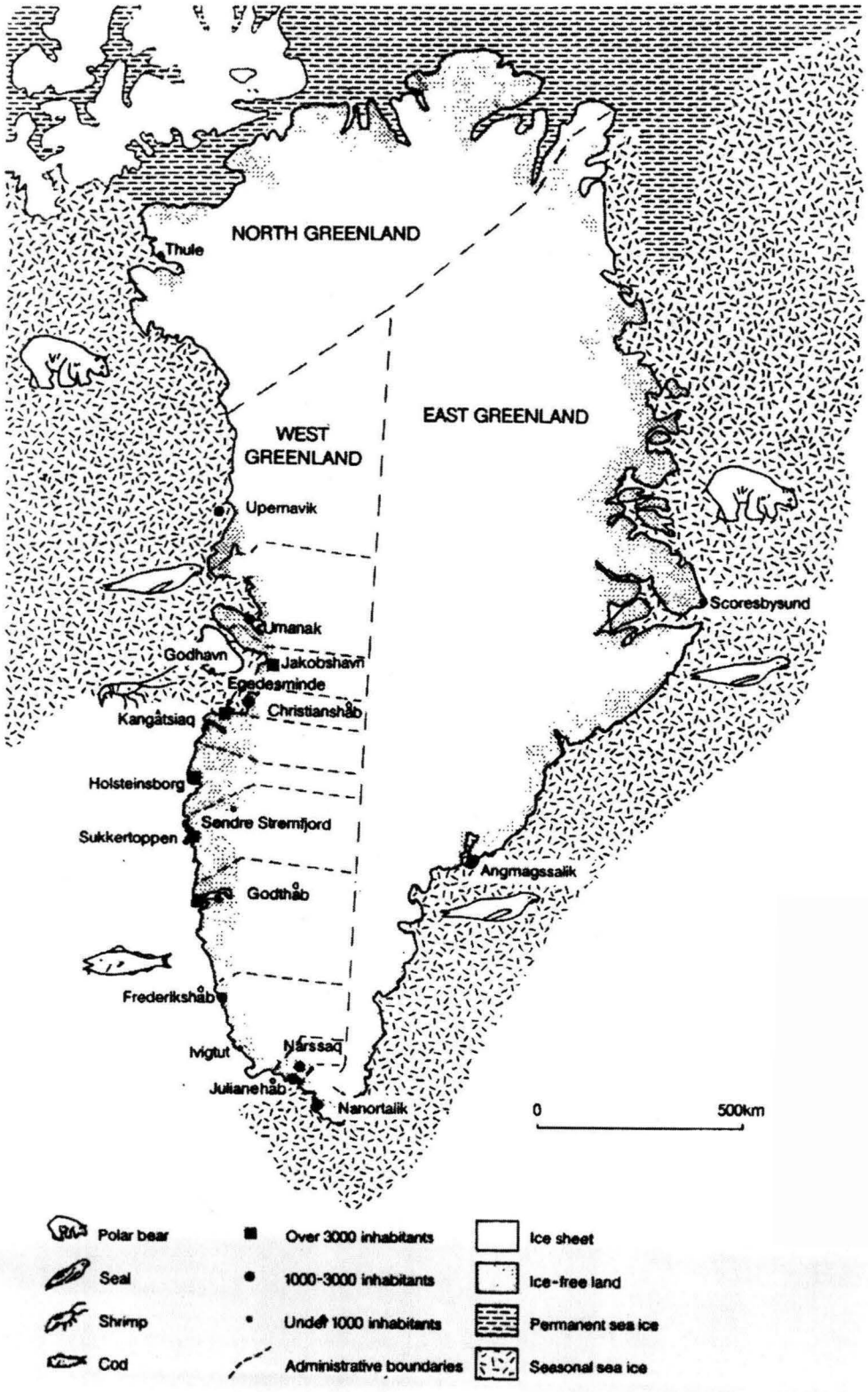
[4] Taagholt, J. 'Greenland's future development an historical and political perspective, 'Polar Record, 1882, P. 27.

Map - IV: GREENLAND (Distribution of Population, Ice Cover and Distribution of Marine Life).



(**Source:** Dumond D.E., *'The Eskimos and the Aleuts'*, 1977.)

Faeroe island have an approximate population of 47,000. strong growth of population is seen since the focus has shifted from the land to the sea for resources.[5]

The switch in resources led is new production methods, changes in the infrastructure, new patterns of settlement and new cultural features.

Two ocean currents, namely the Warm Gulf Stream current and the Cold Norwegian sea causes mixing and good concentration of nutrient salts, thereby enabling the formation of rich fishing grounds in the region. Fisheries and fishing industry thereby, are the main trades and almost all other industries stem directly from these activities on this volcanic island with the oceanic climate. The other fishing and trade related industries are production of trawls, nets, lines, loopes and wine ropes. The most advanced product is the automatic fishing jig which has been exported to Greenland, Scotland and Russia.

2. Norway and Svalbard

NORWAY: Norway is the northernmost country in western Europe, occupying the western and northern portions of Scandinavian peninsula. It's a democratic and parliamentary state. Norway is an extremely mountainous land, nearly one-third of which lies north of the Arctic Circle. It's coastline in proportion to its area is longer than that of any major country in the world.

[5] Op. cit, Peter A. Friis, Rasmus Ole Ramussen, P. 1.

Norway has five main physiographic regions Vestlandet (West country), Østlandet (East country, Tr□ ndelag (Trondheim region) and Nord Norge (North Norway) and S□ rlandet or (South Country).[6]

North Norway is the largest, most remote and least populated region of Norway. It comprises of 35% of the countries area, it supports fewer than 12% of the country's population. North Norway accounts for less than 9% of Norway's agricultural land. In the highlands of North Norway the climate is subarctic. The coastal areas of this region, however, have a moderate maritime climate due to the North Atlantic drift, and most parts even in the far North are ice-free in winters. Tundra vegetation, there is basically treeless consisting of hardy dwarf shrubs and wild flowers. Reindeer, polar fox, polar have, wolf, wolverine and lemmings are common here.

In the North sea principal mineral resources are petroleum and natural gas, extracted from the continental shelf. Other mineral resources are modest quantities of iron ore, copper, zinc and coal.[7]

The population of Norway ethnically homogenous. Apart from several thousand Lapps and people of Finish origin in North Norway, the country has no significant minority groups.

Norway ranks as one of the leading fishing nations of the world, accounting for nearly 5% of the world's total catch. The large motorized fishing feet has expanded its catch area to the Banks of New Foundland, producing slightly less than

[6] op. cit, Funk and Vagnalls, New Encyclopedia, 1982, P. 207.
[7] op. cit, Funk and Vagnalls, New Encyclopedia, 1982, P. 466.

1% of the yearly GNP. Other important economic activities are shipping, whaling and sealing.

SVALBARD: The Svalbard archipelago in the Arctic ocean lies midway between Norway and the North Pole, and belonging to Norway. It comprises of all lands between latitude 74° North to latitude 81° North and between 10° East and longitude 35° East.

The Norwegian archipelago includes the Spitsbergen archipelago, Bear Island, Hope Island. The main group of large islands include West Spitsbergen, Prince Charles Foreland, North East Land, Barrent Island and Edge Island.[8]

Two thirds of the land area is covered by glacier ice, ice caps are typical of the east, whilst valley glaciers and mountain ice fields predominate. Inspite of its location to the far north, it is accessible by sea.

The most striking feature of the human spatial pattern is that there are two largely independent human systems, one Norwegian and other one Russian. In 1979 the total population of Svalbard was 3650 of whom 2460 were Russian and virtually all the remaining 1190 Norwegian.[9]

The islands have experienced several waves of economic exploitation, earlier for sea mammals particularly whales, coal exploitation from 1899, tourism and now oil and gas.

[8] op. cit, Funk and Vagnalls, New Encyclopedia, 1982, P. 85.
[9] Greve, T. Svalbard, Norway is the Arctic Ocean, 1975, P. 287.

3. Sweden (Sverige):

Sweden is the fourth largest country in Europe. It occupies the eastern part of the Scandinavian peninsula and two large islands in the Baltic sea- Gotland and Oland.

Sweden is one of the world's northernmost countries. It's southern end is on the same line as the southern tip of Alaska, and one seventh of its total area is above the Arctic circle. Inspite of its northerly position it has a favourable climate due to the presence of the Gulf Stream Current. The seasons vary between the long haunting opalescent summer nights and the dark bitterly cold winter months. In the extreme north, the sea never rises above the horizon during the winter months, whereas during June and half of July the sea never sets.

Sweden is divided into three major regions – Norrland, Svaland and Gotaland. Norrland occupies the northern two-thirds of the country, the regions western border follows the international boundary with Norway, its also corresponds with the drainage divide of Scandinavian peninsula.

The native Swedish population is quite homogenous except for a small minority of about 10,000 Lapps in the far north. The population of Sweden is about 8.5 million.[10] The soil of Norrland is not suitable for agriculture, however the subsoil is rich in metallic minerals, of which the high- grade iron-ore of Lappland in the

[10] op. cit, Mac linda, Funk and Vagnalls, New Encyclopedia, 1982, P. 97.

extreme north is by far the most important. Here mining is carried out chiefly at Kiruna and Gallivare.[11]

Important economic activities includes fishing, farming, forestry mining and manufacturing largely related to iron and steel industry

4. Finland (Suomi) :

Finland is a republic in northern Europe. In area it is the fifth-largest state in Europe, but by population it is one of Europe's smaller countries. About one third of Finland lies above the Arctic circle, and with Iceland it is the world's northernmost independent state.

The climate of Finland is marked by cold winters and fairly warm summers. In the far north of the country the sun does not set for about 73 days, producing the white nights of summer. In winter the sun remains below the horizon for 51 days in the far north.[12]

However, the climate of Finland is more hospitable than the climates of Alaska and Greenland, which are located at the same latitudes. Finland's average temperature in January is similar to that of the Great Lakes region in North America. However, snow covers the land about five months of the year in the south, and seven months in Lappland.

[11] Mead, William, R. An Economic Geography of the Scandinavian states and Finland, year 1971, P. 213.
[12] op. cit, 'Finland', Funk and Vagnalls, New Encyclopedia, 1982, P. 221.

It has a population of about 5.2 million, with population density of 17 inhabitants per square kilometer. 67% of the population lives in towns or urban areas, 33% resides in rural areas.[13]

Finland has a Soami (Lapp) population of 6,500, who mainly thrive on reindeer herding. Finland now two official languages – Finnish and Swedish and it has a parliamentary system of government.[14]

The finish among unit is the Euro Finland was one of the 12 EU countries that started using euro cash in 2002.

5. Iceland (Island):

Iceland is an independent republic in the middle of the North Atlantic, and the land mass is nearest to that of Greenland, though the country lies immediate south of the Arctic circle, its arctic and sub-arctic climatic and physiographic traits enable it to be a part of the study by virtue of its being an arctic-rim country.

Iceland is a huge block of basaltic rock created due to volcanic activity and the process is still not complete. It is the second largest island in Europe after Britain, Hot spring, active volcanoes, geysers and gushers, exist alongwith glaciers of considerable extent, also along with it exist several rivers and lakes.[15] Iceland has a population of about 2.8 million, the language is Icelandic. Iceland has a thoroughly homogenous racial stock which is a mixture of Celtic and Scandinavian people, as they share the historical, linguistic and cultural heritage with Scandinavian.

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[13] op. cit, Mead, William, R., 1971, P. 204.
[14] Finland at a Glance 'available at http://virtualfinalnd fi/finfo/English/glance.html, May 2003.
[15] Hanson Olafur Facts about Iceland, 13th ed.,1967, P. 174.

Only vegetation of Iceland is low-growing shrubs comprising of Heather, Willow Dwarf, Birch, various Berry plant and Grassland. The only land mammal native to Iceland is the Arctic fox, reindeer, minks were important for fur farming, polar bears, seals and whales are common visitors.[16]

Fishing is the most important economic activity of Iceland, besides dairy farming and now manufacturing of small scale products such as footwear, soap, etc. products is also done.

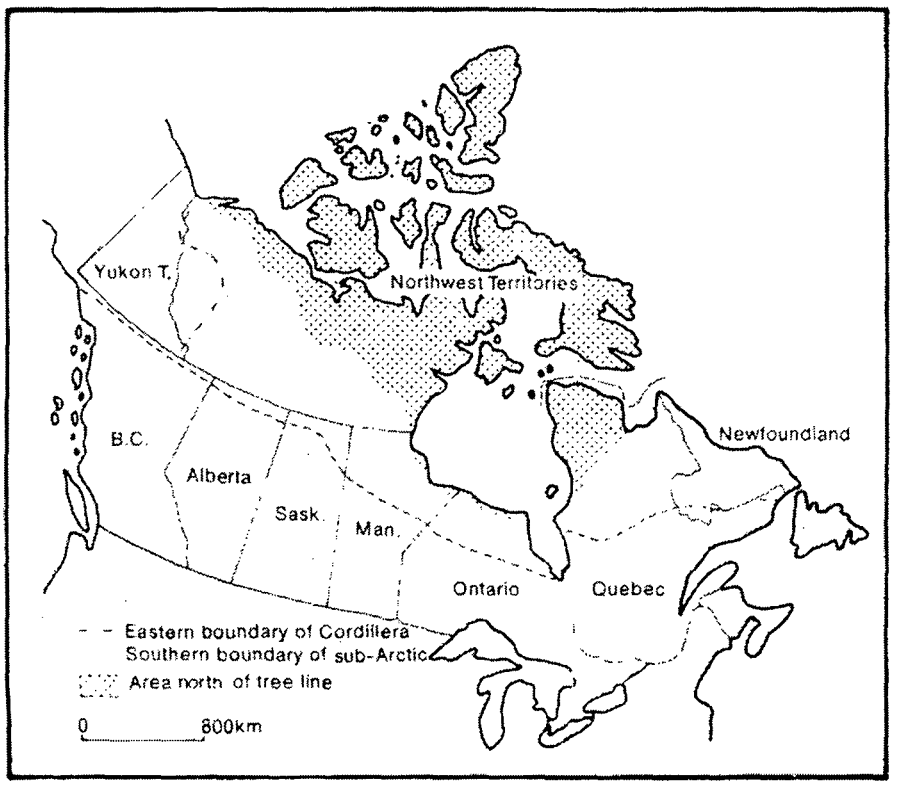
6. Arctic Canada:

Canada is the federal state of North America, formerly known as the Dominion of Canada. It is bounded on the north by the Arctic ocean, on the north east by Baffin Bay and Davis strait, which separate it from Greenland on the Easy by the Atlantic Ocean. On the south by the United States and on the coast by the Pacific ocean and Alaska.[17] (See Map – V)

Artic Canada exceeds the size of its Russian counterpart, it is the largest polar area under the control of one country. The natural boundaries of the Arctic Canada are effectively delimited to the south by the tree line which swings down from the vicinity of the arctic coast in the north west, round most of Hudson Bay and across the northern Ungava Peninsula. This boundary is closely paralleled by the southern

[16] Saminl, Golden Iceland, 1967 P. 89.
[17] op. cit, Graham W. Rowley, *The Encyclopedia Americana International Edition*, 1983, P. 330.

Map - V : NATURAL BOUNDRIES AND ADMINISTRATIVE BOUNDARIES IN NORTHERN CANADA



(**Source:** David Sudgen, *'Arctic and Antarctic'*, 1982.)

limit of continuous permafrost. It also effectively separates Inuit occupied land to the land to the north from the Indian occupied land to the south.[18]

The geological core of the Canadian Arctic is the Laurentide shield which encircles Hudson Bay for much of his area it is a rugged glacially scoured lowland dotted with lakes. In the east forms an uplifted rim and it is here in Labrador and Baffin Island that one find spectacular plateaux fjords and mountains. The shield flanked to the west on north by Palaeozoic sediments which underlie much of the Mackenzie River Basin and the Arctic Islands. In the west, including part of the Mackenzie valley and Yukon Territory are the Northern Cordillera, which form a series of broad valleys, barren plateaux and mountains. Glaciers are restricted to the highest uplands in the Cordilleras and the uplifted rim of the eastern Arctic.[19]

In the Arctic Ocean, the continental shelf is wide but irregular. Its edge lies generally about 70 miles from the perimeter of the Arctic archipelago, it is rather narrower in the north than off Banks Islands and adjacent to the mainland coast where it is almost 700 miles wide. Deep channels run into Amundsen Gulf, Mclure Strait and some of the passages between the Queen Elizabeth Islands.[20]

The Arctic Drainage basin is dominated by the Mackenzie River system which includes Lake Athabasca, Great Slave Lake, the heat Bear Lake, this is the longest river in Canada.

The Artic islands and the northern fringe of the mainland do not have a summer season. Midsummer temperatures average below 50°F stunting or

[18] Wonders W.C., Studies in Canadian Geography, 1972, P. 147.
[19] op. cit, Wondeis W.C., 1972, P. 213.
[20] op. cit, Graham W. Rowley, *The Encyclopedia Americana International Edition*, 1983, P. 334.

prohibiting the growth of trees. Eureka on northern Ellesmere Island, is Canada's coldest weather station. Northern islands constitute the real desert of Canada, as at most place precipitation is below 15 cm.[21]

The tundra soils are perennially frozen and soil development is very slow. On the Precambrian shield the soils are generally coarse textured and acidic, but in limestone areas they are fine textured and more neutral or alkaline. On these soils scattered patches of Boreal Forests are interspersed with tundra vegetation of mosses, lichens and creeping shrubs. The dominant trees are white spruce, black spruce, white perch etc. The fauna is also transitional with both boreal and tundra species overlapping.

On the Arctic islands, most of the country is underlain by permafrost, large areas of mosses, lichens and grasses are interspersed with bunches of alpine Poppy, Saxifrages, Sedges, Buttercups, Alpine Poppy, Mountain Avens, Cotton Grass etc.[22]

The typical mammals found in the Arctic Canada are the barren ground caribou, musk-ox, Arctic fox, Grey wolf, Arctic hare, Arctic ground squirrel and brown and varying Lemmings. In the spring vast numbers of waterfowl shorebirds and other migratory birds fly north to breed in the tundra, where source of the typical species are the Snowy Owl, Willow Ptarmigan, Rock Ptarmigan and the Lapland Longspur.[23]

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[21] Bonghner C.C., Thomas M.K., 'The Climate of Canada', *Canada Year Book,* 1979, P. 41.
[22] Persild A.E., Illustrated Flora of the Canadian Arctic Archipelago, Canada Bulletin, Vol 146, 1957 P. 241.
[23] Godrey Earl T. 'The Birds of Canada, Vol. 4, 1966, P. 203.

About 43,000 people lived in northwest territories in 1981. Approximately 36 percent of these live north of the tree line while 64 percent live south of tree line. About 83 percent of the population of northwest territories is Inuit with few exceptions Inuit live north of the lines while Indian live to the south.[24]

7. Alaska:

In Alaska common view restricts Arctic to the tundra, north of the Brooks range, an area mounting to about one-fifth of the total area of Alaska. Alaska means 'The Great Land', Alaska with its 1.52 million km^2 comprises of the one-fifth of the total area of the United States. The great size of obviously a major resources in its own right as well as a constraint. The Chugach mountains emanate from the ST. Elias Mountains on the Canadian border, and form a backbone of the Kenai Peninsula and disappear below sea level before reappear in the guise of Kodiak Islands. These mountains are dramatically steep and lavishly endowed with glaciers, these are situated near the junction of two tectonic plates, therefore one placed in a region of earthquakes[25] to the grain of the uplands. The area is continental sub-arctic in character (See Map – VI). In the extreme north is the Arctic slope, which is flat, poorly drained, underlain by continuous permafrost and have a maritime arctic climate. This provides for a bleak environment, as Barrow can only muster 17 frost free days in a year.

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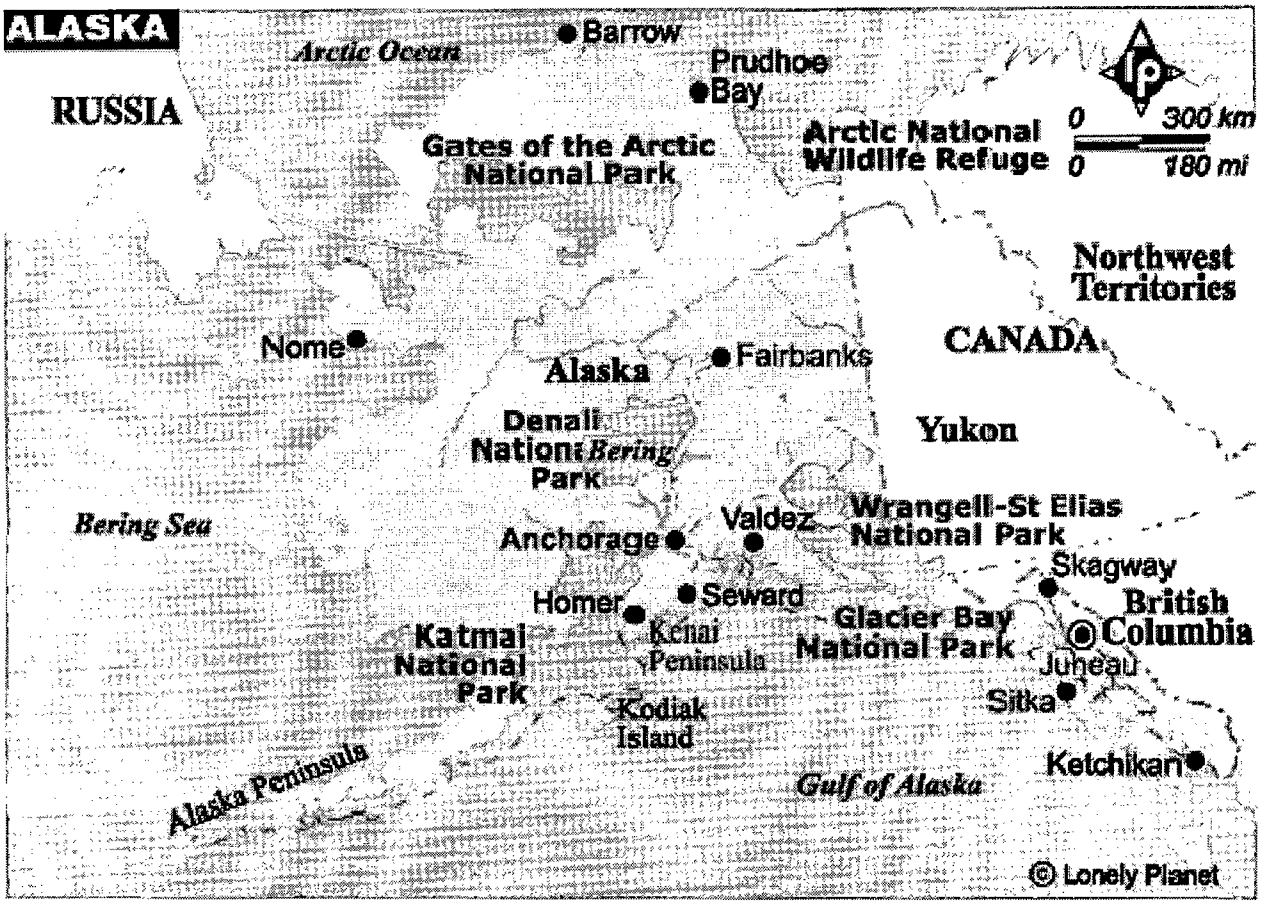
[24] Judd. D., Canada's northern policy, retrospert and prospect, 14(92), 1969, P. 597.

[25] Morehouse, T.A. and Leask L, 'Alaska's Mouth slope Borough: Oil, Money and Eskimo self government, 'Polar Record, vol. 20, 1980, P. 23.

Map - VI: MAP OF ALASKA.



(**Source:** www.lonelyplanet.com)

The physical environment seems to offer an unusually rich set of resources. A compilation of areas with good minerals and fossil fuel prospects includes most of Alaska. The main mountain ranges are known to contain gold, copper, platinum, nickel, tin, silver, lead and zinc, all of which have been mined in the past.[26]

The discovery of oil on Kenai Peninsula near Anchorage in 1957 heralded the start of the current oil boom. Production began in 1960 and within a decade the oil field population doubled, with the discovery of oil at Prudhoe Bay in 1969, it accounted for 91% of the Alaska's total oil production by 1980s.

Population of Alaska was 400000 in 1980, which was eight times more that in Greenland and nine times more than in Northwest territories. About 3,36,000 were non-natives and are mostly immigrant to Alaska or their descendents mostly coming from the United States. The remaining are the native population, majority of them are Inuits.[27]

Anchorage is the biggest town, followed by Fairbanks and Capital Juneau, and oil port Valdez. In the north and west of Alaska population lives in small coastal towns such as Bethel, Nome, Kotzebue, etc.

8. The Russian Arctic Region:

The northern zone of Russia covers 11.2 million square kilometer of territory and includes different territories such as the federal republics, autonomous regions, oblasts and administrative territories. The natural resources of the north are the main

[26] Kresge, D.T. Morchouse, T.A., 'Rural Alaska's Development Problems, Polar Record, 1970, P. 293.
[27] Kruse J., Kleingfield J. and Travis R., 'Energy Development, and the North Slope Inupiat', 1980, P. 171.

source of resources for the entire country. The population of northern zone as of January 1993 was 9.7 million people., which is 6.5% of Russia's entire population of 148.6 million people. (See Map – VII)

In addition the northern zone has fully determined, over the last several years, the volume and growth in production of oil, gas and coal, some types of raw minerals essential timbers and marine products.[28]

The natural boundary of the Arctic, i.e. the tundra, which coincides with the zone of reindeer herding, is a thin strip of land stringing the north coast and broadens only in the far east. The southern limits of continuous, permafrost is quite different and in the east it extends close to the Chinese border while in the west it excludes area well north of the Arctic circle.

The Russian Arctic is huge and extends in an east-west direction for 7000 kilometers. This is almost half way round the world in terms of longitude.

The population living in the Russian Arctic is much larger then in other Arctic areas. There are four main clusters of population concentration, first is, the Kola Peninsula, its an important fishing port, ship repairing centre, major naval base and centre for submarine fleet, overall density of population in Murmansk is the greatest in the Arctic region.

Second is the Vorkuta-lower Ob region, which is a coal town with satellites, the discovery of natural gas in 1960s in the arctic lowlands have led to further concentration of population.

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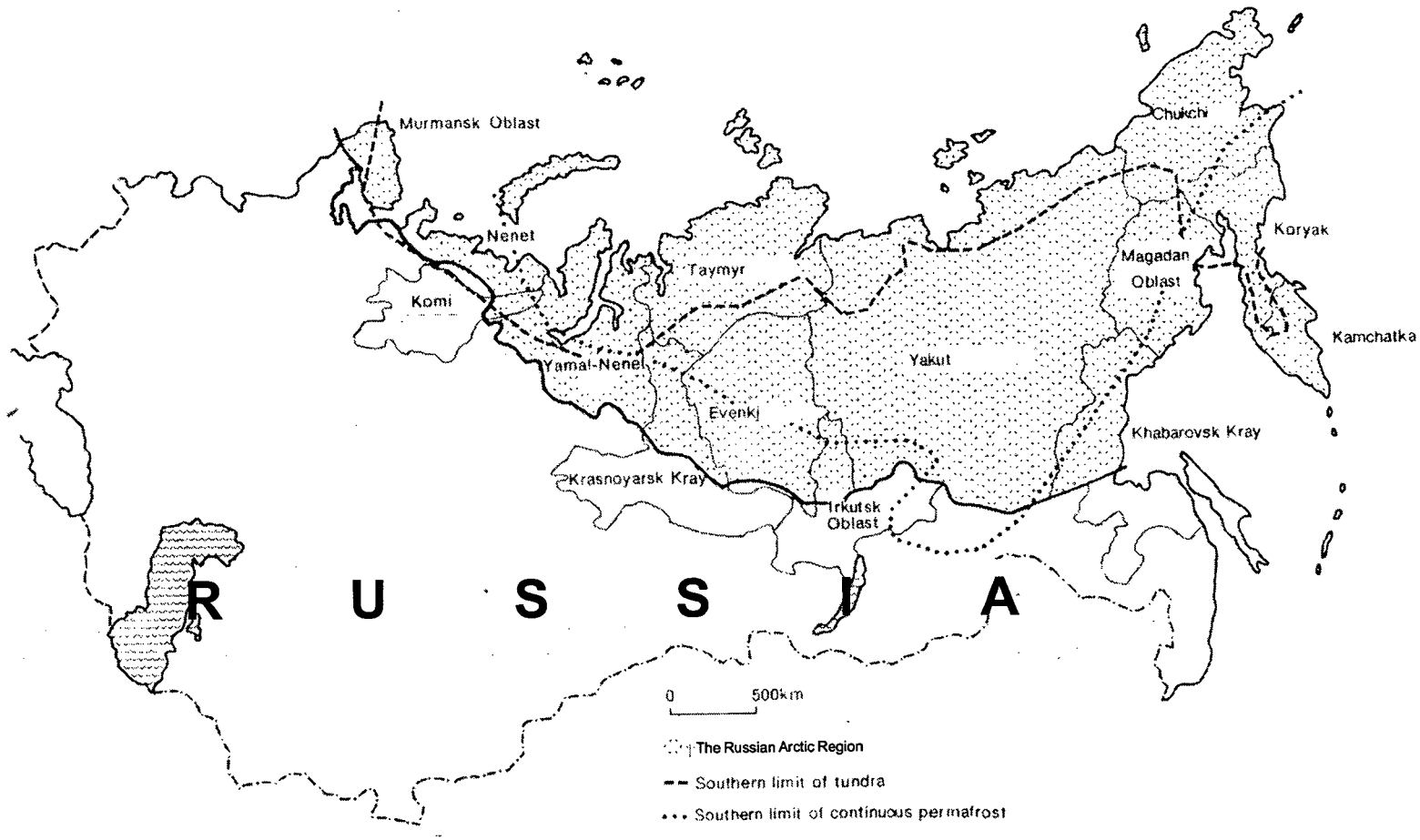
[28] Victor Mikhailov, 'Regional Development in the Russian far North, 2000, P. 240

Map- VII : THE RUSSIAN ARCTIC REGION.



(**Source:** David Sudgen, *'Arctic and Antarctic'*, 1982.)

Third is the Noril'sk complex, the Noril'sk and its surrounding small towns have populations of about 200,000. It has complex of nickel, copper, cobalt and platinum mines.

Forth is the northeastern Siberia here there are clusters of towns, with 2,000 – 20,000 people scattered along the coast or along major rivers. Tin and gold is mined here. Gold mined here account for half of the Russia's production and one-seventh of the world's total production.

The Russian Arctic suffers from abnormal social structure. Males are dominant in the population and commonly comprise 70 percent of the total population, many of these are single, most of them are immigrants from the south.

The indigenous population have experienced explosion in the 1960s, as a result of introduction of modern medicine there have been high fertility and low mortality rates, most of them now have a reasonable standard of living.

PEOPLE OF THE ARCTIC

"... No region on earth seems less inviting to most men than the Arctic. Only in recent years has science made it possible for civilized me to live there with some measures of their accustomed comfort and security. Yet primitive people have been living in the Arctic for thousands of years. They are more then the hardiest people on earth. Among them also are - until civilized men began changing their patterns of life - some of the happiest of humans. Their survival is supreme example of human adaptability. Their happiness, survival is the

supreme example of human adaptability. Their happiness, springing from a philosophy and way of life that civilized people have long since abandoned, is a triumph of human spirit."

— **Willey Ley,** *(talking about people in the high latitudes. in his book 'The Poles' 1976,)*

During ice age when most of the northern hemisphere was covered by ice thousands of meters thick the Paleolithic man grew accustomed to hunting in the Arctic environment. The advancing glaciers pushed all life southwards into the landmasses, however with the change in climate when glaciers related animals such as reindeer and musk ox followed their movement and man apparently followed the animals. The Paleolithic man survived on hunting and gathering and arctic land provided enough game animals, both on land and sea.

A closer look confirms what one would call as Arctic Rim culture, as striking uniformity is found in their culture. Arctic people, though living over vast areas and relatively few of them, their clothing, some of their hunting and cooking instruments and techniques, their social organizations and other cultural elements bear remarkable similarity even if they are trans-continental i.e, irrespective of them being located in Siberia, Europe or North America. For example both the Eskimos of the Bank Islands, in the Western part of the Canadian Arctic archipelago, and the Lapps of

northern Scandinavia prefer the skin of a Caribou –reindeer fawn killed in august, with the hair turned in for inner clothing.[29]

A glimpse at Arctic archeology suggests that the oldest recognizable culture is Paleo-Arctic and is presumed to have existed until around 7000 years b.p. It involved the hunting of land animals on tundra areas exposed at the height of the last Winsconsin glaciation. The heartland was the unglaciated lowland of northeastern Siberia. This arctic culture was similar to the contemporary Advanced Paleolithic culture of Europe which depended on the Caribou of the tundra around the southern and eastern margins of the European ice sheet.[30]

Subsequently, the Arctic was the scene of two rapidly spreading waves of hunting and gathering. The first took place around 4000 years ago and was based on hunting of land animals such as caribou and musk-oxen along with fishing, this is know as the Arctic Small Tool Tradition which originated in Siberia and swept across Arctic Canada to northern Greenland, with time the culture adapted to local circumstances, for example Greenland witness greater dependence on fishing, Alaska developed whaling culture which Canadian Arctic modified to ice hunting of seal and invention of snow igloo, this culture is known as the Dorset culture.

[29] Pitul Ko, V.V. and Kasparov, A.K. Ancient Arctic Hunters Material culture and Survival Strategy, Arctic Anthropology, 1996, P. 12.

[30] Khlobystin, L.P. 'Ancient History of Taimyr and the formation of the North Eurasian Cultures, 1998 P. 133

A second wave occurred in the tenth century A.D. called the Thule culture. This originated in the Bering straits depending on whaling from uniaks and kayaks. Within 100 years it swept along the Canadian straits as far as Greenland.[31]

The oldest group of the arctic people are the Polaeo-Asiatics of north-eastern Siberia. These includes the Yukaghirs, Chikchi and Koryaks, all of them are believed to be remnants of an ancient group of Mongolian –type who have largely turned to reindeer herding. Most aborigines of the Siberian arctic belong to the Ural-Altaic group, which includes the Tungus, Yakuts, and Samoyeds. The Tungus related to steppe dwelling people in the south, were among the first of this group to migrate northwards. There territory was later invaded by the Yakuts and then later by the Cossacks.[32]

West of the Tungus and Yakuts lies the lands of the Samoyeds and beyond them live the Lapps. Most Lapps live in northern Scandinavia, particularly Norway. They have carried the domestication Asian of reindeer to its highest development in fact the advancement of the method of reindeer herding may well be an adaptation of the techniques of horse herding learned on the steppe of central Asia.[33]

What the Yak is to the Tibetan and Ilama to the Peruvian, the reindeer formerly was to the Lapp, an all purpose animal. The Lapps were thought to be descendents of a strain of Caucasians that migrated north into the Arctic area around A.D. 1000, were originally amongst the shortest in stature of the polar area peoples,

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[31] West F., The Archeology of Beringia, 1981, P. 71.
[32] Khlobystein, L.P., 'Ancient History of the Tamyr Transpolar Region and Question of the Formation of Cultures of the Eurasian Extreme North, 1982, P. 161.
[33] Op. cit, Pitul Ko, V.V. and Kasperov A.K., 1996, P. 69.

because of the subsequent mixing with the other Scandinavian such as Norwegians, Finns, Swedes and Russians, it is difficult to identify a Lapp today, unless he is dressed in his traditional costume.

The Arctic people of North America cross the Bering strait from Asia either by land bridge, ice or water; they were mainly Aleuts, Indians and Eskimos. The Aleuts are a Palaeo-Asiatic group who move down the shores of Alaska and settled in the Aleutian Islands. Today however, they number only 1200, and can hardly be termed a population since they were wiped out in the 18th and 19th century, both by early Russian fur traders and by disease epidemics.[34]

No one really knows where the Eskimos came from. They are believed to be descendent of a group of hunting and fishing people who entered north America perhaps 500 years ago. Archeologists have discovered that some of the carving and religious and ceremonial practices of these people are similar to those of certain Siberian tribes, thereby linking the two.

These Eskimos migrated from Northern Alaska to the Canadian Arctic some 800 to 1000 y.b.p., on reaching the Atlantic shore the groups split into two, one moved towards the labrador coast and another one to Greenland.

Due to intermixing with the European settler the Eskimos have changed a lot in appearance and character however, they differ from Indians in having higher, broader cheek bones, small flat noses and slanting eyes. They are Mongolian in

[34] Allep P. McCartney & Douglas, W. Veltre, Alution Island Prehistory: Living in Insular Extremes, *Arctic Archeology,* 1999, P. 510.

appearance with short stocky stature, strait black hair with brownish skin, there babies are born with blue Mongolian spot at the base of their spine.

Eskimos own their private kits of weapons, utensil and clothing, otherwise they believe that the resources of the nature belong to everyone and are to be shared not only with members of their own community but any passing stranger.

According to world watch institute report some 4000 to 5000 indigenous cultures exist around the world representing some 190 to 625 million individuals and 50 Arctic indigenous languages; and indigenous people comprise over 3000 million individuals across the globe..

Arctic indigenous people can be described as "circumpolar culture". They inhabit the upper part of the hemisphere in areas north of the natural treeline in the northern Scandinavia, Siberia, Alaska, Canada and Greenland. The type of landscape in which Arctic people live varies from Southern Boreal forests to Siberian Taiga and high Arctic Tundra.

In the Scandinavian Arctic Saomi people are the native population while different people living in Siberia including Samoyds, Evenki, Nenets, Ukagirs, Koryaks, Chukchi and others. The Inuits live in the Arctic regions of north America and Greenland. The Dene and different Algonquian speaking groups such as the Gee and Nascapi live in the boreal region. The Greenland Inuits a native people of Greenland they are related to the Canadian Alaska and Siberian Inuit.[35]

[35] Henriette Ramsusen, 'The Indigenous people of the Arctic – Survival', P. 41

Almost all the countries bordering the Arctic – the United States (Alaska), Canada, Denmark (Greenland), Norway, Sweden, Finland and Russia have indigenous people living within the region with estimated number of people of these people is as given below:

- The indigenous groups in Alaska include the Inupiat and Yupiit, Aleut, Alutiiq-Aleut, Athabascan Indians and Pacific Indians. The total native population was 85,698 in 1990.
- In Canada the indigenous people includes the Indians in the Yukon, Indians, Metis, Inupialeut, and Inuit in the northwest territories, Inuits and Gee-Indians of Quebec, the Indians and Inuits on the Labrador coasts. The indigenous population of northwest-territories is approximately 30,000.
- In Greenland the total number of ethnic Greenlanders was 47,182 in 1992.
- In Scandinavia the total number of Sami people is between 70,000 and 1,00,000.
- The total number of individual belonging to the officially recognized small people of the north and far east group in Russia was around 1,70,000 in 1989. In addition there were 382,000 Yakuts, 344,500 Kumi, 18,000 Kamchadas and a small number of Veps and Izhors in Russia.[36]

[36] Ole Henrik Magga, 'Indigenous people of the North', 1995, P. 28.

In Sweden the population mainly comprises of Scandinavians of Germanic descent and is almost homogenous except for about 150,000 Finns and 10,000 Lapps in the North; since world war – II the country has witnessed large scale immigration from the Baltic States.[37]

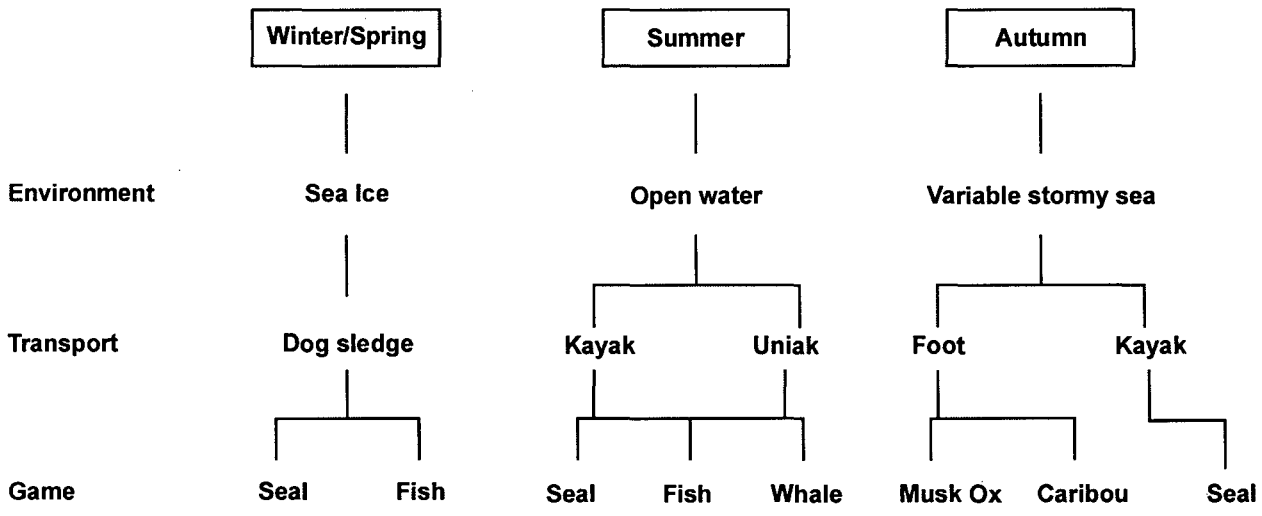
Finland also has a minority of Lapps numbering to approximately 1500, who make their living by tending reindeer; there is a colourful population of 4,000 Jewish of community and a small Turkish minority of nearly 1000 in Norway Lapps form the largest minority group of Samisk speaking individual, although many have being assimilated into the majority culture the Lapps have clearly recognizable linguistic and cultural features and they live in three clearly distinguish groups, the Sea Lapps live along the northern fjords from Varanger to Tysfjord; River Lapps live in the vicinity of the interior rivers Finnmark, and the Mountain Lapps who are semi-nomads, live on reindeer herding.[38]

Greenlanders are in majority in Greenland comprising of 48,000 out of existing 56,000 population. The tradition Inuit living there is constantly on the move to seasonal variation in the hunting environment and the nature of catch available (See Fig. – V)

In Russian arctic the situation of native people is complex involving some 181,500 people in 26 groups. 780 populations have autonomous state structures. The new industrial population is 1.7 million in the region where these native groups live. The death rates for

[37] op. cit, Sweden, 'The Encyclopedia American International', vol.28, 1983, P. 127.
[38] op. cit, Terje I. Leiben, 'Norway', 'The Encyclopedia American International', vol.26, 1983, P. 194.

Figure - V : RELATIONSHIP BETWEEN SEASONAL ENVIRONMENT AND GAME IN NORTHWEST GREENLAND



(**Source:** Dumond D.E., *'The Eskimos and teh Aleuts'*, 1977.)

natives is higher than the population as a whole due to accidents, poor nourishment, trauma and heart disease.

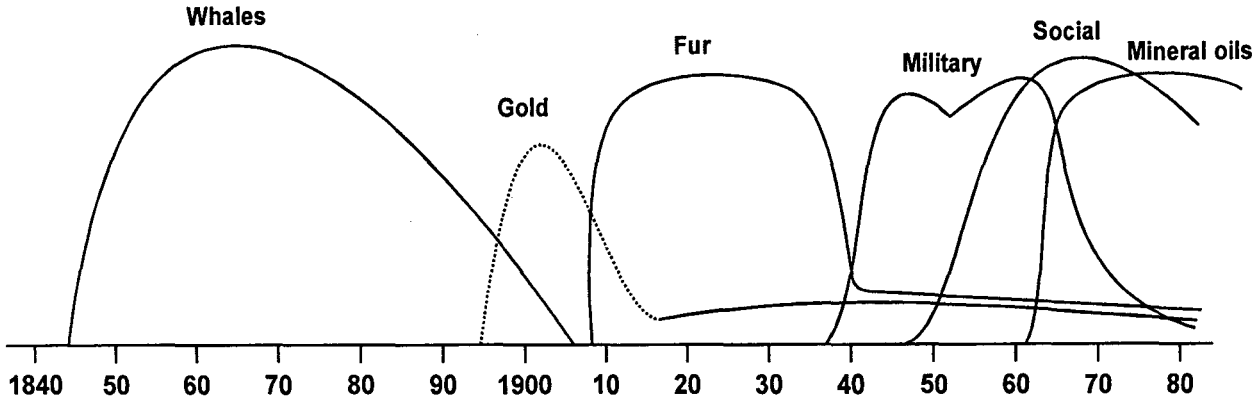
The history is, in principal the same everywhere in the Arctic, people from outside began their invasion with trading, plundering and missionary expeditions and they created borders without asking the indigenous people, that how they have little control over their land and exploitation of resources, as witness by waves of explorers and minors every time new resources discovered in the region.

The Arctic Canada has faced the arrival of immigrants in waves, the first such significant wave of exploitation involved whaling by 1907 the industry collapsed as whales were almost exterminated, then came the Klondike gold rush at the turn of the 19th century and non-natives swarmed into the area. About 30,000 people flooded into the Yukon territory. During the second world war communication infrastructure was installed and highways constructed due to hightened military significance of the region, this was the time of the military diffusion wave. Finally, in 1960s and 70s the diffusion wave that Struct the Arctic Canada was for the exploitation of the petroleum and mineral with the discovery of oil at Prudhoe Bay.[39] (See Fig. – VI).

Alaska had similarly experienced diffusion waves with Russian exploits mostly for Fur seals and later for Whales around 1847 – 53 as a result of which the Inuit population in west coastal villages suffered badly from disease and destruction of their economic and cultural livelihood, the bowhead whale.[40] (See Fig. – VII)

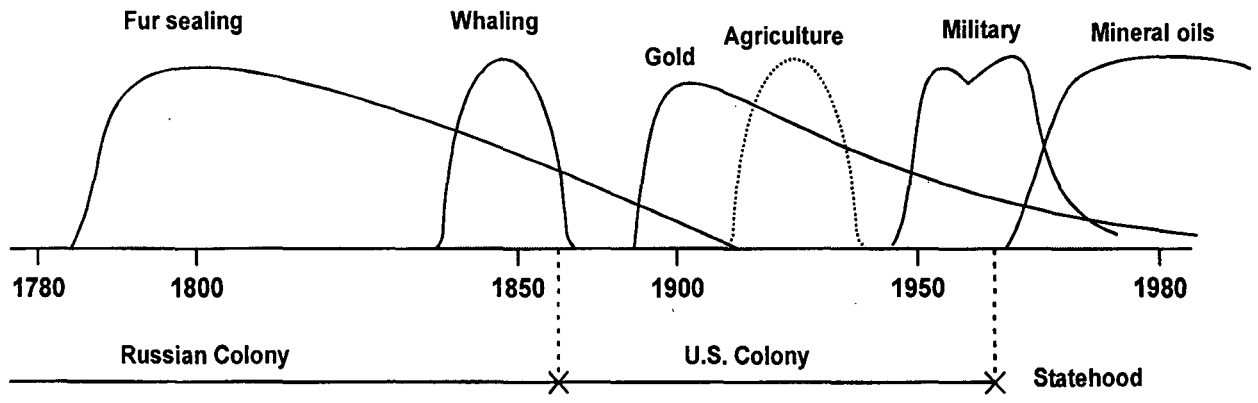
[39] Brody H., Industrial Impact in the Canadian North, *Polar Record*, 1977, P. 337.
[40] Harrison G.S., 'The Alaska Native Claims settlement Act of 1971, *Arctic*, 1972, P. 232.

Figure - VI : WAVES OF EXPLOITATION IN CANADA



(**Source:** David Sudgen, *'Arctic and Antarctic'*, 1982.)

Figure - VII : WAVES OF EXPLOITATION IN ALASKA



(**Source:** David Sudgen, *'Arctic and Antarctic'*, 1982.)

A wave of lasting economic importance is associated with gold mining following gold strikes in Juneau and Klondike in 1880s and 90s. However the deposits were soon exhausted and the gold rush towns soon declined.

The explosive growth of population which followed the second world war is associated with the two waves of exploitation which are important today – the military activity and exploitation of oil. The military wave of exploitation was fueled by strategic considerations concerned with the difference of the USA in the era of intercontinental missiles and the end of cold war and breakup of former USSR the crucial role of Alaska has diminished.[41]

The discovery of oil on the Kanai peninsula near Anchorage in 1957 heralded the start of the oil boom. The early years of production saw Anchorage's population grow by 38% of the total. Overall we see that the highest growth area in the Alaska are all associated with oil.[42]

Surprisingly with the cashing in on an economic development the Alaskan Inuits have seen radical change in their fortunes as they received huge money on land and oil royalties after the 1971 Act. Thereby the groundwork was late for the future bonanza and water shed in the economic development of the Alaskan mineral wealth.

[41] op. cit, Judd D. 1969, P. 601.
[42] Malaurie J. 'Arctic Oil and Gas: Problems and Possibilities', 1975, P. 41.

THE WEALTH OF THE ARCTIC

"We have to accept Arctic as it is, and see it as a challenge, man has to conquer the north and force it to be useful to her"

— Vilhjalmur Stefansson

(arctic Explosure Scientist)

If seems that the Russians understood that very well and have taken the lead in opening up their northlands, and started systematic development of their northern regions decades before Canada or United States. Anyhow we see that most of the earth's land lies in the Northern hemisphere and off-late man is progressing steadily northwards almost upto the poles. With the expanding world population the north/arctic region is one big empty space near the main centres of human civilizations World trade and travel have maneuvered difficulties on the inaccessible areas by taking to the sky finding the north to be the great short cut.

Russian have unlocked the 'jewel chest" in Siberia, Canadians have concentrated attention on their 'great tomorrow land' and United States is pampering 'Alaska' now.[43]

Earlier lack of technology and economic viability prohibited serious consideration of northern mineral and material wealth for the sake of burgeoning human population. However superior technology, military and strategic needs have enabled movement of the Arctic Rim States to explore the resources of the Arctic regions. With superior technology such as G.I.S. and Remote sensing it is far more

[43] op. cit, Willey Leu, 1974-76, P. 151.

convenient and economically sensible to explore the Arctic areas for mineral resources. Remote sensing and its interpretation are a rapid means of assessing the potential of large areas with a low financial outlay per unit area covered. It is a reconnaissance tool that can delimit target areas for follow-up surveys by more detailed and costly ground-based techniques. It can save money by attaching low priority to that vast proportion of the earth's crust that has little economic potential.[44]

When geothermal and hydrogeological surveys are made to decide the location and extent of a resource, they not only are difficult to conduct under the severe Arctic environment, but are also more expensive and tend to test human endurance, but on same terrain techniques such as Remote Sensing not only reduces the entire work and trouble that it takes to conduct those field surveys, but are great money savers as they can easily delimit the extent of a resource buried deep in the ground.

In mineral and oil exploration aerial Photographs and landsat images have proved to be extremely valuable in providing new data and base maps for surface geographical mapping. It is also known for a long time that mineralized areas and oil fields are associated with distinctive large structures which show up very clearly on small-scale images.[45]

Of particular interest is the common association of important mines along and at the intersections of, local fractures and regional lineaments hundreds of kilometers long. Direct examination and digital processing of Land Sat images reveal very rapidly

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[44] Glousen Per, 'Arctic and Antarctic sea Ice 1978-1987 Satellite Passive Microwave Observation and Analysis, 1992 P. 207.

[45] Thomas William L, ed., *Man's Role in Changing the Face of the Earth*, 1965, P. 178.

the vast majority of these straight alignments, thereby locating mines with far greater ease and clarity.[46]

Several ore-bodies are associated with some form of alteration of local rocks by water-rich solution of the concentrated minerals. The secondary minerals in such altered zones are often very distinctive in reflection and hence their appearance is exemplified by the bright red, iron-rich gossans forced by weathering of sulfide minerals and many other such distinctive signal hinting at the presence of minerals ores occurs at wavelengths beyond the sensitivity range of human vision. By using several techniques. Such as contrast stretching, band rationing and colour composing of multispectral images such as Landsat, which enables such altered zones to be pinpointed precisely.[47]

Besides exploration and delimitation of resources several other applications of Remote Serving may be used by man, living in the Arctic and sub-arctic environment, though mostly for the bigger purpose of economic development, for example the environmental application of Remote Sensing are very diverse. Infrared and radar images, particularly from satellite, enable the charting of many elusive aspects of glaciers, lakes, seas and oceans such as wave patterns, currents, pack ice, oil spill, thermal pollution and many other such things. Thereby enabling man to pursue his economic interest and along with it keep a vigil of its impact on the ideologically fragile Arctic.

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[46] Ibid, Thomas William L, 1965, P. 201.

[47] Weight J. Dawn, 'Cutting to the Bottom of It. Tooks, techniques and discoveries of the Deep Oceans Geography, Professional Geographer, 51(3), 1999 P 428.

Also at the same time snow avalanches, mud flows and many such catastrophes can be predicted with ease because of the weak filed of view and rapidly and repetitiveness of remote sensing provides invaluable assistance to the continual search for means of predicting minimizing and reducing the impact of any such catastrophe.[48] The accessibility, and assurance provided by such techniques has enabled the Arctic to be what it is today, exemplified by bustling civilization of urban centers such as Fairbanks, Alaska which has advanced radar to monitor weather modulation to small things such as antifreeze in their fire hydrants.

We see that military has been in the forefront of all exploration and research in the Arctic, during the second World War and immediately after that during the cold war era both United States and Erstwhile Soviet Union made frequent surveillance flights over the poles, air strips were operated on the ice pack or on huge floating in islands of the North Polar Basin.

In the 1950s Arctic-circling radar stations were set up by joint cooperation of US and Canada in Thule, Greenland the northern most is airforce base was establish, with powerful radar to detect Intercontinental Ballistic Missile, however with the end of cold war and introduction of Missile defence program and state-of-art Remote Sensing surveillance such extreme military practices however have been abandoned. But nevertheless, with the detection of mineral oil, etc., military presence in the north has found a reason to continue. In order to protect these strategic resources.

[48] Op. cit, Cambridge Encyclopedia of the Earth Sciences in, 1981, P. 418.

In 1968 oil discoveries were made in Prudhoe Bay, the North Slope of Alaska, which instigated a major oil rush in which geologists, technicians, and oil executives, all rushed to the ice tundra. Later similar rich oil reserves were discovered on Mackenzie basin and Melville islands in the Canadian Arctic and Russia have found vast amounts of oil on shore and off shore from the Barent sea to Siberia and inspite of the cost and environmental problems, oil reserves in the Arctic have tremendous strategic significance to the three big nations on whose land they have been found.

Besides mineral oil, big Swedish mines at Kiruna produces high quality Iron-ore. In Canada there are huge oil-deposits which are mined at Labrador and northern Quebec and Baffin Islands. Similarly vast amount of iron-ore deposits are being mined at central Siberia.

Major hydro power projects are erected to meet the power supply needs for heavy industry built on the ore field and bauxite deposits. Big power stations are at set-up at Banks of river Angara and at Kransnoyarsk on the Yenisey river in Russia and in Canada Churchill Falls Hydro Project is built at Labrador Canada, and big Yukon dam at Rampart Canyon is being worked upon in Alaska. The United States army has installed reactors at bases in Greenland and Alaska.

However for transport, which is another necessity there are very few roads which are difficult to build and maintained as summer thaws leads to stretching and sucking down of these roads. However, the Alaska-Highway inspite of high maintenance has enable transport link from Alaska to western Canada to the United States.

In Alaska and Canada bush planes haul cargo everywhere. In Siberia similar planes regularly serve villages with population even lower than 500.

Pipe-lines have faced stringent opposition from the environmentalist, making it to be a little lesser used option, however in 1969 ice-breaker super tanker S.S. Manhatton successfully crunched the thick ice of Canadian Arctic and thus opening up the northwest passage, thereby enabling tankers and freighters to transport oil and mineral which has previously been locked up deep under ice and snow.

The nuclear submarines have also been serving as a alternative route for commercial cargoes.

Besides this mineral wealth, arctic is a treasure of rich living resources, for example its marine life not only provides food for local settlers but for the world at large. The northern seas are rich in marine life, its open water are rich in mineral nutrients nourishing a tremendous supply of drafting plankton life on which fish, shrimp and other large creature feed. Herring and Haddock are extensively caught near the west coast of Greenland. Fish such as Mackerel and Tunny are fished near Iceland, spawning fish Cod to the north coast of Iceland. The arctic port of Murmansk provides for 2/3 of the entire countries catch. The world's biggest shrimp beds have been discovered off the western coast of Greenland.

Domestic animals such as reindeer are aplenty in the Siberian and the Scandinavian region, where reindeer herding is practiced on a vast scale, In Alaska and Canada however reindeer herding is rather limited do the native population only.

Another significance Arctic animal is the Musk Ox, besides meat and hide it possesses soft underwool which is also described as the world's finest wool, called as quivet, its finer than cashmere and can be used to make fine sweaters and other luxury clothing items. Efforts have been made to domesticate the animals and raise them at farms, just like sheep in Australian land.

Besides these animals Arctic region have more than 900 species of animals and more the 400 species of flowering plants.

Besides, hunting and trapping for fur trade and fishing, tourism, now is a new commercial enterprise in the region. With a global boom in nature-based and adventure tourism, also called as eco-tourism and their expansion into even the most remote and hostile regions of the world. People are attracted to such places to experience its isolation, appreciate the scenic grandeur of its pristine wilderness, to re-live something of its pioneering history and meet the personal challenge of wilderness adventure. The tourist activities include commercial ship cruises, air voyages, privately conducted expeditions for climbing, skiing and related pursuits.[49]

If we consider regional details of resource endowment amongst the Arctic Rim States we see great generosity displayed by nature as it has kept a considerable infirmity in distribution of mineral and living resources.

Looking at Greenland and Faeroe Islands we realize that inspite of poor territorial resources both the islands are rich with their living marine resources. The water around Greenland are the most productive seas in the world, with more than

[49] Paul Dingwal, 'Is Tourism is a Threat to Polar Wilderness? And Antarctic Case Study, 1995, P. 87.

200 different species of fish, crustaceans and mussels. Shrimps constitute the most important commercial export, with an yearly haul of once 80,000 tones, Cod and Halibut are two important fishes, along with Norway Haddock, Catfish, Atlantic halibut, Salmon and Char.

Besides fishing, Sealing is also important particularly for the native population. Besides these there is rich bird life around the coast mostly comprising of gulls and ducks, such as common eider[50].

On the Land there is the reindeer, mostly found on west Greenland is significant for local hunters. Musk-oxen found in north east of Greenland are also hunted, another animal which has been hunted, though not extensively is the polar bear, others are polar hare and the polar fox.

Greenland consist of a fragment of the North American shield and is known to have deposits of such minerals as iron, lead, zinc, nickel and ammonia. Also the Palaeozoic sediments of north and east Greenland and offshore in western and eastern Greenland hold potential for oil, gas and coal. Finally Tertiary basalts related to the tectonic break-up of Greenland are associated with 100 million tonnes of low grade coal on Disko Island.[51] However, in reality few of the mineral deposits found in Greenland have so far been exploited. The resources that have been exploited, however, include the only known occurrence in the world of cryolite which was mined in (Ivittuut), between 1867 and 1987. Coal was once mined near Oeillisat

[50] op. cit, Peter Fariis, Rasmus Ole Rasmussen, 2003, P. 4

[51] Taagbolt J., Greenland's Future Development: A Historical and Political Perspective, Polar Record, 21 (130), 1982, P. 23.

(1924-1970), marble, zinc, lead and silver near Marmorilik (1965-1990) and zinc near Mesters vig (1956-1963).

Other mineral deposits such as oil on the west coast and diamond, gold, tantalite, uranium and iron deposits on the East near Jameson would prove to the significant in future.[52] Lead and zinc is mined as Marmorilik, iron ore at Godthals, molybdenum in the Veniner Mountains near Mesters Vig in East Greenland and Uranium are near Narssq.

The Faeroes economy seen on the marine living resources which are aplenty on the islands coasts. Some 20-25 different species of fish are landed every year on the Islands, most important ones however, are Cod, Haddock and Coalfish besides these greater Silver Smelt, Norway port, Greenland halibut, Atlantic halibut are other significant deep-water fish. The most important pelagic fish species on the island waters are Blue Whiting Capelin and Salmon as well as Herring. Fish is so significant such that Faeroes exports consist mainly of fish and fish products.[53]

In Sweden the Arctic northern territories have subsoil rich in metallic minerals, of which high-grade iron ore of Lappland in the extreme north is most important here, mining is carried on chiefly at Kiruna and Gallivare. Sweden's second most important iron-ore district is Bergslagen, which also produced copper and silver earlier.

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[52] Armstrong T. Rogers G. and Rowley G. The Circumpolar North, 1978, P. 169.

[53] Denmark, - Greenland & F. Is – available on http://www.um.dk/english/denmark/denmarksbog/kup7/7-2.asp.

Other 120 mines producing copper [54], lead, zinc, silver and gold are concentrated around Skellefte district of Norrland. [55] Besides mineral wealth, considerable amount of fishing takes place in the North Sea, Principal species caught here are Herring, Cod, Storming and Mackerel Reindeers are common in Sweden, besides, Lynx, and Lemmings are plentiful.

Iceland too, has a vast fishing fleet, however fishing here is seasonal, mainly in the summer and fall important catch are Cod, Haddock, Herring and Halibut.[56]

In the Norway's northern territories fishing, sealing and hunting have significance. Today many nations fish extensively in the Barrent Sea. During the past 20 years more than 2 million tones have been fished in the northern parts of the Norwegian sea. In recent years the biggest catches have been of cod and capelin, due to natural variations however, the capelin stock has continued to fluctuate in the past years.

Until quite recently Norwegians have harvested large number of marine mammals such as seals and whales. After International Whaling Commission has declared a moratorium on all commercial whaling Norway halted all Mink whaling after 1987, however the hunt was resumed in 1993. Norwegian sealers now operate on the hunting grounds west of Jan Mayen and west in Novaya Zemlya – around the mouth of the white sea, hunting the Harp seal and the Hooded seal.[57]

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[54] Arahow W. Rowley, 'Sweden', Encyclopedia Article – Vol. 4, P. 107, 1979.
[55] Arahow W. Rowley, 'Finland', Encyclopedia Article – Vol. 4, P. 31, 1979.
[56] Arahow W. Rowley, 'Finland', Encyclopedia Article – Vol. 4, P. 713, 1979.
[57] Odin, Norway in the Arctic Available on http://A:\odin-Norway in the Arctic.htm.

In the late 1960s, the economy of Norway was transformed by the discovery and exploitation of oil and natural gas beneath the waters of the North Sea. First, the wildcat well have been drilled on the continental shelves of the Barents sea since 1980, so far 260 million standard cubic meters of gas, and 25 million standard cubic meter of oil has been found. The latest estimates from the petroleum Directorate indicate the presence of 800 to 150 million standard cubic meters of oil equivalents in the Norwegian part of the Barents sea, most of them in the form of gas.[58]

Svalbard has extreme reserves of mineral resources particulars coal, which occurs in flat, lying sediments of Spitsbergen. The Norske spitsbergen Kulkompani extracts about 300,000 tonnes of coal a year from the mines around Longgearbyen, which is also the main settlement of Svalbard. Other unexploited deposits of iron, asbestos, gypsum and uranium are also known to have existed on the island, also there are estimates on the reserves of oil and gas trapped in the continental shelf of the island. The island also has great biological reserves most important being whales, seals, walrus and fish along with them the reindeer, polar bear and arctic fox have proof to be a major attraction for the adventure tourism industry thinning on the Svalbard Island.[59]

Alaska has the kind of physical environment which seems to offer and unusually rich set of resources. A compilation of areas with good mineral and fossil fuel prospects includes moors of Alaska. The main mountain ranges are known to contain gold, copper, platinum, nickel, tin, silver, lead and zinc, all of which have

[58] Bower Derek, 'Norway: A shift in Focus' *Petroleum Environment,* May 2001.
[59] Grene T., 1975, Svalbard, Norway in the Arctic Ocean, P. 284.

been mined in the past. Known gold reserve exceeds 300 tons. Large copper reserves occur at Bornite, about 500 million tones near Nabes ranges. Huge iron deposits exist on the west side of cook Inlet and Nushagak. Tin occurs on the Seward Peninsula.[60]

Oil and gas reserves seems enormous. Estimates of the recoverable reserves from the North Slope oil pioneer range from 7-20 billion tons of oil as well as 8.5 trillion metric cube of natural gas. In the Cook Inlet oil province reserves are estimated at 200 million tones of oil and 5 trillion meter of natural gas. In addition there are several other promising oil provinces on land and offshore. Coal reserves, too are huge, the most extensive deposit of over 100 billion tons in north of Brooks range and includes some bituminous coal. Taken together with other fields, Alaska's known reserves are 130 billion tons but possibly five to ten times as much remains to be discovered.

Annually Alaska was providing 31 tonnes of Antimony, 90,000 tonnes of Baryte, 660 kilos of Gold 124 kilos of Silver, 650,000 tonnes of Coal, 3,240,000,00 cu.m of Natural Gas, 58,00,000 barrels of Crude Petoleum and 22,000,000 tonnes of sand and Gravel.[61]

Renewable resources of significance are the fisheries along the 9000 km of Alaska coast and extensive continental shelfes. The most important coast for fishing are in the Kodiak and Aleutian island areas but in the north and west Bowhead Whales and Seals are seasonally abundant. Fur seals thrive in the Pribilof Islands where the 1.75 million which breed there annually provide an important resources.

[60] Harrison, G.S. and More House, T.A. and Roger G.W., Issues in Alaska Development, 1977, P. 353.
[61] Alaska Statistical Review, 1990.

Timber is a major resources is cool temperate Alaska. Another Alaskan resource is scenery and wildlife. The spectacular mountain backdrop and sea inlets of the south coast and wilderness of interior Alaska are an attraction for the tourist.[62]

Arctic Russia has important resources for Russia, The North accounts for 10 percent of the industrial production of Russia, 92 percent of the gas, 75 percent of the oil and a large part of gold, diamond, silver, tin and other mineral resources. In 1992, exports of northern natural resource products accounted to 53 percent of all Russian exports. The North today provides 20% of the Russian National income.[63]

Minerals, tundra, rivers and vast space are actually considered to be Russia major mineral resources, the shield mineral are associated with the Kola Peninsula and the uplifted Angara shield in the Norli'sk area east of the River Yenisey, the oil, and coal are found in flat-lying sediments of the plains of western Siberia and the basins and coastal plains of Siberia and tin and gold are associated with the fold mountains of the far east.

Nickel and copper is mined at Zapolarnyy and iron at Kovdor and Olene Gorsk and Apatite at the Kirovsk of the Apatity area, its provides for 80% of the Russian sulphate fertilizer production. Vorkuta and Inta coal mines produce about 10 percent present of the Russia's coal. In 1970 gas from the northern region account for about 9 percent of the Soviets total at present however it is more that 40%.[64]

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[62] Gray J, Alaska's unique transportation system. Alaska Review of Social and Economic Conditions, 1980, P. 924.

[63] Victor Mikhailov, 'Regional Development in the Russian for North, 1995, P. 240

[64] op. cit, David Sudgen, 1982, P. 364.

Noril'sk has a complex of mines processing nickel, copper, cobalt and platinum. Russia's main gold mining complexes in the upper Kolyura Valley and smaller towns such as Bilibino and Perck and is Magadan in north-eastern Siberia. The Russian diamond Capital of Mirny, which was a crude Siberian tent camp in the mid 1950s when the diamond rich 'Peace Pipe' formation was discovered there.[65]

About 2.5 million reindeers are reared for meat and herds are tended by indigenous people. They are raised on state farms and are also responsible for fur. Such farms were located at Cheriskes, Nizhne and Kolymsk.

The wealth of Arctic Canada in renewable resources is complemented by non-renewable resources of great value. Metallic minerals ores, industrial minerals, and petroleum minerals are found in great abundance in the Arctic Canada. These reserves have made Canada a leading producer of several minerals including copper iron-ore, nickel, zinc, asbestos, uranium, gold and silver.[66]

The broad geological patterns provide a basis for predicating the location of major mineral resources in Arctic Canada. Within the Canadian shield are zones of mineralization on either flank of the Hudson Bay, on the western edge near the Mackenzie Valley and in North Baffin Island Major deposits of Iron, asbestos, lead/zinc are known to exist in these areas.[67]

The Cordillera region has major deposits of gold, copper, iron, lead and zinc. oil and gas is located in these major region, first in the Mackenzie delta on the Beaufort Sea Basin, which have about 580 million tons of oil and 1.1 million m^3 of

[65] op. cit, Willey Ley, 1976, P. 154.
[66] Arahow W. Rowley, 'Canada', Funks and Waganelles Encyclopedia, 1982, P. 207.
[67] Arahow W. Rowley, 'Canada', Funks and Waganelles Encyclopedia, 1982, P. 344.

natural gas, second is the Sverdrup basin in the Arctic islands is estimated to have 220 million tones of oil and 680 billion m^3 of gas. The third zone for oil and gas in the Arctic Canada is the continental shelf off Baffin Island and Labrador.[68]

On an average Arctic Canada produces about 78,000 tonnes of copper, 18,880 kilos of gold, 1,44,000,000 kilos of lead, 163,000 tonnes of silver, 233,000 tonnes of zinc, 8,000,000,000 m^3 of natural gas and 900,000 barrels of crude petroleum per year.[69]

The living resources of the area of northern Canada are not vast. There is a large tundra area of low-grade pasture land suitable for caribou and musk-ox. A disadvantage of the tundra from the point of view of potential reindeer herding is that much of it is remote from the forest edge or isolated on islands. Thus it does not offer support to reindeer herding on the other hand there are numerous rivers, lakes and a long coastline provides the basis for fishing and the exploitation of the sea mammals.

Substantial catches of Bears, Musk Ox, Mink, Wolf, Coloured Fox, Weasel, and Squirrel along with Lynx, Otter, Wolverine provide for Cananda's one of most traditional Industries i.e. the fur industry. Earlier, this industry depended on hunting and trapping, which led to dwindling of population of several animal, in the later 1930s fur farming started thankfully, however, the industry waivers due to the unpredictable demands of the fashion industry.[70]

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[68] Bougliner C.C. and Thomas M.K., 'The Geology of Canada', *Canada year Book,* 1969, P. 334.
[69] Denimian Bureau of Statistic, Canadian Statistical Review, 1989, P. 452.
[70] Innis Harold A., 'The Fur Trade in Canada, 1962, P. 369.

Extensive fishery resources are available in the Canadian water the vast quantities of Halibut, Haddock, Sockeye, Polka are caught for centuries in the Canadian waters and inspite of intensive exploitation its resources have been sustained and have increased in some aspects by conservation and development measures.

THE ENVIRONMENTAL CONCERNS OF THE ARCTIC

"Like many people, I have become quite besotted by the wonders of the North. The fantastic extremes of winter and summer, of dark and light, of fecundity and sterility and of human warmth and hospitality. Most of us acknowledge the importance of polar regions to the health of the world but sadly all is not well in the Arctic. Much of the Arctic's wild life is struggling to survive, waters are polluted and overfished; and there are communication difficulties between the indigenous peoples and the controlling authorities, to mention but a few of the problems....."

— **Graeme Dingle,** *New Zealand adventure who made a 28,000 kilometer journey round the Arctic.*

The Arctic Ecosystem on the Cryosphere is a fragile and self-contained, the atmosphere, land freshwater and sea are highly interconnected vertically and laterally. There is circulation within the system from air to land to water to sea and back again. There is a circulation of ice and sea, of chemicals, of animals and plants and humans within and around the Arctic ocean.[71]

If one part of the system is pushed, its affect would be felt in all the other part of the system. It is a single integrated, dynamic ecosystem on a massive scale, driven by the sum, however, its not isolated from the rest of the planet, for that matter no ecosystem is.

[71] Bill Heal, 'The Arctic is an Ecosystem', (available on http://www.thearctic.is), 2000

The Arctic region during most of human history have cradled human civilization where means of subsistence was hunting, gathering gradually fishing and simple agriculture and pastoralism – which however much widespread was not extensively damaging put more recent human activities have transformed this peripheral areas into the store house of raw material of great value to the industrialized nations. The development would now threatens this environment by unprecedented quest for oil and gas development, disposal of waste in the ocean, militarization, year-round shipping, and biological resource over harvesting. The consequent effect of which is air and water pollution, radioactive concentration, degradation of wild life habitat, and a range of social problems found in the oppression and displacement of native peoples and their traditional ways of life.[72]

Polar wealth plays an important role in shaping new national and international concerns for environmental protection. The susceptibility of conspicuously pristine – appearing landscapes and ecosystems to disturbance from far-travelled pollution, the clear evidence that living resources in polar lands and seas are vulnerable to overexploitation, the indications that environmental change due to planetary warming from greenhouse gases will be the greatest in Arctic latitudes, the growing appreciation that the knowledge of Arctic indigenous peoples has much to contribute to other societies in learning how to manage resources and adapt to environment change – all these, added to the fascination with polar wilderness, have affected recent politics.

[72] op. cit, Bjern Kaltenborn, 2001, P. 107

All Arctic rim countries now have policies protecting the northern environment and promoting however ineffectively, the rights of northern indigenous peoples to manage their natural resources. Several countries are setting aside Arctic areas as parks or biosphere reserves, not because they are spectacular playgrounds but because they are valuable wilderness areas themselves.[73]

The obvious solution to the problem of environmental destruction caused by past and present development practices in technically adavanced Arctic-rim countries is to reduce the present 'ecological demand' at both the input and (economic growth) and output end (waste). However, success in such an endeavour requires a basic transformation in the economies of these countries whereby the profit motive is diminished in favour of the environment in which its members reside. Given this magnitude of change at this point in time, such an event is difficult even to envision.

Instead government and industrial leaders promote the view that new technical knowledge will eventually overcome our ecological problems thereby enabling the continuation of economic growth with fewer environmental penalties. However scientific breakthroughs have added to the deteriorating environment while technological improvements are certainly to be encouraged but economist Robert Costanza's words cannot be ignored, as he said that economic growth, which is an increase in quantity, cannot indefinitely be sustained on a finite planet.[74]

First indications that the region was not isolated from anthropogenic influence came more than twenty years ago with the discovery of a thick layer of winter air

[73] opcit., Fred Roots, 'Polar Wilderness: what does it Contribute and to whom?, 2001, P. 124.
[74] Norman Chance, 'Northern Development and the Global Economy, 4-2000, available on http://A:\northern development and Global Economy.htm

pollution over the Arctic. This haze, which covers a region the size of Africa, is attributed to industrial pollution emanating primarily from central Eurasia, Europe and to a lesser extent, eastern North America. This haze is largely high proportion of carbon particles, sulfur dioxide, sulfate and heavy metals in the winter and spring Arctic atmosphere. Because of the extremely cold temperatures, there is hardly any precipitation to wash the pollutants from the atmosphere. They stay airborne for weeks to months, and are transported to large distances in summers.

A quantitative assessment of the sources of sulfur to the Arctic region for the period July 1979 to June 1980 estimated that of the anthropogenic sulfur entering the Arctic about 25% was from western Europe, 27% from eastern Europe, 42% from FSU (Former Soviet Union and 4% from North America.[75]

The ozone layer over the Arctic shown no holes unlike Antarctic, however, there is a remarkable depletion in the zone concentration it was about 20-30% below normal in the Arctic winter in 1994-95; leading to unexpectedly cold winter temperature and increased intensity of ultraviolet radiation, on densely populated regions in the northern hemisphere, posing a threat to primary plant and animal plankton productivity and human health in terms of increased risk of skin cancer and other health problems.[76]

Due to enhanced green house effect, continued warming is expected in these region, some computer models, predict extreme warming over most of the

[75] Stephanic Pfirmen, Kathlun Crane, Kimkrane and Tanya Simonela, 'The Arctic at Risk: A circumpolar Atlas of Environment concerns' (available on http://ranbow.ideo.columbia.edu/idf/txt/htm.)

[76] op. cit, Polar regions, UNEP 1997 edition, P. 118

circumpolar land area. If warming proceeds as predicted sea ice could thin and become less extensive on the shelves, with profound effects on biologic activity and planetary heat balance.[77]

Growing concern about pollution of the Arctic air and water have overlooked sea ice as a key element of transport of contaminants. Sea ice flows are transported thousands of kilometers through the Arctic regions over the years. Accumulated contaminants are released into the ocean as the ice thaws, refreezes and thaws again.

Most of the Arctic land is covered by glaciers which may again trap and release pollutants in the Arctic ecosystem, alternatively. Radioactive and other material dumped on the shallow Siberian shelves could be ploughed into icebergs with the potential for rupturing the containers and releasing containments into the water columns.

Due to permafrost in the arctic and sub-arctic areas pollutants deposited on the soil surface do not disperse as readily as in temperate regions. Besides, if global warming proceeds as predicted, the active layer may become thicker and some regions may lose permafrost altogether, causing prevalent land failures.[78]

It is a relief to know that the levels of heavy metals and organochlorines in the Arctic are quite low and are comparable to background levels in remote ocean waters. Typically, the levels of pollutants in the Arctic oceans are highest in the surface waters and decrease with depth, indicating that pollutants are entering the Arctic ocean through riverunoff, release from sea ice, etc. the Siberian rivers discharging

[77] Dunbar, 'M.J., Climate change and northern development, Arctic 1976, P. 187.
[78] Denton, G.H. and Hughes, T.J. ,'The last great ice sheets, 1981, P. 197

into the Kara, Lapter and East Siberian seas and most of these rivers are polluted with PCBs, DDT, heavy metals and contaminants, these pollutants are deposited where the river water encounters seawater at the river delta or in river estuary. Pollutants also enter the Arctic ocean through the Bering Strait between Alaska and Russia, in addition airborne pollutants deposit on the sea surface or on sea ice, which then melts and releases its pollutant load to the surface ocean waters.[79]

One of the greatest problems with some pollutants is their tendency to build up in the body and cause toxic effects in animals, including human, the term for this process is bioaccumulation, it can take place from water, food or air and often from more than one source. The Arctic ecosystem is especially vulnerable to contaminants because i) there is low species diversity with low fecundity, ii) the long length of food chain makes it susceptible to biomagnifications, iii) many of the organism are long-lived, so persistent contaminants that break down slowly have a long time to accumulate in the animal and then passed up the food chain when consumed, iv) many contaminant are found in fatty tissues, which make much of loss of organisms at the top of the Arctic food chain, eg. (seals, whales, walrus, polar pears, etc.). and v) there is high per-capita human consumption of local wildlife.[80]

Contaminant levels in parts of the marine food chains are now high enough to cause concern about human consumption of particular animals, as well as to raise the concerns about the health of the animals themselves. The onshore and offshore

[79] op. cit, Stephanic Pfirmen, Kathlun Crane, Kimkrane and Tanya Simonedls, 2000, (available on http://ranbow.ideo.columbia.edu/idf/txt/htm)

[80] Ibid., op. cit, Stephanic Pfirmen, Kathlun Crane, Kimkrane and Tanya Simonedls, 2000, (available on http://ranbow.ideo.columbia.edu/idf/txt/htm)

exploitation of oil and gas and their transportation through pipe-lines and by ships, represent a risk to the regional environment. The continued use of outdated technology in some areas increases this risk.

The Exxon Valdez accident in Alaska and the oil spill in the Komi Republic of Russia are example of accidental damage caused by oil related activities. Decomposition of hydrocarbons is slower in the cold arctic climate compared with warmer areas. This provided extra time for release of contaminants to spread and extend the time that they can have impact on the environment.

Besides the industrial and economic activity Arctic land and surrounding seas also play an important role in the defense strategy of arctic-rim countries, the movement of missile-carrying submarines in the Arctic waters, installation of modernized radars and laser oriented detection facilities, airborne warning and control system besides laying down to launch pads and storage basis in Alaska for the U.S. National Missile Defense system are a few activities. These military and economic pursuits have constantly been challenged by environmental organizations like the National Resources Defence Council in the United States, Social Ecological Union in Russia, Greenpeace, WWF along with indigenous and other local and political groups.

THE CONCERNS OF THE INDIGENOUS PEOPLE OF THE ARCTIC

Indigenous people are permanent residents of the Arctic and sub-arctic regions they have inhabited these lands since prehistory and have strong ties to he

nature, the current economic exploitation by the technological advanced population have made them restless and angry and they have now a strong political voice as awareness has spread and they have questions and demands regarding the use of 'their land'. They have fears about the effect of economic development on their life patterns for e.g. they fear that what will happen when the large gas complex, which is presently being erected in Siberia's Yamal Peninsula will destroy their summer reindeer herding pastures, what will happen to the resident Nenet Families when large number of pipeline workers and the other Russian newcomers would move into the regions, in addition to that comes the effect of pollutant making its way to edge of the Kara sea through Ob on their commercial fishing grounds.

Similar questions are being raised by the natives of Alaska who have sea-mammal oriented subsistence economy, about the offshore drilling projects.

The Athabascan Indians of northwest Canada are equally apprehensive about the negative impacts of oil exploration from the Arctic national Wildlife Refuge, would have on the calving grounds of the Porcupine Caribou Herd. Effort to settle the conflicts between the multinational energy corporation, environmentalists indigenous peoples and agencies of state of national governments have not met with considerable success.

Following the discovery of oil and Prudhoe Bay, the U.S. Congress was forced to address a long standing conflict over the legal ownership of Alaska's land, a dispute that was at least partially concluded with the passage of the 1971 Alaska Native claims settlement Act (ANCSA). In this legislation, Alaska Natives retained 44

million areas of land and nearly a billion dollars in compensation for the extinguishment of all aboriginal claims totaling 330 million acres. Significantly, the act also obligated the Native population to establish 12 in-state project making corporation and more than 200 village corporations to serve as vehicles for the ownership and management of the land and money which then became corporate assets, thereby enabling active involvement of Alaska Natives in the national economy.

Similarly, indigenous land claims in Canada have met with considerable success in the recent past. A noticeable agreement was to establish a new constitutional and political structure in the Northwest Territories. After two decades of struggle the Canadian government and the Canadian Inuit have agreed on the creating of the Nunavut Territory, which became legally recognized in 1999, that enabled them to voice their concerns as a part of the representative government at the centre.

Greenland's Home Rule Act of 1979 provided that nation's Inuit population with a substantial base from which to build their own Greenlandic political and cultural identity. Today 'Kalaallit' is a nation within the nation of Denmark, a geopolitical entity in which the indigenous populations assumes major leadership.[81]

The Sami population of the northern parts of Norway, Sweden, Finland and Russia have not able to claim complete control over land and resources. In Finland and Norway these native at the most have their own parliaments which have limited

[81] Norman Chance, Arctic Circle and Introduction, (available on http://arcticcirlce.ucon.edu.intro.html)

powers, mostly to do with their language and culture, they are still unable to assert their aboriginal right to the land. In the northern frontier of Siberia and the Russian Far East the 26 indigenous group living their have even lesser influence over their resources and cultural future. However the building up of political pressure is leading the process towards a more equitable solutions, the 1994 conference on 'Problems of the Indigenous peoples of the (Russian) North was outcome of such initiatives, however a long battle is due for any satisfactory resolution of the fight for ownership of the indigenous people.

The whole aspiration of the indigenous northerners can be summed up by this statement made in 1992 Inuit circumpolar conference which emphasized that "Northern development must refer to more than economic growth. It must allow for and facilitate spiritual, social and cultural development".[82]

INTERNATIONAL EFFORTS TO PROTECT THE ARCTIC ENVIRONMENT

The late 1980s saw a significant change in the approach to Arctic management which shifted remarkably from military perspective to a more environment centric one.

Former Soviet Union President Mikhail Gorbachev's speech in Murmansk in 1987 sparked a new intensity in the bilateral and regional environmental cooperation in the Arctic. This speech signaled a determination to make a manifest distinctions

[82] op. cit, Norman Chance, 2000, available on http://A:\northern development and Global Economy.htm

between military and non-military issues in the Arctic. He especially mentioned five areas suitable for international cooperation, one of which was environmental cooperation.[83]

The International Arctic Science Committee (IASC) was established in 1988, and its secretariat is seated in Oslo. The IASC is a cooperative organization for national research institutions in the eight Arctic and Nordic countries (Canada, Russia, Norway, Denmark-Greenland, Sweden, Finland and Iceland). In addition research institutes from Germany, Great Britain, France, Japan, the Netherlands and Poland cooperate.[84]

The most extensive international Arctic cooperative programme is the Arctic Environmental Protection Strategy (AEPS) adopted by the eight Arctic countries – Russia, the United States (Alaska), Canada, Greenland/Denmark, Iceland, Norway, Sweden and Finland – in Rovaniemi in 1991 (also referred to as the Rovaniemi Process). A number of other countries and international organizations have observer states – in the AEPS. The objectives of the AEPS are to protect the Arctic ecosystems, to provide for the protection, enhancement, and restoration of natural resources, to recognize the traditional and cultural needs, values and practices of the indigenous peoples, to review regularly the state of the Arctic environment, and to

[83] Carola Bjorklund, 'A comparison of the legal environmental regions in the Artic and the Antarctic, 2001, P. 145.

[84] op. cit, Prof. Torro O. Vorren, Odin-Norway in the Arctic. 1999.

identify, and as a final goal reduce pollution. Its second meeting was held in Nuuk, Greenland in 1993 and third in March 1996 in Inuvik, Canada.[85]

The AEPS has established five working groups:

1) **AMAP:** Arctic Monitoring and Assessment Programme, focusing on contaminants and their effects in the Arctic Environment.

2) **PAME:** Protection of the Arctic Marine Environment to assess the need for further actions or legal instruments to prevent pollution of the Arctic Marine environment.

3) **EPPR:** Emergency, prevention, preparedness and response, addressing accidental pollution and emergencies.

4) **CAFE:** Conservation of Arctic Flora and Fauna to facilitate initiatives to conserve the density and habitats of Arctic Flora and Fauna; and

5) **SDU:** Sustainable Development and utilization with particular reference to the use of natural resources.[86]

The third AEPS minstrel meeting in March 1996, the eight Arctic rim countries agreed to set of work priorities for the Arctic and to the establishment of the Arctic Council, with the involvement of Arctic indigenous communities and other Arctic inhabitants.

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[85] Stephanic Pfirmen, Kathlun Crane, Kimkrane and Tanya Simonedls, 'The Arctic at Risk: A circumpolar Atlas of Environment conceious' 4-2000, (available on http://ranbow.ideo.columbia.edu/edf/txt/.....)

[86] Willey Lee, polar Regions, UNEP – 1997, P. 210.

The council is designed to promote co-operation and coordination on particular issues of sustainable development and environmental protection, to co-ordinate programmes established under the AEPS; and to encourage research.

Besides these is sub-regional co-operation on Arctic issues, for example, the North Atlantic Marine Mammal Commission (NAMMCO) was established at Nuuk, Greenland in April 1992. The agreement was signed by Norway, Greenland, the Faraoe Islands and Iceland. The objective for cooperation to conservation, rational management and study of marine mammals in the North Atlantic.[87]

The Euro-Arctic Barents region is yet another example of sub-region co-operation on the Arctic, it was an initiative to develop industries, trade and local cooperation in the northern regions of Norway, Sweden, Finland and Western Russia, it also includes efforts to deal with industrial and nuclear waste in north-western Russia and an environmental action plan was adopted in 1994.

Alongside a set of progressive and coherent measures exist to protect the marine environment. Important global conventions for Arctic marine pollution include

i) Convention on the Preventions of Marine Pollution by Dumping of waste and other matter (1972).

ii) International convention for the prevention of pollution form ships (1978).

[87] op. cit, Sigbjom Eriksen 'Governmental structure of the Arctic – The Rights and Duties of the Northern peoples, 2001. P. 154.

iii) Convention for the prevention of marine pollution from dumping from Ship and Aircraft. (1974).

iv) Convention for the prevention of Marine pollution from land based sources. (1974).

All these are now consolidated into a single body, known as the 1992 OSPAR Convention for the Protection of the Marine Environment in the north-east-Atlantic.[88]

Another relevant international initiative, the Global Action for the Protection of Marine Environment from land-based Activities was adopted in 1995.

For addressing the transfer of airborne contaminants to the arctic, the United Nations Economic Commission for Europe's convention on Long-Range Trans-boundary Air-pollution (1979) is considered to be an appropriate measure. Negotiations are being made on the protocols on the Persistent Organic Pollutants (POPs) and heavy metals, global agreement on POPs was concluded in 2001 as the Stockholm Convention. The Stockholm Convention required ratification by 50 countries to take affect, would ban or severally restricts the production and use of 12 chemicals once implemented these include eight pesticides as well as PCBs, DDT and Dioxins, that can wreak havoc in human and animal tissue, damaging the nervous and other systems and causing reproductive and developmental disorders and cancers.

[88] op. cit, UNEP – 1997, P. 211.

Russia, one of the biggest industrial nation has signed the Stockholm convention last year, which is considered to be an important and welcome decision for the health of the fragile Arctic.[89]

Arctic wildlife and habitats stands to benefit from global conventions focusing on biodiversity, migratory species endangered species and wetlands, besides there are some regional agreement, such as 1979, Berne Convention on the conservation of European wildlife and Natural Habitats, 1973 Oslo Agreement on conservation of Polar Bears etc.

All the countries in the Arctic region have established protected areas, in 1993, 427 protected areas qualified for IUCNs categories I to V which included nature reserve and wilderness areas, national parks, natural monuments, habitat/species, management areas and protected land/sea scapes. These have a total area of 2,080,56 Km^2 representing 5% of the total and area and 14% of the Arctic.[90]

The largest of these protected areas is Greenland National park with 972,000 Km^2. The United States has 68 such protected areas in Alaska covering an area of 698,270 square kilometer. Other countries with significant Arctic protected areas are Russia, Norway (including Svalbard), Sweden, Finland and Iceland.[91]

The current set of protected areas is considered inadequate to maintain the biodiversity of the region. CAFF has recently prepared a strategy and action plan for developing an adequate and well managed circumpolar protected network, which would involve local and indigenous peoples and their needs, concerns, and

[89] Julian Woolfered, 'Russia signs POPs Convention, Arctic Bulletin, May 2003, P. 7
[90] Jens Wahlssedt, Arctic Conservation Strategy, 2001, P. 171.
[91] op. cit, P.H.C. Lueas, National Parks and Protected Areas in Polar Regions, 2001, P. 167.

knowledge, would aim to provide relative strict protection and at least 12 percent of each Arctic ecozone.[92]

In 2000, the Arctic council held its 2nd ministerial meeting at Barrow Alaska, arctic countries agreed to conduct an assessment of the current and projected impact of climatic change in the Arctic. The Arctic Climatic Impact Assessment (ACIA) with summarize existing knowledge both scientific and traditional to make policy recommendation. The US is a major contributor, providing 2.5 million USD in support of ACIA, and its due submission in 2004.

ACIA is perhaps the most international significant product to come out of the Arctic council. It was clear at the Ministerial meeting at Barrow, that ACIA would also be politically contentious. It is expected to show real and serious impacts of climate change already in some parts of the Arctic, with significantly more change to come.

ACIAs main founder, the US, has refused to ratify the Kyoto protocol after the failed Johnasberg Summit in Aug-September 2002, though Canada and Russia have indicated that they will ratify it.[93]

In June 2002, eight member countries met at a workshop in Finland to create a programme for promoting sustainable town development in the Arctic.

The coordination commission, consists of the state of Alaska, Alaska wilderness recreations and Tourism Association Swedish Eco-touristm Association,

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[92] op. cit, UNEP – 1997, P. 211.

[93] Samantha Smith, 'Finish Successes Zeelandic Challenges, Arctic council WWF Arctic Bulletin, 2000, P. 5.

Executive Committee of Northern Norway, WWF Arctic programme and Kemi-Tornio Polytechnic.

The participants finally agreed and a programme framework that will assist the arctic tourism sector to adopt economically environmentally and culturally sustainable tourism practices.[94]

[94] Arctic Network for sustainable tourism takes of 19 July 2002, WWW.Arcticprogram (available – http://www.ngo.grida.no/wwfap/core/newsroom/stmis2002/07/19.html)

CHAPTER IV

INTERNATIONAL LAWS, CONFLICTS AND AGREEMENTS IN THE ARCTIC REGION

The circumpolar north rimland for centuries have been treating Arctic as a frozen wasteland, however with the discovery of significant quantities of oil, natural gas and mineral resources, coupled with the realization that the arctic holds super abundant quantities of living resources in the 19 century, changed the attitude of the arctic rim states and the rest of the worlds towards it. There were several other factors, like the increase of the military activity in the Arctic waters, development in transportation and drilling technologies which enable resource exploitation of frigid climate, the growing awareness of the Arctic's importance in the global climatic processes which diverted the attention of the world to the north pole, alongwith ascending interest came the conflicting views on the ownership of the arctic land and sea resources. With growing friction the need for Arctic cooperation was felt and first voiced in 1987 by the then former Soviet Union's President Gorbachev.

United Nations convention of 1982 undertook all such controversial claims such as fishing laws and rights, demarcation of straits, baselines, passages, drilling of high seas for hydrocarbons and deep seabed mining. The following few pages shall deal with various specifications and nuances of these laws, which are of specific application to the Arctic region. The United Nation's convention on the law of the sea lays down a comprehensive regime of law and order in the world's ocean and seas

establishing rules governing all uses of oceans and their resources. It enshrines the notion that all problems of ocean space are closely interrelated and need to be addressed as a whole.

The United Nation's Law of the Seas is an umbrella convention that began in the cold war era of 1958. UNCLOS-I was born of the idea that the high seas and their ocean floors were store houses of mineral deposits with great strategic importance.

The first order of the business was to define and give legal legitimacy to the notion of the limits of national sovereignty into the offshore tide lands. The three nautical mile limits was recognized by Hugo Grotius, the Dutch Father of the International Law and Trade, under the Doctrine of Mare Liberum (1609). The Doctrine was a Northern Free Trades alternative to the prior doctrine Mere Claussum under which the Catholic church granted divinely inspired exclusive territorial guides to the royal ports of Spain and Portugal. The limit was based on 1) The Cannon Shot limit rule of the day, 2) the line of the site boundary drawn from shoreline to the horizon, 3) the historical precedence of the Scandinavian League.[1]

In 1982 the Second Order of Business was to extend the Doctrine Mare Nostrum to the area of the High Seas. Under that doctrine landlocked nation states would become "stakeholders" in the Ocean's Commons. Legitimacy was established by granting planery to key commissions and agencies. The key commissions are The

[1] UNCOLS Fact Sheet, 2003, available on (http://www.oslerbooks.com/ecology/unclosfacts.html.)

- Archipelago states, made up of a group or groups of closely related islands and interconnecting water have sovereignty over a sea are enclosed by strait lines drawn between the outermost points of the islands; The waters between the islands are declared archipelagic waters where states may establish Sea Laws and Air routes in which all other state enjoy the right of Archipelagic passage through designated sea lanes.
- Coastal states have sovereign rights in a 200 nautical mile exclusive economic zone (EEZ) with respect to natural resources and certain economic activities and exercise jurisdiction over marine science research and environmental protection.
- All other states have freedom of navigation and over flight in the EEZ, as well as freedom to lay submarine cables and pipelines.
- Landlocked and geographically disadvantage states of the right to participate on an equitable basis in the exploitation of an appropriate part of the surplus of the living resources of the EEZs of the coastal states of the same region or sub-region, highly migratory species of fish and marine mammals are accorded special protection.
- Coastal states have sovereign right over the continental shelf (the National Arch of the Seabed) for exploring and exploiting it, the shelf can extend at least 200 nautical miles from the shore, and more under specified circumstances.

- Coastal states share with the international community part of the revenue derived from exploiting resources, from any part of their shelf beyond 200 miles.
- The commission on the limits of the continental shelf shall make recommendations to states on the shelves outer boundaries where it extends beyond 200 miles.
- All state enjoys traditional freedoms of navigation, over flight, scientific research and fishing on the high seas; they are obliged to adopt or cooperate with other states in adopting measure to manage and conserve living resources.
- The limits of the territorial sea, the Exclusive Economic Zone and the continental shelf of islands are determined in accordance with rules applicable to land territory (but rocks which could not sustain human habitation or economic life of their own would have no economic zone or continental shelf.
- States bordering enclosed or semi-enclosed seas are expected to cooperate in managing living resources, environmental and research policies and activities.
- Landlocked states have the right of access to and from the sea and enjoy freedom of transit through the territory of transit states.

- States are bound to prevent and control marine pollution and are liable for damage caused by violation of their international obligations to combat such pollution.
- All marine scientific research in the EEZ and the continental shelf is subject to the consent of the coastal state but in most cases they are obliged to grant consent to other states when the research is to be conducted for peaceful purposes and fulfills specified criteria. States are bound to promote the development and transfer of marine technology "on fair and reasonable terms and conditions", with proper regard for all legitimate interest.
- State parties are obliged to settle by peaceful means their disputes concerning the interpretation on application of the convention.
- Disputes can be submitted to the International Tribunal for the Law of the Sea established under the convention, to the International Court of Justice, or to arbitration. Conciliation is also available and in certain circumstances, submission to it would be compulsory. The Tribunal has exclusive jurisdiction over deep sea bed mining dispute.[4]

[4] D.P.O'. Connell, 'The International Law of the Sea', 1984, Pp. 708-709

INTERNATIONAL TRIBUNAL FOR THE LAW OF THE SEA

The International Tribunal for the Law of the Sea is the centre forum established by the United Nation's convention on the Law of the Sea for the peaceful settlement of disputes, its seat is at the Hamburg, Germany.

The jurisdiction of the Tribunal comprises all disputes and all applications submitted to it, in accordance with the UNCLOS, and all matter specifically provided for any other agreement which confers jurisdiction on the tribunal. It has exclusive jurisdiction, through its Seabed Disputes Chamber, with respect to dispute relating to activities in the international Seabed Area. The Tribunal is composed of 21 independent members elected by State parties to the CLOS from among the persons with recognized competence in the field of the Law of the Sea and representing the principal legal systems of the world. The first election was held in August 1996.

The Seabed disputes chamber is to be composed of 11 members selected by a majority of the members of the tribunal from among them the members of the chambers serve for 3 years, and are eligible for re-election. Quorum of seven members is required to constitute the chamber.

The Tribunal applies the provisions of the UNCLOS and the other rules of the international law which are compatible with the convention and deciding dispute submitted to it. Disputes are submitted to the Tribunal depending on the case, either by notification by the special agreement or by written application, addressed to the Registrar, the Tribunal and its Seabed dispute chamber has the power to prescribe provision measures. All hearings before the Tribunal are under the control of its

President, and are to be made public. Whenever the interpretation or application of the convention or any other agreement is in question, the Registrar will notify all State Parties to the Convention or to such agreements.

Those parties have the right to intervene in the proceedings. Decisions of the Tribunal are final and shall be complied with by all the parties to the dispute. However, decision will not have a binding force except between the parties in respect of the particular dispute. The International Court of Justice is one of the Courts or Tribunals that may be chosen under the dispute settlement mechanisms of the UNCLOS.[5]

[5] Settlement of Disputes Prepared by the Division of Ocean Affairs and the Law of the Seas, Office of Legal Affairs, United Nation, 2003 (also available on http://www.un.org/desots/los/settlement_of_disputes.html)

FISHING RIGHTS AND POLICIES

"I think the man who makes the unnecessary fisheries law deserves a heavier punishment then he who breaks it".

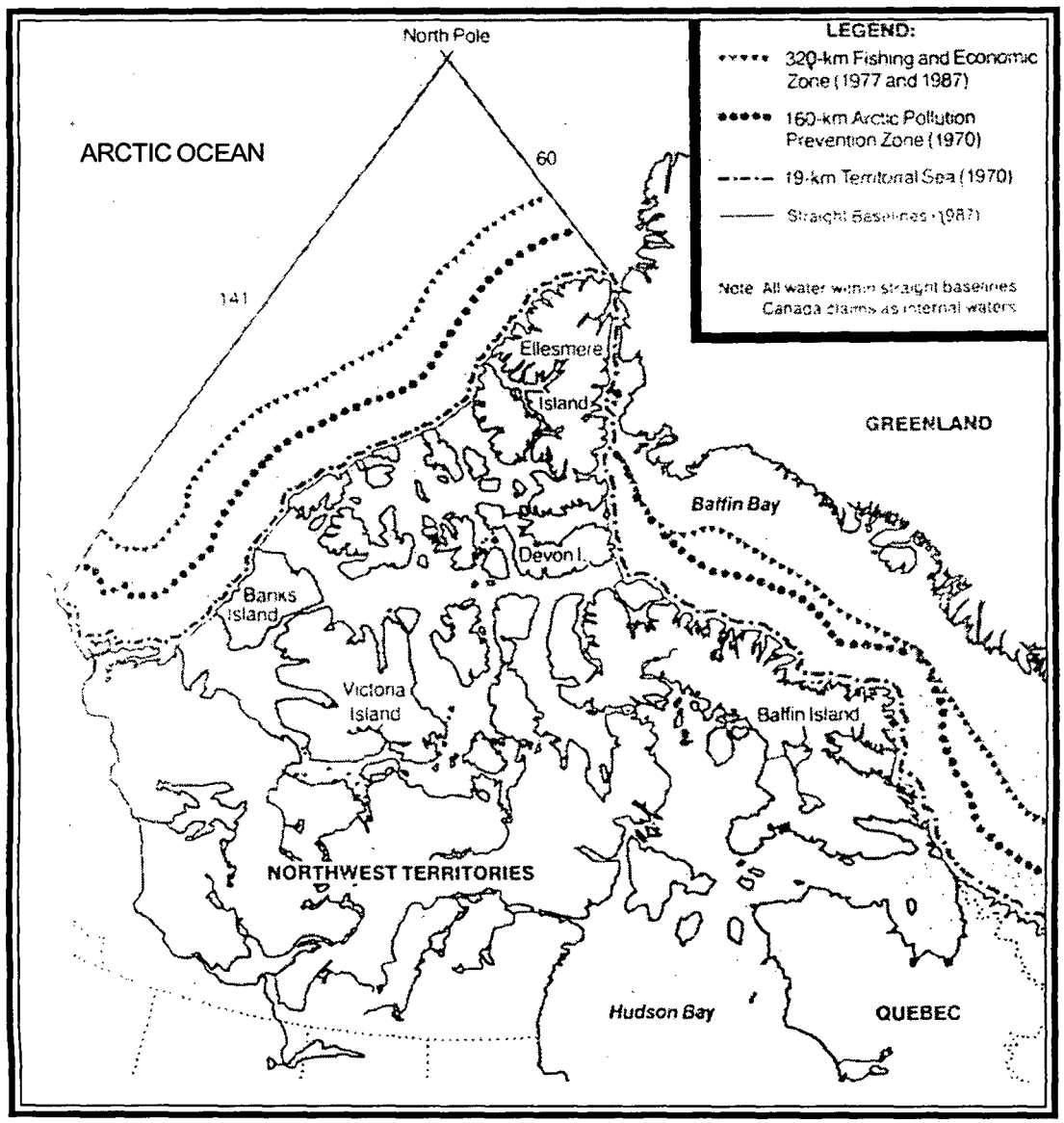
—Thomas Henry *Huxley, Marine Biologist, Head of Royal Commission Survey of British Fisheries in 1866.*

Fishing nations have begun to abandon the century old tradition of free access to ocean fisheries, the new regimes are evolving rapidly. The trend is clearly towards more well defined, tangible and exclusive rights for those who use marine resources. Coastal States are districted the access of foreigners to most of the worlds valuable stocks and in a growing number of case their governments have limited the access of their nationals as well. Increasing rights to fish are now specified in quantitative terms and have the character of property. Experience so far suggest that these trends hold considerable promise for improving fisheries management, the economic performance of fishing industries and cooperation of users in managing and consuming resources.[6]

At present the old traditional principal that fish in the sea are available to anyone has been replaced by the policies and ownership rights of the Coastal States. In 1977 Canada led the world and taking the daring step of unilaterally extending its fisheries jurisdiction to 200 miles (See Map – VIII). This was quickly followed by United States and the number of other countries. The concept of an 200 mile

[6] Peter H. Pearse, 'Fishing Right and Fishing Policy: The Development of Property Rights as Instruments of Fisheries Management', P. 76.

Map - VIII: CANADIAN BOUNDARY CLAIM IN THE ARCTIC.



(**Source:** Phenand Donat, *'Canada's Arctic Waters and International Law'*, 1998.)

exclusive fishery zone was incorporated into the 1982 Law of Sea Convention. The signing of the UNCLOS – III treaty was of great benefit to most coastal countries. The treaty however, was not without shortcomings. One of the shortcoming relates to the fact that at the time the treaty was negotiated about 95% of the world's commercial fisheries occurred within 200 miles of a coast line as a result most of the provisions of the treaty were directed towards the regulation of fisheries within a countries 200 miles Exclusive Economy Zone (EEZ). Unfortunately this left a number of gaps in the treaty with respect to highly migratory fish stocks such as Tuna and straddling fish stocks, such as Cod and Turbot.[7]

One of the traditional use of the Arctic has been fishing for example, the Barents Sea has long supported one of the world's major commercial fisheries in the mid and late 1970s, there were peak catches of about 4 - 4.5 million annual tones, which was 6-7 % of the world's total marine fish catch. The catch in recent years has however been approximately 1 – 1.5 million annual ton representing about 1.5 – 2% of the world's total.

In 1981 a Royal Commission investigating Canada's specific fisheries recommending quota licensing for the beleaguered Halibut fisheries, within an astonishing short time, quota licenses variably called individual transferable quotas, quantitative rights, enterprise a locations and catch quotas were introduced in major fisheries in several countries: Canada, New Zealand, Australia, Iceland and Britain amongst others.

[7] op. cit, Jan Henry Oslen, Regional Cooperation in the Arctic as a strategy for Marine Management, 2001, P. 159.

Several countries such as Canada try to remedy the deficiencies in the fishing agreement of UNCLOS-III through participating in various regional organizations such as the northwest Atlantic Fisheries Organization, but not with limited success, Canada raised the same issue at the International Earth summit at Rio de Janeiro in June of 1992 as a result of which United Nation conference discussed the matter of straddling and highly migratory fish stocks in 1993; finally in 1995 the United Nations adopted an International Convention titled, Agreement for the Implementation of the Provisions of the United Nations Conventions on the Law of the Sea of 10th December, 1982 relating to the conservation and management of straddling fish stocks and highly migratory fish stocks. This agreement is commonly refer to as the United Nation's Fishing Agreement. On December 11th, 2001 this agreement was ratified by 30 countries. According to the agreement the UNFA provides a framework for the conservation and management of straddling fish stocks and highly migratory fish stocks in the High Sea areas regulated by Regional Fisheries Organization. It provides for the obligation to use the precautionary approach and the ecosystem approach when managing these fisheries on the High Seas. It obligate states to minimize pollution, waste and discard of fish.

It reiterates obligation of states to control the fishing activities of their vessels on High Seas. But the most innovative aspect of the agreement is the right of the state party to the agreement to monitor an inspect vessels of the other state parties, to verify compliance with internationally agreed fishing rules of regional fishing organization such as the Northwest Atlantic Fisheries Organization (NAFO) and the

International Commission for the Conservation of Atlantic Tunas (ICCAT). Finally, UNFA provides a compulsory and binding dispute settlement mechanism to resolve conflict in a peaceful manner.[8]

The International Whaling Commission: The International Whaling Commission was established in 1950, the participating countries were Japan, Netherlands, Norway, US, UK, Former Soviet Union, South Africa; these countries conducted research coordinated by the commission the stock of five species were controlled by a catch quota of Blue Whale units weighed by the sizes of the different species. In 1956 trouble detected was that the recruitment was declining under the pressure of fishing, such estimates require that the Whales could be aged and at that time there were three independent methods of age determination.

Although the scientific solution appeared in 1964, the catch quotas were not reduced to a level low enough to prevent for the decline until 1968. The reason for the delay between solution and action was that the Japanese entered the Whale fishery late having got factories and catchers from Netherlands, Norway and UK. When these countries stop fishing, each one went some distance towards the amortization of investment by the Japanese. However, during these interim periods the commission encouraged the whalers to divert their activities from Blue and Fin Whales to the Humpback and Sei.[9]

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[8] Brad M. Caldwell, 'United Nations Fishing Agreement in Force 11 December, 2001; an Incremental Step towards Enforcement of the High Seas'. March 2002, Fisherman Live Magazine, P. 29.(also available on http://www.admiralitylaw.com/fisheries/unclos.htm)

[9] Clyde W. Voigtlander, 'The International Structure of Management, the State of World's Fisheries resources – The Proceedings of the World Fisheries Congress Planary Session, 1994, P. 232.

By 1968, when the capture of Blue Whales was forbidden by the commission, the stock was reduced to about1000 animals since blue Whales produced one calf at a time. Therefore, the dependence of the recruitment on parent stock is easier to establish than in a fish stock in which recruitment is highly variable. The failure of the Blue Whale stock was the classical example of recruitment over fishing and the diagnosis was conformed as the stock began to recover. In March 1973, there were indications that the number of Blue Whales were increasing.

The Arctic Ocean is home to four species of whales namely Bowhead, Gray, Humpback and Blue Whale. Over fishing of these stock led to rapid depletion and near extinction of these species, the Blue Whale was really affected. That's when the Whaling Commission took a firm stand over the issue of over whaling in the Arctic. The International Whaling Commission have set a moratorium on the taking of whales accept by native people and for scientific research until 1990. However, several states such as Japan, Iceland and Norway are believed to be violating the terms of moratorium.[10]

The taking of seals is now regulated by several international conventions and bilateral treaties. However, the decline in the demand for seal skin products in the developed countries is a major factor in conservation. Seal still are the main stay for the economy for many of the Arctic people and are the principle source of food for the Polar Bear.[11]

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[10] David L. Larson, US Interest in the Arctic Region', *Ocean Development and International Law,* 1989, P. 169.

[11] Carson, C. and Vander Zwaag, D.L., 'Arctic Waters: Needs and Options for Canadian – American Cooperation', *Ocean Development and International Law,* 1987, P. 89.

DEEP SEABED MINING - THE INTERNATIONAL AGREEMENT AND POLICIES

As scientist learn more and more about the potential of the oceans as a source for minerals, world statesmen, international entrepreneurs and mining personal have been pushing seaward the frontier of continental shelf petroleum production and for mining the deep seabed's for metals.

F.C.F. Earney identified a great many advantages and disadvantages of seabed mining; few advantages he cited were i) many seabed ores are richer than onshore deposits, ii) the water provides for relatively cheap transportation needs, the facilities (ports) for leading mining supplies and unloading mineral products are in place, 4) Onshore processing operations may be built in politically stable areas as specifically desired labour and energy supply regions, 5) fewer constraint exist an environmental regulation and zoning ordinance.[12]

Amongst the disadvantages is the distance between the mining site and the markets, more time and capital investment on mining and processing equipment, unknown environmental problems, weather related work hindrances, etc. are few of them.

It is universally accepted now that oil and other mineral resources are no longer merely an economic commodity but has become an international political commodity. As offshore has fast become an important resource region. Thereby

[12] P.V. Rajiv, 'Mining the Seabed World Marches Towards 21st Century, 1992, Pp. 85-86.

intensify confrontation among private industry, national, regional and international agencies; such competition and diverse agendas have focused on the need of international regulation of deep seabed resources, exploitation. The LOS convention and its ratification is a major step in this direction however, years of negotiations lie ahead to resolved detailed procedures and regulations for extracting these minerals.

In 1967 with the underdeveloped, the landlocked and the geographically disadvantages stated in mind Arvid Pardo (Maltas Ambassador to the UN) called upon the United Nations to reserve all non-territorial seabed resources as a common heritage of mankind and establish some form of international control in the use of the ocean seabed.[13]

The call by Arvid Pardo finally led to convening of UNCLOS-III, the agreement reached on the area of Seabed Mining included the establishment of an International Seabed Authority consisting of an Assembly, a Council, a Secretariat and an Enterprise; it is meant to deal with the issues of how and by whom potential seabed resources should be managed and exploited, how much of certain seabed minerals should be produced, and how mining could be equitably shared with LDCs, with landlocked and geographically disadvantages states.[14]

The final arbiter of decision within the ISA is to be the Assembly of which every party to the convention is to be a member. It is to meet annually at the designated seat of authority. The functions of the assembly includes :

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[13] Pannel on the Law of Ocean uses, 'Deep Seabed Mining and the 1982 Law of the Sea Convention: A Symposium of the Status of the Treaty in 1987', October 1987, P. 3.

[14] P Rothe, 'Deep Seabed Politics and Minerals – Managing the Ocean Resources and Research Law', 1985, P. 21.

i) establishment of subsidiary organs within the Authority,

ii) assessment of the contribution of members to the Authority's Administrative budget,

iii) distribution of financial and other economic benefits accruing from the activities,

iv) approval of the budget proposed by the council, and

v) examining of records by the various organs of the Authority.[15]

The main fulcrum of power in the ISA will rest with the council which shall consist of 36 members elected by the assembly. In 1987 a panel of distinguish specialist on Law of the Sea problems issued a statement containing a call for the US and the other world states to re-negotiate the LOS convention, until it is acceptable to all.

Such a consensus should be obtainable given the general agreement of nearly all states on matters other than deep seabed mining. The panel stressed, that rapidly changing world mineral market conditions have reduced the urgency for finalizing a deep seabed mining regime and made it unlikely that a full scale International Seabed Authority, could become self supporting from revenues produced by Seabed mineral development. In addition, changed technological capabilities make obsolete the present conventions provisions for the number, size and production tonnages for the first generation mine sites. Finally, the panelists emphasized that recently discovered

[15] op. cit, Panel on the Law of Ocean Uses, October, 1987, P. 39.

onshore mineral sources and postponement of, and slower projected rate of growth for commercial deep seabed mining operation.[16]

INTERNATIONAL STRAITS AND THEIR LEGAL STATUS

Between the years 1974 to 1982 there were major fundamental differences between the maritime powers and the bordering states, it was believed that the question of international states would lead to the failure of the Third UN Law of the Sea Conference. On one hand, the maritime power insisted on unrestricted freedom of navigation for maritime commerce and strategic mobility, on the other, the states bordering straits maintained that they had to restrict such freedom in order to protect their marine environment and national security. Fortunately a compromise was finally reached and a fairly comprehensive set of provisions on international straits were adopted. The convention specified the categories of international states falling within the scope of the convention and legal regime applicable to each category.

From a strictly geographic point of view any narrow and natural passage, between adjacent land masses, joining two parts on the High Seas or two bodies of sea water comes within a definition of a strait. From the legal point of view, this definition is unsatisfactory since it mentions no width and does not cover the over lap of territorial waters.[17]

Since it 12 mile territorial sea has been permitted in International Law a legal or territorial state means one which is 24 miles or less in width. Under the 1982 Law

[16] Council on Ocean Law, 'The United States and the 1982 Law of the Sea Convention: A Synopsis of the Status of the Treaty in 1987', October 1987, P. 3.
[17] D.H. Miller, 'Political Rights in the Arctic', *Foreign Affairs,* 1965, P. 49.

of the Sea convention such a strait must join either a part of the High Seas with another part of the High Seas with the territorial sea of a foreign strait.

Exceptionally, a strait of more than 24 miles and used for international navigation might be considered a legal or territorial strait; if the high seas route in the middle is not suitable or convenient enough for navigation.[18]

The functional criterion in the determination of what is an International Strait, the following proposition may be formulated:

i) actual use of a strait, in opposition to mere potential use, is necessary;

ii) the strait must have a history as a useful route for international maritime traffic and episodic or infrequent transit is insufficient;

iii) the strait does not have to constitute a necessary route for international navigation and may be only an alternative one;

iv) the sufficiency of the use is determined mainly, although not exclusively, by reference to two factors, namely the ships using the strait a number of flags represented; and

v) the number of ships and flags should normally reach the order of magnitude shown to exists in the Corfu Channel Case (between United Kingdom and the State of Albania) regarding the decision impart North Corfu Channel an International Strait status as decided by the ICJ in 1949.[19]

[18] D. PHarand, Canada's Arctic Waters in International Law, 1988, P. 74.
[19] Donat Pharand, 'The Legal Status of International Straits – International Straits of the World – Northwest Passage – Arctic Strait', 1098, P. 96

CLASSIFICATION OF INTERNATIONAL STRAITS

The 1982 convention of the Law of the Sea covers at least five categories of international straits and provide for 4 different legal regimes, these five categories are:

i) International Straits with a route of High Sea of 'similar convenience' within them will be subject to freedom of navigation at over flight applicable to the High Sea and EEZ. The determining criterion of 'similar convenience' refers to 'navigation and hydrographical characteristics'

ii) International Straits with route of High Seas not of 'similar convenience' will be governed by the right of transit passage. This category of straits is provided for by implication in article 36 which states that 'this part does not apply to a strait used for International Navigation if there exists through the strait a route through the High Sea or through an exclusive economic zone 'similar convenience'.

iii) The International Strait with the High Seas route of 'similar convenience' seaward of an island of the coastal state are subject to the right of non-suspend able innocent passage.

iv) For International Straits joining a part of the High Seas with the territorial seas of a foreign state are governed by the non-suspend able innocent passage.

v) International Straits joining a part of the High Seas and not included in the previous categories are subject to the right of transit passage.[20]

THE RIGHTS OF PASSAGE THROUGH THE INTERNATIONAL STRAITS

Innocent Passage:

In 1958 convention on the Territorial Sea and Contiguous Zone, Passage was defined as innocent 'so long as it is not prejudicial to the peace, good order or security of the coastal states'. In the 1980 to convention on the Law of the Sea the same definition of 'innocent' is retained, accept that it specifies a series of activities which are considered to be non-innocent. Eleven such activities are listed and related to the following; use of force, violation of customs, fiscal, immigration and sanitary laws, willful and serious pollution, fishing, research and survey, and interference with communications.[21]

To sum of the meaning of innocent passage the following proposition may be stated:

i) passage is innocent so long as a ship does not engage in any of the specifically prohibited activities or any other activity not directly related to the passage;

ii) prohibited activities are expressed in the form of overt acts; and

[20] Ibid, Donat Pharand, 1984, Pp. 97-98
[21] op. cit, Donat Pharand, 'The Legal status of Northwest Passage', 1984, Pp. 102-103.

iii) it is not clear if the burden of proving that an activity is not in accent is on the coastal state or on the ship, but it seems to be on the coastal states.[22]

Passage of Worship:

In preparing the draft of 1958 convention on the Territorial Sea and Contiguous zone, the International Commission fully debated the question of passage of worships. It began by granting passage of worships without prior authorization or notification but due to the strong opposition of certain members and the comments received from governments, it provided in its final draft article that prior authorization was necessary and should normally be granted.[23]

As to the right of innocent passage on a part of a submarine, both the 1958 and 1982 conventions provides that submarines have an obligation to navigate on surface and show their flight. In 1982 the text enlarges this obligation to 'other under water vehicles'. Considering the fact that the innocent passage of submarine would normally be war ships, it is an additional reason to conclude that the intention of the drafters of both the 1958 and the 1982 convention was to make the right of innocent package applicable to war ships.[24]

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[22] C. Larson and D.L. Vender Zwaag, 'Transit Management in the Northwest Passage: Problems and Prospects' 1988, P. 74.
[23] W.H. Critchley, 'Polar Deployment of Soviet Submarines', *International Journal,* 1984, P. 829.
[24] Ibid, W.H. Gritchley, 1984, P. 830.

BASELINE AND THE INTERNATIONAL LAW

The baseline is the line from which the outer limit of the territorial sea and other coastal state zones, including the continuous zone, exclusive fishing zone and the exclusive economic zone are measured. Article 3 of the 1958 convention on the Territorial Sea and the Contiguous Zone (TSC) and the Article 5 of the 1982 United Nation's convention on the Law of the Sea specify that the normal baseline is the low water line along the coast as marked on official large scale charges. Straight baselines are straight lines connecting the outermost point on a skjærgaard. These were historically used by Norway as a baseline from the mid 19th century onwards and were opposed by the United Kingdom from the 1930 has been contrary to the International Law. This resulted in the Anglo-Norwegian Fisheries case in which the International Court of Justice has accepted the Norwegian straight baseline are consistent with international law and provided criteria for the legal definition. These criteria with some changes were later incorporated into TSC Article 4 and 1982 Convention Article 7.[25]

The criteria developed under the Anglo-Norwegian Fishery case, the TSC and the 1982 Convention are highly complicated, largely due to complicated physiographic formation of the region where the straight baselines are too be established, however in absolutely brief consideration. It explains;

i) 'deeply indented and cut into' as the expression indicating a coast similar to Finnmark. A quick look at the geographical area

[25] W. Michael Reisman and Gayl S. Westerman, 'Straight Baselines in International Maritime Boundary Delimitation', 1992, P. 32.

indicates the existence of fjords, base of substantial sites and smaller inlets all in the same area. TSC Article 4 and 1982 convention Article 7 permit the interpretation that a coastline with a singular deep indentation would suffice.[26]

ii) 'Coastlines localities' this term include small islands and reefs naturally connected with the adjacent land and rising above the surface of water, but not shoals perpetually covered by water. Though there may be some relevance in the argument that through the interchangeability of the terms coast could mean that a series of interconnecting lines between points from the actual interface of the terra firma and the hydrosphere ipso facto produces a coast which is indented and cut into, generally the distinction would appear to be insignificant.[27]

The ICJ ruling of the Anglo-Norwegian Fisheries case use the term 'skærgaard' or fringe of islands along the coasts in its immediate vicinity. The UN group of experts see two possibilities for fringing islands under TSC Article 4 (1) and 1982 Convention Article 7(1); Islands forming a unity with the main land and island some distance from the coast forming a screen which 'washes a large proportion of the coast from the sea and immediate vicinity is viewed as generally agreed to be a maximum of 24 miles and islands lying linearly perpendicular or at an acute angle to

[26] Churchill and Lowe, 'The Law of the Sea', 1988, P. 27.
[27] Ibid, Churchill and Lowe, 1988, P. 28

the coast are also excluded as not lying 'along' the coast'.[28] The sea area enclosed by the straight baseline should have close link between enclosed waters and land. From the ICJ's judgment, it seems that the linkages is to be similar to that used in the determination of the rules would suffice relating to the bays, liberally applied to coasts geographically as unusual as Norway', the mathematical ratio of water land is 3.5 : 1.[29]

The ICJ's decision where the conditions precedent of deep indentation on fringing islands are met and the method of straight baselines is applicable, economic interest peculiar to the region concerned may be taken into account. However, the economic interests alone do not justify the use of straight baseline, only the geographic criteria do; but provided the latter is satisfied economic factors in regions may be allowed to influence the way actual baselines are drawn.[30]

According to 1982 convention Article 10 an indentation along a coast shall not be regarded as a bay unless its waters are largely surrounded by land and its area is as large as, or larger then that of a semi circle whose diameter is a line drawn across the mouth of the indentation.[31]

In 1982 convention Article 46(a) defines an archipelagic state, the only type of a state permitted to draw archipelagic baselines to enclose archipelagic waters as one

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[28] op. cit, W. Michael Kisman & Gayl s. Westerman, 1992, P. 37.
[29] J. Ashley roach and Robert W. Smith, 'Excessive Maritime Claims, *International Law Studies,* 1994, P. 12.
[30] Michael Akehurst, 'A Modern Introduction to International Law', 6th Edition, 1992, P. 204.
[31] K.R. Simmonds, edt. 'New Directions in the Law of the Sea', 1995, P. 19.

composed entirely of islands, thus excluding continental states with archipelagic territories.[32]

INTERNATIONAL CONFLICT AND THEIR RESOLUTION IN ARCTIC

US-Canada:

The two big countries in the north are logger-heads with each other over a number of Law of Sea issues, including:

i) Breadth of territorial sea;

ii) Navigation through international straits;

iii) Creeping jurisdiction out into the Arctic Ocean;

iv) Freedom of the seas;

v) Fisheries conservation;

vi) Pollution Control, and

vii) Resource Development.

The implementation of 1976 Magnuson Fisheries and Conversation Act, 20 new international maritime boundaries were created for the US, negotiations to delimit their boundaries began soon after the MFCA came into force. The EEZ proclamation, and the potential for mineral resources. Many of these boundaries has re-emphasized the urgency of establishing mutually recognized boundaries.

Prior to the establishment of the US EEZ, Canada and the US were negotiating four boundaries. One in the Gulf of Marine (lying between New England

[32] R. Douglas Brubaker, 'The Legal Status of the Russian Baseline in the Arctic, *Ocean Development and International Law,* 1999, P. 198.

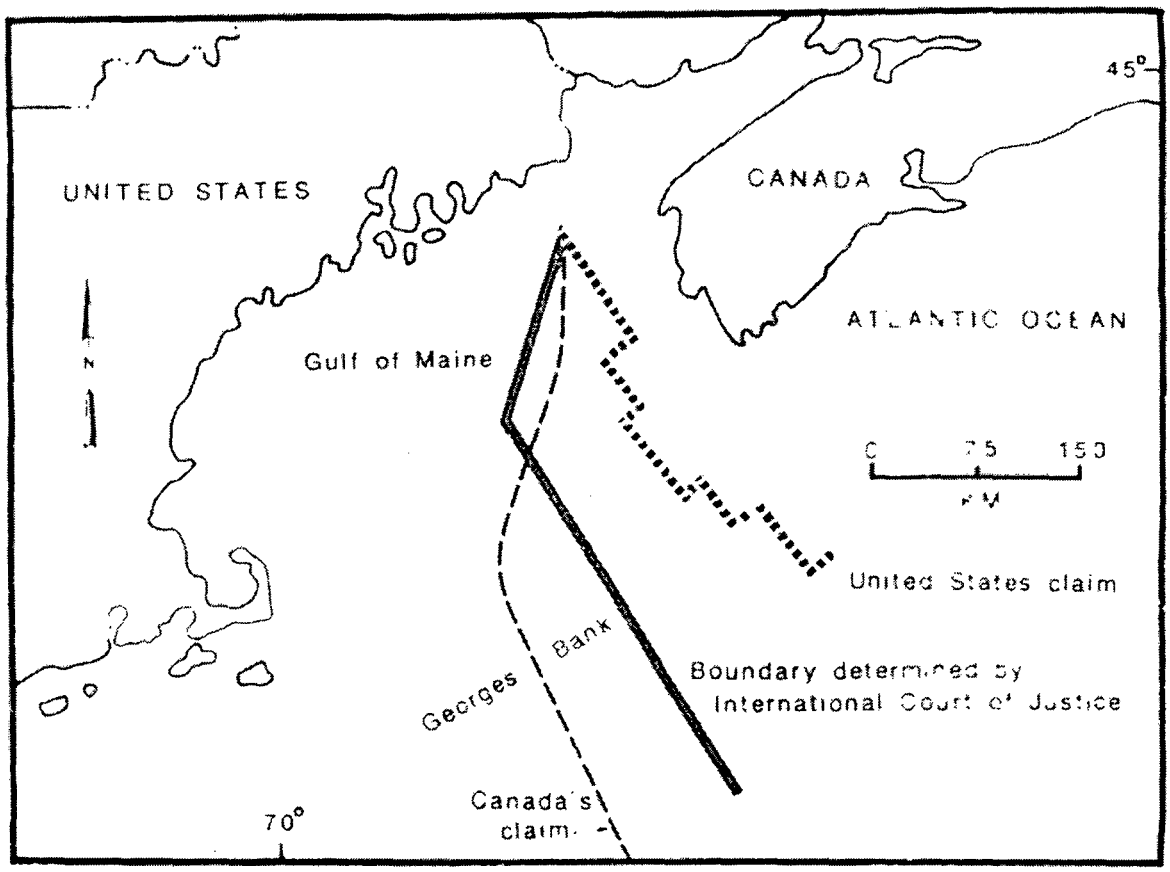
and Nova Scotia), was settled by the ICJ through binding arbitration (See Map – IX). When negotiation first began in 1975, the disputes focused upon delimiting the Gulf of Marine's continental shelf boundary. Like the U.S., Canada in 1977 also established a 200 nautical miles fishery zone. The two zones overlapped within the Georges Bank area, an important fishing ground. At about the same time, geologists were working enthusiastic about this region's offshore petroleum potential. Canada has actually began issuing exploration licences for Nova Scotian waters as early as 1964, and drillers had brought in small oil and gas wells of Sable Islands. Estimates in one US DOI study put the crude oil potential of the Georges Bank at about 200 million billion barrel and gas at about 139,000 million cubic meters.[33]

The oil and gas discoveries in the offshore of Nova Scotia and the USDOI petroleum potential estimates added fuel to the political fire coming from both Washington DC and Ottawa. After laborious negotiations, the two sides concluded a treaty to put the issue before the ICJ, which gave its judgment on 12 October 1984, with the area being divided about equally. By the time of ICJ decision, several dry exploratory wells along the US continental shelf have dampened the optimism of those who thought a petroleum bonanza might lie near New England shore. In hind sight based on the regions unproved petroleum potential, debate was overdrawn.[34]

Of the other US-Canada boundary dispute, only one concern an area with a major mineral resource potential, i.e. the Beaufort Sea, and area lying east of the US's

[33] V.E. Mekelvey, 'Subsea Mineral Resources, Chapter A of USGS Bulletin (1986), P. 17.
[34] J. Hondrich, 'Arctic Imperatie: Is Canada Loosing the North?' 1987, P. 60.

Map - IX: THE INTERNATIONAL COURT OF JUSTICE'S GULF OF MARINE BOUNDARY DETERMINATION.



(**Source:** H.R. Marshall, Jr. *'Disputed areas influence OCS leasing policy'*, 1985.)

giant Prudhoe Bay Petroleum field. Debate centres on the seaward extension of the US-Canada boundary at 141° west longitude, with US opting for a median line, whereas Canada insisted on a northward extension along the 141° west meridian (See Map – X). The locational difference of the two lines significant wedge of offshore waters with considerable potential for petroleum negotiations are still in progress.[35]

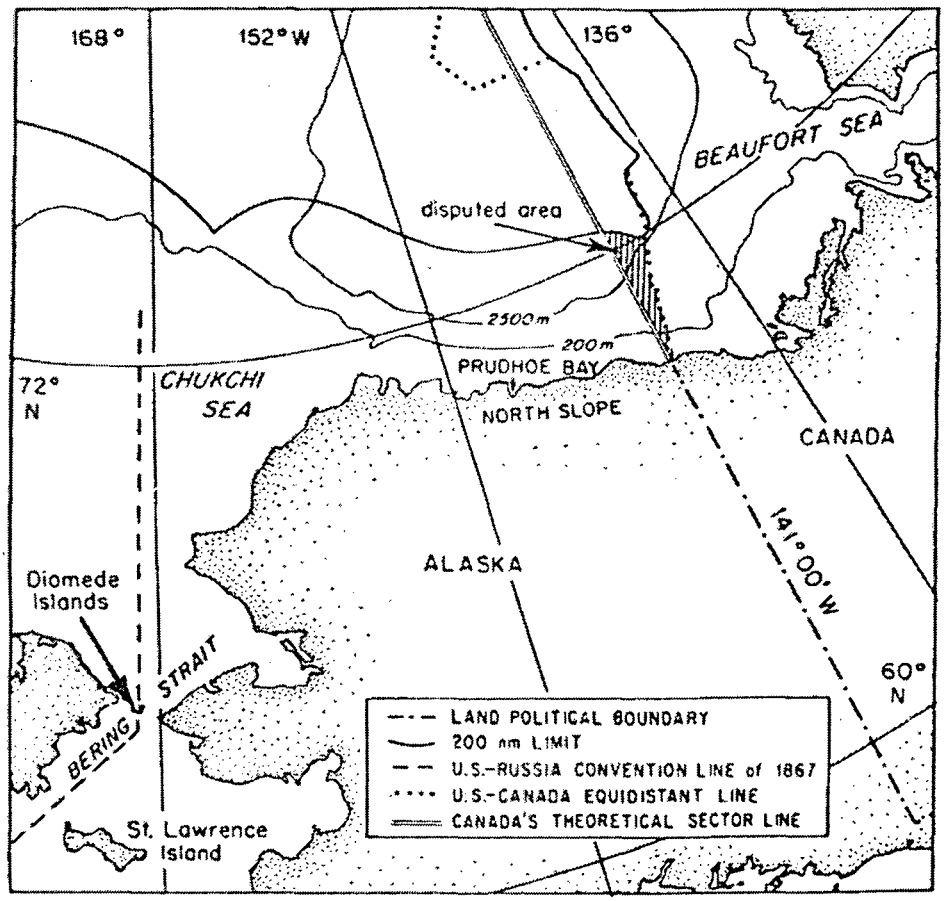
THE NORTHWEST PASSAGE CONTROVERSY AND ITS SETTLEMENT

In May 1985, officials in the United States Departments of State and Defence informed representatives from Canada Department of External Affairs that a United States coast Guard Vessel, the Polar Sea, would be traveling from Greenland to Alaska via the North West Passage (NWP), it was claimed to save the additional 20 to 30 days of travel time and 500,000 in fuel costs that would be required to travel from Greenland to the Beaufort Sea via the Panama Canal. Canada's initial reaction was to 'authorize' the Polar Sea's Voyage and to reiterate separately its claim over the waters of the Canadian Arctic archipelago, particularly in the NWP.[36] (See Map – XI)

Prime Minister Mulroney echoed a similar message shortly after the voyage completed: "That's ours, lock, stock and icebergs. That belongs to Canada and I have

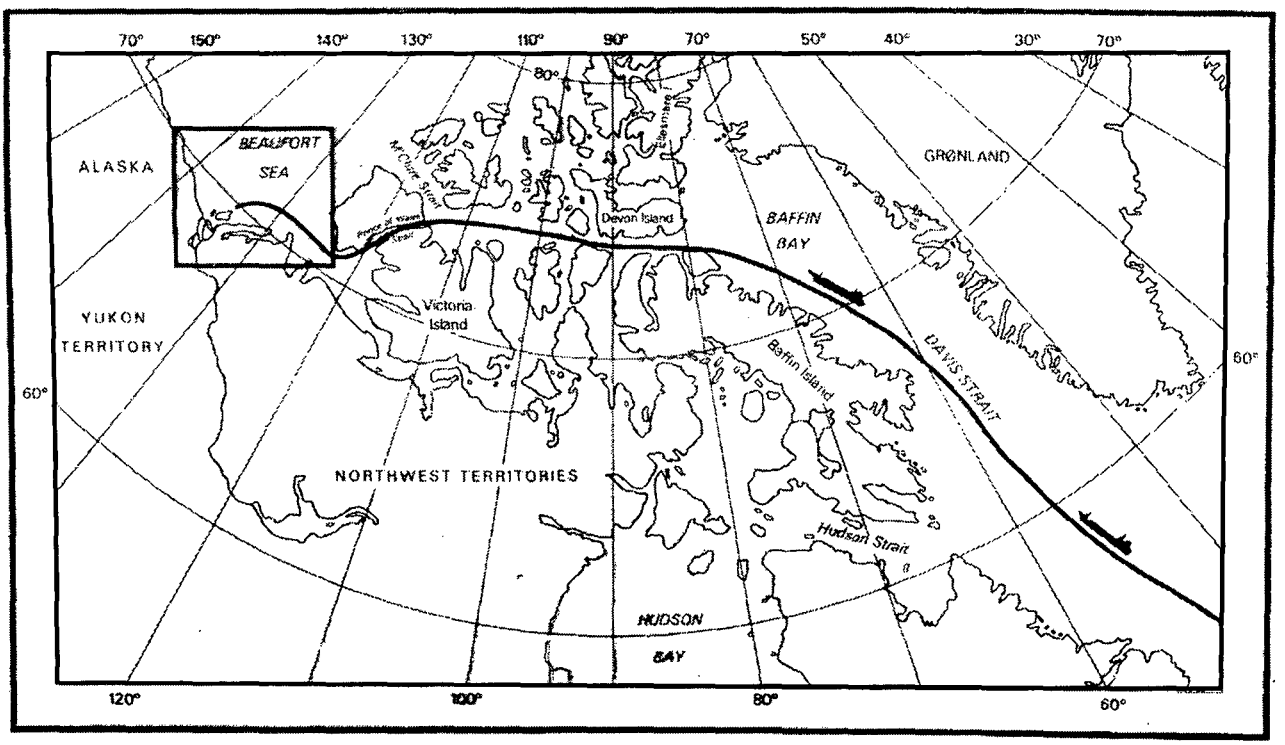
[35] op. cit, V.e. McKelvey, 1986, P. 19.
[36] David Leyton – Brown, 'Canada – US: towards a closer relationship, Canada Among Nations; 1985. The Conservative Agenda, 1985, P. 191.

Map - X: UNITED STATES - CANADA BEAUFORT SEA BOUNDAY DISPUTE.



(**Source:** R. Bowen and T. Hennesey, *'U.S. EEZ relations with Canada and Mexico'*, Oceanus, 1985.)

Map - XI: ROUTE NO. 1 OF THE NORTHWEST PASSAGE (via Prince of Wales Strait).



(**Source:** Pharand Donat, *'International Straits of the world - Northwest Passage'*, 1984.)

indicated that any suggestion to the contrary will be construed as an unfriendly act by the government of Canada".[37]

Over the summer, opposition parties, legal scholars, ardent nationalists, and Canadian society at large, all pressed for an effective response to this unwarranted American inclusion into 'Canadian Waters'. As a result of which the Mulroney government introduced on 10 September, 1985 a broad series of a legal, military, navigation and diplomatic measures designed to strengthen the Canadian position on northern waters.

The proposal included the establishment of straight baselines around the region, construction of a Polar icebreaker, an immediate increase in the number of military surveillance over flights in the Arctic by Amora long-range patrol aircraft, plans for Canadian naval exercises in the eastern Arctic in 1986, introduction and immediate adoption of legislation extending jurisdiction of Canadian laws to offshore areas claimed by Canada, and withdrawal of the April 1970 reservation to Canada's acceptance of the compulsory jurisdiction of the International Court of Justice.[38]

Negotiation between Ottawa and Washington began in 1985, the US stand in the course of bilateral discussion was that it no difficulty with the claim of Canadian ownership and control per se in Arctic, but it has reservations against the increasing Canadian claims to longer and larger slice of oceans and has the effect of turning international straits into territorial waters and therefore into areas over which adjacent countries can, in various legal ways, limit the transit of submarine and surface naval

[37] Christopher Kirkes, 'The Canadian American Bargaining Relationship in the North Explaining Interstate Bargaining outcomes, 1994, P. 236.

[38] op. cit, David Leyton – Brown, 1985, P. 192

fleets; and it was concerned that declaration of North-West Passage as territorial waters to create a precedence for closure elsewhere in the world.

The Canadian American Negotiations over the jurisdictional status of the NWP commenced in the autumn of 1985 and concluded in January 1988 with the signature of both parties to the Arctic Co-operation Agreement. The Negotiation process carried out in three distinct phases.

Phase one Canada pressed hard on US to accept Canadian's position of its claim over the North-West Passage. However, US refused to accept the Claim because it meant accepting full Canadian Control over the North-West Passage and would terminate US navigation rights through the passage under the international law and such an acceptance would also complicate maintenance of US's navigation right in other areas such as Indonesia and Aegean Sea. Ultimately the issue remained irresolvable.[39]

In the second phase of the negotiation of fresh impetus was provided by a personal meeting between Prime Minister Mulroney and President Reagan in Washington during March 1986. Till the end of discussion the differences could not be worked out.

In phase three president Reagan visited Ottawa in April 1987, during the discussion US was open to the concept of a simplified political arrangements for governing US's coast guard ice breaker transits through the NWP, but was not content with the prospect of requesting Canada's consent for each voyage; US feared

[39] D.L. Larson, 'Innocent Transit and Archipelagic Sea Laws Passage', *Ocean Development and International Law,* 1987, P. 413.

that such a procedural regime founded on the ideal of 'permission' would only strengthen the Canada's jurisdictional claim while weakening its own legal position. Finally, consent was reached over linking the transit of each ice breaker with a scientific research mission.[40]

By early December 1987 the 'transit per consent' agreement was completed. The agreement on Arctic Co-operation was signed in Ottawa on 11th January, 1988. As a result of that agreement, United States now acknowledged a legal obligation to seek Canada's permission before there is a transit through North-West Passage of government owned and operated ice breaker; the bargain process can be seen as mutually satisfactory to both parties.

The Canadian Politician was able to say that there will not be any more voyages in these areas without the consent of Canada and the future ice breaker passages would no longer be potentially embarrassing to the political health of ruling party in Ottawa. This point is confirmed by the fact that since the signing of the agreement in the January 1988, several US ice breakers have made a transit passage through NWP, virtually unnoticed by the Canada.[41]

The US managed to achieve its subjective by specifically linking the principal of consent to scientific ice breaker research mission for the mutual benefit of Canada and United States, the US retained access to the passage for its maritime purposes and simultaneously averted recognizing the NWP as Canadian internal waters.[42]

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[40] op. cit, David Leyton – Brown, 1985, P. 193.
[41] Christopher Kirkey, 'Smoothening Troubled Waters: The 1988 Canada – United States Arctic Co-operation Agreement', *International Journal,* 1995, P. 411.
[42] Ibid, Christopher Krikey, 1995, P. 143.

The Arctic Co-operation Agreement between the two countries is marked by the effects of symmetric interdependence between Canada and the US in short both countries were dependent upon the cooperation of the other for the fulfillment of their national interest.

The United States – Russian Boundary Disputes:

The boundary between United States and Russia in the Bering Sea between North-Eastern Siberia and Alaska was established by 1867, US-Russian Convention. This boundary passes through water, that, until the petroleum potential of the region was recognized, had an economic importance to the two states only for fishing.

The US and the Former Soviet Union were at odds over the convention line's exact position, because there were different methods of calculation. The US employed and arc of a great circle (a straight and shortest distance line on a globe), whereas the FSU used a rhomb line (a straight line on a Mercator's map). The difference in the method resulted in a lens shape disputed area.[43]

Since 1965 Oil and Gas has been discovered of the North Slope and also substantial reserves in the South and North Chukchi Basins, which lie astride the convention line of 168° 58' 22.587" West Longitude and above 72° Latitude. In addition United States Unilaterally proclaimed a 200 nautical mile exclusive economic zone in March 1983 and this zone extends North above 72° North Latitude from the Beaufort Sea to North Chukchi Basins.[44]

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[43] G. Blake, Maritime Boundaries and Ocean Resources, 1987, P. 70.
[44] op. cit, Christopher Kirkey, 1995, P. 51.

A preliminary agreement was reached in June 1990 after 9 years of negotiation between the United States and the Soviet Union. The essence of the agreement is that the 1867 line has been confirmed in its entire land with three special resource zone east of the line for the United States and one special resource zone west of the line for the Former Soviet Union.[45]

THE RUSSIAN NORWEGIAN MARITIME DISPUTE

The Svalbard Problem:

The discovery of coal in the early 20th century on Svalbard set the states for one present day dispute. In 1920, about 40 countries signed the treaty of Svalbard which awarded Norway sovereignty over Svalbard. The treaty lays down specified rights to which persons and companies in the contracting states are entitled. The most important of these is the right to engaged in certain type of economic activity on an equal putting with Norwegian companies. The Svalbard Treaty applies to the islands which lie between Longitudes 10° East and 35° East and Latitudes 74° North and 81° North.

Although all the parties to the treaty have a right to maintain permanent settlements and activity on Svalbard, only the Former Soviet Union has availed herself of the opportunity. In addition the FSU has from time to time seen fit to lodge objections to Norway's mode of exercising sovereignty over the archipelago.

[45] op. cit, G. Blake, 1987, P. 74.

Furthermore, with the sole exception of Denmark/Greenland the FSU was the only state with which Norway shared ocean boundaries of any sort that concern.[46]

Other zones in this area are the Svalbard zone i.e. 200 nautical miles fishery protection zone around Svalbard. By direct reference to the Svalbard treaty, Russia rejects the legality of these fisheries zones[47]

The Barents Sea Dispute: The issue of lack of delimited continental shelf boundary in the Barents Sea between Norway and FSU was first raised by Norway in 1967 but substantive talks did not begun before 1974. The point of departure of the negotiations was the delimitation of the continental shelf outside the Varanger Fjord in the Barents Sea, and further Northwards since then nine formal negotiating sessions have been held and numerous informal contacts exchanged but as yet no resolution is in sight.

Norway argues the shelf boundary follows the median line. Such a boundary would yield to Russia a Continental Shelf i.e. covered by about 3/5 of the disputed ocean expanse, and to Norway the remaining 2/5. The Barents Sea is about 1.4 million square kilometers, of this, the contested area constitutes about 11% or 155,000 square kilometers, which makes it larger then the entire Norwegian North Sea continental shelf.[48]

Russia argues that the median line rule is not compulsory as long as a boundary can be established by negotiations. In its reply Norway emphasized that the contours of the relevant section of the coastlines of both parties in the Barents Sea

[46] J.J. Holst, 'Norway's search for a Nordpolitik', *Foreign Affairs,* 1961, P. 65.
[47] T. Mathisen, Svalbard in the Changing Arctic, 1954, P. 38.
[48] David Scrivener, Gorbachev's Murmansk speech, 1988, P. 37

will produce a median line that will afford Norway no unreasonable and exceptional advantage. To this the FSU replied that the sector line has acquired the status of administrative custom in the Soviet Union and therefore, has psychological and political significance. Norway has declared itself ready to straighten the mathematical median line. Given a similar readiness on the part of the Former Soviet Union the Norway has also declare itself willing to search for a compromise on the entire issue of the boundary that will be independent of the two parties legal positions.[49]

On October 1 1987, FSU President Gorbachev gave a speech in Murmansk that addressed a number of Northern issues of concerned to several countries. This speech created expectations in Norway regarding the prospect of a final solution to the Barents Sea disputes.[50]

The then Soviet Prime Minister Ryzhkov visited Oslo in January 1988, and he proposed special economic zones which includes formation of a joint venture company with equal participation, and the joint activities were last as long as the resource lasted, the proposal was immediately rejected by the Norwegian government, this marked a clear reversal of Norway's attempts to arrive at a firm boundary and of the hopes to solve the Barents Sea conflict then.

Thereafter with the formation of Barents Euro Arctic Council, mostly with Norway's initiative in January 1993 in Kirkenes, Norway with its six members (namely: Denmark, Finland, Iceland, Sweden, Norway and Russian Federation) have

[49] Clive Archer, 'Arctic Co-operation: A Nordic Model, *Bulletin of Peace Proposal,* 1990, P. 169.
[50] Clive Archer, 'Western Responses to the Murmansk Initiative, 1989, P. 124.

opened the door to economic, scientific, environmental, educational, cultural and trade related co-operation in the region.[51]

[51] The Barents Euro Arctic Council (available at http://virtual.finland.fi/finfo/english/barents.html)

Norway-Iceland Conflict and the Jan Mayen Agreement:

Rich fishing grounds surrounding Jan Mayen have long attracted Seamen from both Norway and Iceland. Thus the two governments initial jurisdiction negotiation created on fisheries disputes. These were settled on 28 May, 1980 but after geologists began suggesting that petroleum resources might exist along the Jan Mayen Ridge that extends southward towards the Iceland the issue focused on the claim to continental shelf.

To resolve the issue the parties appointed a conciliation commission composed of Jens Evensens of Norway, Hans Anderson of Iceland and Elliot Richardson of the US. In May 1981 the commission suggested the establishment of a Joint Development Agreement. Norway and Iceland accepted the proposal in October 1981 and it took effect in June 1982.[52]

The Joint Development zone lies between 70° 35' and 68° North Latitude and 6° 30' and 10° 30' West Longitude and includes an area of about 32,750 km^2 on the Norwegian site and about 12,725 km^2 on the Icelandic side of Iceland's 200 – nmi EEZ boundary.

Under the final agreement the total participation by the two governments in the zones joint venture petroleum exploration all development contracts would be at least 50 percent. Norway gets 25 percent of the shelf resources on the Icelandic side of the 200-nmi EEZ boundary and Iceland receives a smaller portion from the

[52] Ø Noreng, 'the International Petroleum Game and Norway Delima', *Cooperation and Conflict,* 1982, P. 85.

Norwegian side. Iceland not only has its aerial-income advantage but also receives technical help from Norway and has its seismic costs paid by Norway.[53]

Some critics believe Norway has been two generous with the Iceland while other say that Iceland has supported Norway's claim to shelf areas surrounding Jan Mayen a position that helps strengthen Norway's bargaining position with Denmark in establishing a boundary between Jan Mayen and Greenland.[54]

These are just a few of the significant international conflicts that have emerged due to realization of the potential of the Arctic Region, particularly the Polar Oceans as the store house of future energy and living resources. The International Co-operation has led to complete settlement of a few and evasion of some, however as coveted resources are being located beyond the EEZs of the coastal states and in lieu of state of the art technology more and more conflicts are bound to occur. No international law regime would encompass complete solutions to these problems as the constantly changing factors of the technology and uses of resources makes them obsolete even before they are fruitfully applied to resolve an international conflict in its entirety.

[53] op. cit, Ø Noreng, 1982, P. 87.
[54] op. cit, J.J. Holst, 1981, P. 68.

CHAPTER V

CONCLUSION

"As the world population has grown and as are resource use systems have pushed more and more into the oceans, societies have been forced into a maritime proximity with others. The consequence has been oftentimes, a reaction to protect what one already holds or to take today what one fears may 'not be there tomorrow'. Such perceptions and relationships have led to waist to frustration, to conflict and to accommodation".

— **Robert Repetto** *'Handbook of Natural Resources and Energy Economics'.*

The quest for mineral and living resources have pushed our civilization to unknown and unproductive lands and sea, we now even look at the prospect of mining the moon and colonizing other inhabitable planets. The ever increasing significance of resources in the present day political and human systems have led to the projection that the next world war would not be based on ideological or other such differences but over the access of fundamental resources. The military warfare technology have advanced from territorial ambush types to air raids and submarine attacks; now the nations at logger heads over different issues target each other's satellites installed in space to handicap each other and we thought that space wars happened only in televisions and movies.

Man has this unique ability to transform their imagination into reality, with off-course substantial help from science and technology. We thought of flying, we built planes, we imagined going to the moon, we did. Fulfillment of human needs is yet another factor that pushed science and technology to makes nature succumb to our needs; we needed food we develop agriculture, we need more space to live we moved on from river valleys to mountains and deserts. We needed water, we dug wells, tube-wells and pump subsequently.

Human adaptability and scientific and technological advancement have made us think of the unthinkable and also make it come true for us. Extraction of natural gas and oil from under several hundred meters of ice at sub-zero temperatures of the poles is once such example. Our need and our greed both has pushed advanced civilization to far north, in order to extract its resources for the benefit of the mankind.

We are used to visualizing Arctic as an isolated region, far removed from the world. However, in reality the Arctic is increasing linked to, and threatened by, international political and economic events. Trouble in the Middle East today translates into renewed interest in Arctic oil, gas and mineral resources, particularly in Russia; where resource development driven mostly by security concerned is fast. There is a lot of money at stake, with little time for planned development, environmental protection or structural changes that protects the rights of the indigenous people of the Arctic.

Presently the international threat of terrorism also has echoes in the Arctic. For instance in the Arctic Russia and elsewhere the cold war legacy survives in the form of stored Nuclear, biological and chemical weapons, nuclear wastes and nuclear fuel. Besides, the threats posed on human life, also have a long term threat to environment.

It is concluded by archeologists and anthropologists that are ancestors in the north subsisted mostly on hunting of Caribou and other such animals. As the climates warmed and ice retreated, these herd of animals migrated northwards and human groups followed them. Those sturdy prehistoric human groups are perhaps today the indigenous population groups such as Eskimos in Canada, Inuits of Greenland, the Lapps and Saomis of Finland, Sweden and Norway and the Siberian Chukchi, Yakuts, etc.

These indigenous populations lived in harmony with the nature for hundred of years; hunting whales, seals, reindeers and other arctic animals and occasionally fishing in the arctic waters.

Till early nineteenth century the interest of the developed countries in the Arctic was largely for fishing since the fishery resources of the Arctic Oceans are amongst the richest in the world because of the high oxygen content of water, mixing of ocean currents brings in rich supply of phytoplanktons and other nutrients, enabling the existence of plentiful marine life. The predominant fishes taken include Salmon Capelin, Cod, Haddock, Herring, Pollock and several others.

Arctic ocean is distinct in a way that it harbours enormous variety of marine mammals including four species of whales, seven species of seals, and several species of walrus.

For several centuries whaling was common in the Arctic Ocean, Japan, Iceland, Norway, United Kingdom and Denmark have whaled extensively in the Arctic waters till the stock of Blue and other whales started dwindling. It was then, a ban was put on whaling in the Arctic as the stocks reached near extinction. In 1990 the International Whaling Commission prohibited whaling in the northern waters and reserved it for either the indigenous population or for scientific study.

Similarly the trend for fur in the international fashion market led to an unprecedented killing of Arctic animals such as Arctic Fox, Hare, Mink, Lemmings and Polar Bear. However, realization dawned and efforts were made to conserve these rare species, the Polar Bear Convention in 1973 was one such successful step in conserving the sharply diminishing Polar Bear population in the Arctic.

The most productive fishing areas in the Arctic are the Bering Sea, Barents Sea, Norwegian Sea and the waters around the Iceland. Earlier ocean wealth was free for exploitation for all, however, the international standards moved on from 3-12 nautical miles and then finally in the Third United Nation's Convention of the Law of the Sea 200-nmi exclusive economic zone parameter came into the picture. That settled whatever conflicts that have emerged over the conflicting claims of the coastal states and also justly preserved the rights of the landlocked countries on the ocean wealth. However, the issue of highly migratory and straddling stocks of fish became a

controversial question, with Canada's initiative it was resolved with the signing of United Nation Fishing Agreement in 2001.

It was the discovery of the hydrocarbons in the 1950s that made the Arctic region a hot bed of international Politics. It has been estimated that the Arctic Region contains somewhere between 200 billion barrels of recoverable oil and natural gas deposits of about 2000 cubic feet. In addition Northern Alaska's coal reserve may total four trillion tones, which is roughly equivalent of all coal reserves in the lower states, while Siberia may contain seven trillion tones of coal.

The magnitude of these resources is understated noting that all of OPECs oil reserves are about 440 billion barrels and all of the lower 49 states of US have about 492 million cubic feet of natural gas. The Prudhoe Bay fields on the North Slope of Alaska, contains about 9-10 billion barrels of recoverable oil and 26 trillion cubic feet of recoverable gas. In addition it is estimated that there may be 50 billion or more barrels of recoverable oils in the North American Arctic.

Including onshore and offshore fields in Alaska and Canada, principally in Beaufort Basin, the North and South Chukchi Basin, the Hope Basin and Norton Basin around Arctic Alaska, and the Mackenzie Delta and Bent Horn fields off Canada. Similarly Russia has strikec gold in most of Siberia, Norway has found enormous quantities of oil and gas in the sea.

In the Barents Sea oil has been located and holds great economic promise for the future. On the flip side the location of hydrocarbon and other minerals such as iron, zinc, nickel, tin, gold and copper in the Arctic region has led to claim and

counter claims of different state over the resource rich region. Luckily most boundary disputes have been able to resolve the problem amicably but some still remains as constant irritants to the concerned countries. For example the Jan Mayen Agreement resolved the boundary dispute between Iceland and Norway quite smoothly, however the Barents Sea region boundary dispute between Russia and Norway still remains owing to its rich mineral reserves. Most of it being oil and natural gas. The boundary dispute between U.S. and Canada, near the Beaufort Sea region have been somewhat resolved.

Considering the fact the polar route was the shortest one between the then two super-powers during the cold war era made it a strategic hub. A lot of military installation, surveillance and submarine warfare was deployed in the Arctic region. The end of cold war and the disintegration of Soviet Union reduced it considerably; however the strategic relevance is still not-completely over with. For example the fact that along the Bering strait only 4 miles separates Russia and United States, allows constant military exercise in the region.

Besides in the old Soviet Arctic and other such naval bases hundreds of submarines have their nuclear warhead tipped missiles and launchers removed. But the nuclear reactors inside these submarines remain. Many of these old submarines are sinking slowly, raising serious environmental risks from these reactors.

Norway, the United States and Russia initiated the Arctic Military Environmental Co-operative (AMEC) program to deal with such issues. To date the US has contributed US$ 25 million Norway has put in $ 9.9 million and Russia $ 6.5

million on several projects dealing with the spent nuclear fuel including the development of a storage cask.[1]

The North-West Passage controversy between Canada and US raised questions on the sovereignty of Canada on its archipelago and US vessel movements were seen as threats to Canada's National Security however, the 1988 Arctic Agreement between the two parties have led to a particularly satisfactory settlement between the two parties. Another issue which have considerable dimensions and is invariably linked with the economic development of the Arctic region is the issue of the rights of indigenous populations over their land and resources. When other cultures rush into the Arctic in search of oil, gas and minerals and established their strategic bases and radar sites, the traditional way of life suffered and deteriorated rapidly. At present several voluntary organizations and other unique transnational non-governmental organization such as the Inuit Circumpolar Conference (ICC) are working diligently to protect the rights of these people.

The breakthrough in struggle came with the 1971 Alaska Native Claim Settlement at: thereby involving the native population in the main stream development. Other such examples are the creation of a Nunavut Territory and its recognition by the Canadian government in 1999, something similar to the Greenland's Home Rule Act of 1979. It provided the Inuit Population a political and cultural identity. Consequent struggle and claims are also made by the native population living in the Arctic Russia and Scandinavia.

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[1] Mark Helmke, 'Arms Control and Environment: the Future', *WWF Arctic Bulletin,* 2002 P. 30.

Management of northern wildlife is done in sync with the advancement of Community Economic Development, by way of Wildlife Co-management in the Arctic and sub-arctic Russia and Canada has brought out sustainable development without disrupting the fragile ecosystem, thereby making economic progress and northern justice come together.

The environmental impact of human exploitation, have played havoc with the Arctic environment. This is a serious issue, because everyone knows it too well that the Arctic environment is inextricably linked with global climate and sea level. Unplanned economic activities have resulted in serious land degradation, forest depletion, breaking of food chains in the ecosystem thereby distorting the biodiversity of the land, marine and ice edge ecosystem in a severe way.

Besides this, the ozone depletion, increasing concentration of toxic elements in the arctic by way of chemical pollution, radio activity has posed a serious environmental threat not just to the arctic but to the entire planet itself. Universe itself is one big ecosystem and disharmony in one part would invariably affect the rest others.

Serious efforts were made by the eight Arctic rim states to address the environmental concerns of the Arctic region. The Arctic Environmental Protection Strategy (AEPS) in 1991 also called as the Rovaniemi process. The objective of AEPS is to protect the Arctic ecosystem, to provide for the protection, enhancement and restoration of natural resources, to recognize the cultural needs, values and practices

of the indigenous people, to review regularly the state of the arctic environment and to identify reduce and eliminate pollution.

AEPS established five different working groups each focusing on different areas namely – Arctic Monitoring and Assessment Program (AMAP), Protection of the Arctic Marine Environment (PAME), Emergency Prevention, Preparedness and Response (EPPR), Conservation of Arctic Flora and Fauna (CAFF), Sustainable Development and Utilization (SDU).

Considerable efforts have been made, not just by the arctic rim states but the entire world as it is realized that there is a dire need to co-operate in order to bring down the level of pollution in land, water and air, which in effect would reduce global warming. The failure of the Earth Summit last year seems to frustrate such efforts as the biggest contributors to the pollution refused to ratify the Kyoto Treaty.

One cannot cease all economic activities on the poles for the preservation of the wild life and restoration of normalcy to the native peoples lives, however a compromise could still be reached between the two. When people thought the gold, nickel and zinc was mined only from the Arctic the fisheries became important when the fish stocks started getting exhausted hydro carbons were located and now mining of seabed for poly metallic nodules in the Arctic or the development of adventure/ecotourism in the region and economically viable methods of tapping of ocean energies is likely to be developed in future.

Therefore, no stop-cork would be put on to stop the exploitation of the Arctic region, in fact exhaustion of one avenue of resource opens up another. What should

be realized is that with the development of technology and creation of new resources which one has never thought of before would materialize. There utilization would bring additional environmental pressures therefore the need is to plan economic development in such a way that it minimizes the impact. Since neither development could be stopped nor the environmental impact of economic development can be entirely fathomed.

The location of new resources would invariably create international conflicts and no international law can be forever binding in the face of ever changing technology. They would sooner or later be obsolete.

In the Arctic so far the conflicts generated have so far been successfully handled by diplomatic channels or by the laws established and ratified by the international community namely – The United Nations. What one should hope for, is that the conflicts over the resources in the Arctic region should not escalate in future, since the fragile Arctic will not be able to endure the military means of settlement of a dispute over the resources in the region.

SELECT BIBLIOGRPAHY:

Books:

- Rajeev P.V., *World Marches Towards 21st Century,* (Deep and Deep Publication, New Delhi, 1992).
- Heezen Bruce, *Ocean Floor: Commemorative Volume,* (Jolen Miley and Sons, London, 1982).
- Reinhold Nostrand Von, *Enclyclopedia of Marine Resources,* (NSF, Washington DC 1975).
- Voighonder W. Cycle, edt, *The State of World's Fisheries Resources: Proceedings of the world's Fisheries Congress Plenary Session.* (Search Publication, 1994).
- Tyler Nichlas and Meutin G. Vanee, *Arctic Wilderness: The 5th World Wilderness Congress,* (North American Press, Colorado, 1995).
- Schneider, S.H. and L.E. Mesirow, *'The Genesis Strategy: Climate and Global Survival* (New York: Planum, 1976).
- Seidel, S. and D. Keyes, *'Can we delay a Greenhouse warming? U.S. Environmental Practition Agency.* (Washington, D.C.: U.S. Government Printing Office, 1983).
- *Cambridge Encyclopedia of Earth Sciences* (Cambridge University of Press, 1981.)
- Willy Ley and the editors of Time-life books, *'Life Nature Library: The Poles'*, 1974-76.
- H.E. Johansen, O.P. Mathews and G Rudzitis (edt.) *'Mineral Resources Development: Geopolitics, Economies and Policy',* (Westview Press, Colarado, US, 1987).
- D.P.O. Connell, *'The International Law of the Sea'*, Vol. Oxford: Clanedom Press, 1984).
- T. Mathisen, *'Svalbard in the Changing Arctic'*, (Oslo: Cylendal Norsk Forlak, 1954).
- Archer Clive, *'International Organizations'*, George Allen and Unwin: London, 1983).
- K.R. Simmonds, *'New Directions in the Law of the Sea'*, (Oceana Publications, London 1995).

- Reisman Michale and Westerman S. Gavyl, '*Straight Baselines in International Maritime Boundary Delimitation*', (Macmillan Publication, 1992).
- Lowe and Churchill, '*The Law of the Sea*', (Manchester Univrsity Press, 1984).
- Akehmst Michael, '*A Modern Introduction to International Law*, 6th Edition, (Harper Collins Academic: London, 1992).
- Pharand Donat, '*International Straits of the world – North West Passage*', (Martinus Nijnoff Publisher, 1984).
- Phenand Donat, '*Canada's Arctic waters in International Law*', (Cambridge University Pres, Cambridge, 1998).
- Griffiths. F., edt, '*Politics of the Northwest Passage*', (McGrill-Queen's University Press, 1987).
- Kirkey Christopher, '*The Canadian-American Bargaining Relationship in the North: Exploring Interstate Bargaining Outcomes*', (Ann Arbor University, 1994).
- McClave's ,'*Standard Fishing Encyclopedia and International Angling wide*', (Holt Richards Winston Publication, 1965).
- Repette Robert, '*Living resources of the millennium 2000*' (Chennai-Loyola College, 1998).
- Wunns, Edward John, *'Race for the Pole'*, (Henry Holt and Company, New York, 1960).
- Harderich J., *'Arctic Imperative: Is Canada Losing the North?'*, (University of Toronto Press, Toronto, 1987).
- Kilwan, L.P., *'A History of Polar Exploration'*, (Penguin, Harmonds Worth, 1976).
- Mcghee R., *'The People of Arctic North America'*, (Methuch: London, 1974)
- Y. Human, *'Marine Geology and Oceanography of the Arctic Seas'*, (Springle – Verlag, New York, 1974).
- Laws, R.M., *'Seals and Whales of the Southern Oceans'*, (Philosophical transactions of the Royal Society: London, 1977).
- Dumond D.E., *'The Eskimos and the Aleuts'*, Thomas and Hudson: London, 1977.

- Armstrong Rogers, T. Kowley G., *'The Circumpolar North'*, (Methuen: London, 1978).
- Greve, T., *'Svalbard, Norway in the Arctic Ocean'*, (Grϕndahl: Oslo, 1975).
- Nemsen F., *'The Crossing of Greenland'*, (Longman Green Publication: London, 1920).
- Armstrong, T.E., Roberts, B and Swithen Bank. C.W.M. *'Illustrated Glossary of Snow and Ice'*, (Scott Plar Research Institute, Cambridge,1973).
- Orig S. (Editor), *'Climates of the Polar Regions' – World Survey of Climatology,* Vol. 14, (Elsevier, Amsterdam, 1970).
- Bliss, L.C. Cragg, J.B., Heal, D.W. and Moore, J.J. (editors), *'Tundra Ecosystems: A Comparative Analysis'*, (Cambridge University, Cambridge, 1981).
- French, H.M, *'The Peri-glacial Environment'*, Longman, London, 1976).
- Sharp T.A. *'Arctic Oil and Gas, problems and possibilities'*, (Mouten, Paris, 1975).
- *'Encyclopedia Americana International Edition'*, (Grolier Incorporated: US) 1983, Vol. – 1, 14, 23, 28, 32.
- *'Funk and Wagnells New Encyclopedia'*, 1982, Several Volumes.

Reports:

- Global Environment Outlook, *'United Nations Environment Programme'*, (Oxford University Press, 1997).
- Panel on the Law of Ocean uses, *'U.S. Interest and the United Nations Convention on the Law of the Sea'*, Ocean Development and International Law, Vol. 21, 1990, Pp. 373-410.
- Panel on the Law of Ocean Uses, *'Deep seabed Mining and the 1982 Convention on the Law of the Sea,* Council on Ocean Law, Washington, 25 September, 1987, Pp. 3-23.
- Council on ocean Law, *'The United States and the 1982 Law of the Sea Convention: A synopsis of the States of the Treaty in 1987'*, Washington DC, Oct 1987.
- USGS Bulletin on Subsea Mineral Resources chapter by V.E. Mckelvey, (Washington D.C., 1986).

- AAAS selected symposium, edt. By Many A Mchhinnie, *'Polar Research: Status and Prospectus'*, 1978.

Articles:

- Anderson R. Mark, and Drobot D. Sheldon, *'Spaceborn Microwave Remote Sensing of Arctic Sea Ice Deering Spring'*, Professional Geographer, Volume 52, Nuba 2, May 2000, Pp. 315-322.
- Weight J. Dawn, *'Getting to the Bottom of it, Tools, Techniques, and Discovery of Deep Ocean Geography'*, Professional Geographer, Vol. 5 1, Member 3, August 1999. Pp. 426-439.
- Brody, H. *'Industrial Impact in the Canadian North'*, Polar Record, Vol. 18, 1977, Pp. 333-339.
- Judd. D., *'Canada's Northern Policy: Retrospect and Prospect'*, Polar Record, Vol. 14, 1969, Pp. 593-602.
- Harrison, G.S., *'The Alaska Native Claims Settlement Act,* Arctic, vol. 25, No. 3, 1971, Pp. 232-233.
- Green Horse, T.A. and Leark, L., *'Alaska's North Slope Borough: Oil, Money and Eskimo Self-Government'*, Polar Record, Vol. 20, 1980, Pp. 19-29.
- Kemp, W.B., *'The flow of energy in a hunting society'*, scientific American, Vol. 224 No. 3, 1971, Pp. 104-115.
- Sudgen D.E., *'Glacial Erosion by the Laurentine Ice Sheet'*, Journal and Glaciology, Vol. 20, Number 83, 1978, Pp. 367-391.
- Week, W.F., *'Iceberg Water: An assessment Annals of Glaciology'*, 1980, Pp. 5-10.
- Mereer, J.H., *'West Antarctic Ice sheet in CO_2 Greenhouse effect: A threat of disaster Native,* Vol. 271, 1978, Pp. 321-325.
- Benson, C.S., *'The role of air pollution in Arctic Planning and development'*, Polar Record, Vol. 14, No. 93, 1969, Pp 783-790.
- Durban, M.J., *'Stability and Fragility in Arctic ecosystem'*, 'Arctic', Vol. 26, 1973, Pp. 179-185.
- Julian Woolfard, *'Russia Signs POPs Convention'*, WWF Arctic Bulletin, Vol. No. 302, May 2002, P. 7.

- Julian Woolfard, *'Toxics threaten Arctic'*, WWF Arctic Bulletin, Vol. No. 302,May 2002, P. 6
- Caldwell M. Brad, *'United Nations Fishing Agreement in Force 11 December 2001 – An Ineremental Step towards Enforcement On the High Seas'*, Fisherman Life Magazine, March, 2002.
- Huebert Rob, *'Canada and the Circumpolar World: Meeting the Challenges of Cooperation into the Twenty-First Century: A Critique of Chapter 4 – "Post-Cold war Cooperation in the Arctic: From Interstate conflict to new Agendas, for Security Omitted Arctic Security Issues'*, International Relations, Marks 2001.
- Lovins B.Amory and Lovins Hunter L., *'Fools' Gold in Alaska'*, Foreign Affairs, Vol. 80, No. 4, July-August 2001, Pp. 73-85.
- Qiunlan Mortin, *'The oil-price factor kichs In'*, Petroleum Economist, April, 1999, Pp. 27-30.
- Townsend David, *'Offshore Links'*, Petroleum Economist, October 2001, Pp. 18.
- Thomas Victoria, *'Heading for Compromise: US energy policy'*, Petroleum Economist, July 2001, P. 12
- Fellus Aune, *'North Slope Focus Shifts to Gas: Analyzed Alaska'*, Petroleum Economist, July 2001, Pp. 13-14.
- Brown Derek, *'Norway: a shift in Focus: World Gas'*, Petroleum Economist, May 2001, Pp. 5-6.
- Hueper F. P aid, *'The snϕhrit L NG project is on the h orizon'*, Petroleum Economist, November 2000, Pp. 18-20.
- Bandman K.M., *'Transport conidors and formation of a new economic Euro-Asian belt within Russia'*, Economies and Sociology, Vol. 1, 2001, Pp. 181-198.
- Kolemin V.M., *'A New Configuration of Russian Strategic Interest in the Arctic Region'*, Economies and S ociology, Vol. 2, 2001, Pp. 21-28.
- Gary Kafinas, *'Subsistence Hunting in a Global Economy: Contributions of Northern wildlife Co-Management to Community Economic Development'*, Newsletter for Community Economic Development (CED) Practitioners in Canada, Vol. 4, No. 3, August 1003.

- F.C.F. Eaurey, *'The geopolitics of Minerals'*, Focus, Vol. 31, No. 5, 1981, Pp. 1-16.
- Amfinn Jorgensen – Dahl, *'The Soviet – Norwegian, Monitrive Disputes in the Arctic: Law and Politics'*, 'Ocean Development and International Law, Vol. 21, 1990, Pp. 411-429.
- E.M. Borgese, *'The Law of the Sea'*, Scientific American, Vol. 248, No. 3 (1983) Pp 42-47.
- Arcchuctive, *'Arctic Cooperation: A Nordic Model'*, Bulletin of Peace Proposals', Vol. 21(2), 1990, Pp. 165-174.
- Archer Clive, *'Western Responses to the Mumansk Initiative'*, Centre for Defence Studies, Spring 1989. Osherenko Gail, *'Environmental Cooperation in the Arctic: Will the Soviet Participate?'*, International Environmental Affairs, Vol. 1, No. 3, 1989, Pp. 203-221.
- Merritt John, *Factors Influencing Canadian Interest in Greater Non-Military Cooperation in the Arctic'*, The Arctic Challenge, (Boulder and London: Western Press, 1988).
- Brubaker, Douglas R, *'The Legal Status of the Russian Baselines in the Arctic'*, Ocean Development and International Law, Vol. 30, 1999, Pp. 191-233.
- Roach Ashley J. and Smith W. Robert, *'Excessive Maritime Claims'*, International Law Studies, Vol. 66, 1994, Pp. 12-13.
- P. MeCartney Allen and Douglas W. Veltre *'Aluctian Island, Prehistory: Living in insular extremes'*, world Archaeology, Vol. 30(3) 1999, Pp. 503-515.
- Lamson C. and Vander Zwaag D.C. *'Arctic Waters: Needs and Options for Canadian American Cooperation'*, Ocean Development and International Law, Vol. 18, 1987, Pp. 54-52.
- Larson L. David, *'United Stats Interests in the Arctic Region'*, Ocean Development and International Law, Vol. 20, 1990, Pp. 167-191.
- Herriman Max and Tsanienyi Mertin, *'Ocean Energy and the Law of the Sea: The Need for a Protocol'*, Ocean Development and International Law, Vol. 29, 1998, Pp. 3-19.
- J.J. Holst, *'Norway's search for Nordpolitik'*, Foreign Affairs, Vo. 60, No. 1, 1981, Pp. 63-86.

- Larson D.L., *'Innocent, Transit and Archipelagic Sea Laws Passage'*, Ocean Development and International Law, Vol. 18, 1987, Pp. 411-444.
- Joyner C. Christopher, *'United States Legislation and Polar Oceans'*, Ocean Development and International Law, Vol. 29, 1998, Pp. 265-290.
- Pharanel D., *'Canada's Arctic Water in International Law'*, 1984, Pp. 311-314
- Miller D.H., *'Political Rights in the Arctic'*, Foreign Affair's, Vol. 4, October 1945, Pp. 47-60.
- Critchley W.H., *'Polar Deployment of Soviet Submarines'*, International Journal, Vol, 39, Autumn 1984, Pp. 828-865.
- Kirkey Christopher, *'Smoothing troubled waters: the 1988 Canada-United States Arctic Cooperation Agreement'*, International Journal, Spring, 1995, Pp. 400-426.
- Menon K.P.S., *'Oil and the Ocean'*, Contemporary Review, Vol. 19, Pp. 209-32.
- Johnson Michael, *'Sustainable Arctic Tourism is "SMART"*,' WWF Arctic Bulletin, No. 302, May 2002, Pp. 20-22.
- Odgaard Jonna, *'How Green is Greenland?'* WWF Arctic Bulletin. No. 302, Pp. 12-14.
- Norris Stefan, *'Protection Act for Svalbard'*, WWF Arctic Bulletin. No. 302, P. 15-17.
- Ptiul'ko V. Vladimir, *'Ancient Humans in Eurasian Arctic Ecosystem: Environmental Dynamics and Changing subsistence'*, World Archaeology, Vol. 30, 1999, Pp. 421-436.
- Pital'ko V. Vladimir and Kasparov, A.K., *'Ancient Arctic Hunters. Material Culture and Survival Strategic'*, Arctic Anthropology, Vol. 33(1), 1996, Pp. 1-31.
- Renouf M.A., *'Northern Coastal Hunters, Fishers: An Archeological Model'*, 'World Archaeology, Vol. 16(1) 1984, Pp. 18-27.
- Klare T. Michael, *'Resource Competition and World Politics in the Twenty First Century'*, Current History, December 2000, Pp. 403-412.

Websites:

- www.artigas.com
- www.usatoday.com
- www.vecopolar.com
- www.dartmouth.edu
- www.northpole4kids
- ths.sps.lane.edu/biomes
- www.santaline.com
- www.neti.no
- www.outokumpo.com
- www.arcticpublications.com
- www.nri.umn.edu
- www.academicmilinfo.net
- www.seaworld.org
- www.ubii.org
- www.arctic.noaa.gove
- www.uarctic.org
- www.anwr.org
- www.exporenorth.com
- www.alaskawild.org
- www.arcticdevelopment.com
- www.mines.uidaho.edu
- www.environmental-law.org
- www.unclos.com
- www.arcticcircle.com
- www.wwf.com
- www.caff.com
- www.caec.org
- nunahet.com

- public.i.org
- arcticcirucl.comm.edu
- gatesofthearctic.ereaparts.com
- roat.dk
- biology.usgs.gov
- infopleax.com
- nationalgeographic.com
- abcteach.com
- arcticconnection.com
- maps.guide.no
- interknowledge.com
- edtechkennesaw.edu
- artigas.co
- usatoday.com
- vecopolar.com
- dartmouth.com
- northpole4kids.com
- ths.sps.lane.edu
- santaline.com
- neti.no
- ontokumpu.com
- neti.no
- arcticpublications.com
- nrri.umn.edu
- academicmiceinfo.net
- seaworld.org
- dartmouth.edu
- ubill.org
- arctic.noaa.gov

- answer.org
- explorenorth.com
- alalskawild.org
- arctic.dev.org
- nuies.uidho.edu
- environmental-law.org
- instaar-colorado.edu
- arcticodyssey.com
- dls.educationalworld.com
- cspace.nub.ca
- arcticexplorer.com
- pennyhill.com
- edu-index.com