OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE **2692/RB**

GEOGRAPHY B

Issues in Sustainable Development

RESOURCE BOOKLET

JUNE 2008

This booklet is available for use by candidates not earlier than six weeks before the examination.
It can be taken into the examination but must not be annotated in any way.

CUP/T52694

INSTRUCTIONS TO CANDIDATES

Candidates are reminded that this synoptic unit requires you to draw upon your knowledge and understanding of the relevant physical and human processes you have studied and the connections between different aspects of geography represented in your course. You will also be required to show a knowledge and understanding of the content of Module 2692 (Issues in Sustainable Development).

The issue:

Sustainable Issues in the Polar Regions

CONTENTS

This booklet is divided into five sections as listed below. It provides a range of information relevant to the selected issue that demonstrates the different points of view and development pressures relating to Polar Regions including environmental, social and economic issues. It examines alternative strategies for protecting Polar Environments.

Section A: The Polar Regions 2

Section B: Why are the Polar Regions important? 13

Section C: What are the threats to the Polar Environment? 16

Section D: What strategies exist to protect Polar Environments? 28

A guide to using the resource booklet during the study period 33

This document consists of **34** printed pages and **2** blank pages.

  [Turn over

SECTION A: THE POLAR REGIONS

Resource 1

The North and South Poles are often called 'The ends of the Earth': mysterious, challenging and inaccessible to many, yet holding a fascination for most and still relatively unexplored, they represent the last great wilderness areas on this planet. The main difference between them is that the Arctic is largely an ice-covered ocean, with thousands of large and small islands, surrounded by the huge continents of North America and Eurasia. Antarctica is a continent in its own right, surrounded by the Southern Ocean. It is a remnant plate broken off from the original Gondwana continent, which was once covered by thick vegetation in the Cretaceous period. Then about 35 million years ago the Antarctic ice sheet began to form as the pattern of ocean currents was established, and the circumpolar oceanic current reinforced the continent's isolated position around the South Pole.

Climatically the two regions are similar. They are very cold. The bitter winds often blow fiercely. The coldest temperatures ever recorded on Earth were in Antarctica. In the Arctic, the average winter temperature is –30°C. Precipitation is surprisingly low. The Antarctic receives only a few centimetres of new snow each year, yet most of the land lies beneath ice and snow almost two kilometres thick. The interior of the continent is, in fact, a cold desert almost devoid of life except for a few lichens and mosses that cling to rocks. It has high mountains and glaciers. In winter, the sea surrounding Antarctica freezes into solid pack-ice that covers an area almost as big as the continent itself.

By contrast, the Arctic lands can support the growth of a greater variety of plants as its summers are warmer than the Antarctic. The tundra regions are swampy plains with a range of low-growing plants, often very colourful during the short flowering season. There is plentiful reindeer moss growing above the permafrost which ensures a constant source of water as the frozen subsoil prevents water from draining away.

Antarctica is over 58 times the size of the United Kingdom. The icecap contains almost 70% of the World's fresh water and 90% of the World's ice. The winter icepack changes seasonally, and at warmer times icebergs break off the edges of the ice shelves. It was uninhabited until the establishment of research stations during the last century, and now scientists from over 27 countries work there to pursue the understanding of topics such as climate change and the workings of polar ecosystems.

Resource 2

Climatic Data for Qaanaq (Thule) Greenland, Lat. 77.5°N, Long. 69.3°W

Month	Temperature °C				Relative humidity %		Average Precipitation (mm)	Wet Days (+0.25 mm)
	Average		*Record*					
	Min.	*Max.*	*Min.*	*Max.*	*am*	*pm*		
Jan.	-27	-17	-38	2	76	76	3	0
Feb.	-29	-20	-41	2	76	76	3	0
March	-28	-19	-39	1	75	73	3	0
April	-23	-13	-32	3	88	71	3	0
May	-9	-2	-22	7	77	74	3	0
June	-1	5	-6	15	81	78	5	1
July	2	8	-2	15	84	80	13	2
Aug.	1	6	-4	14	77	71	13	2
Sept.	-6	1	-14	7	80	76	10	1
Oct.	-13	-5	-24	10	80	78	3	0
Nov.	-19	-11	-33	3	79	81	3	0
Dec.	-27	-18	-38	2	75	76	5	0

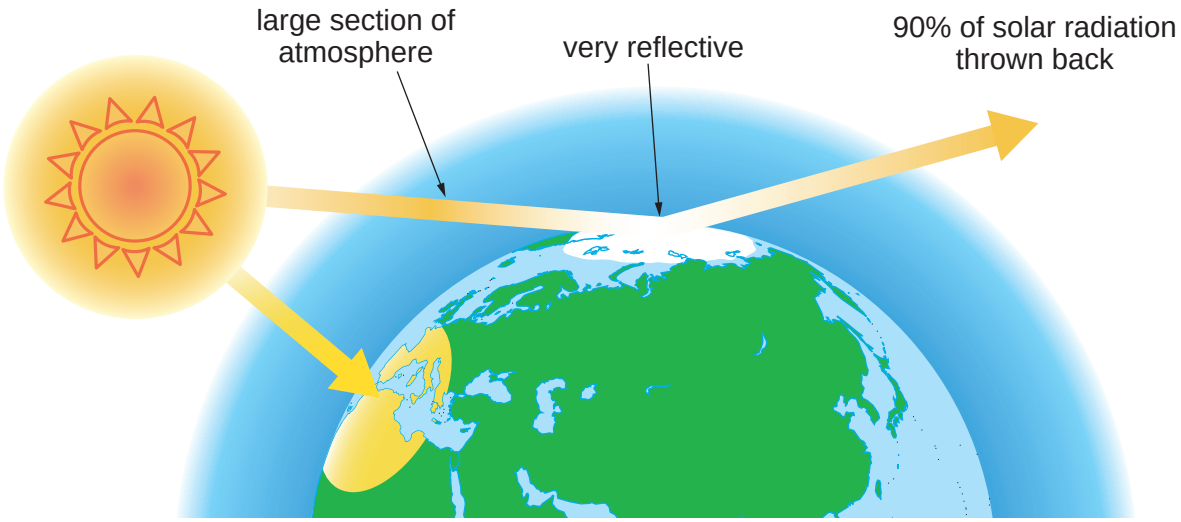
Resource 3

How does the climate work at the Poles?

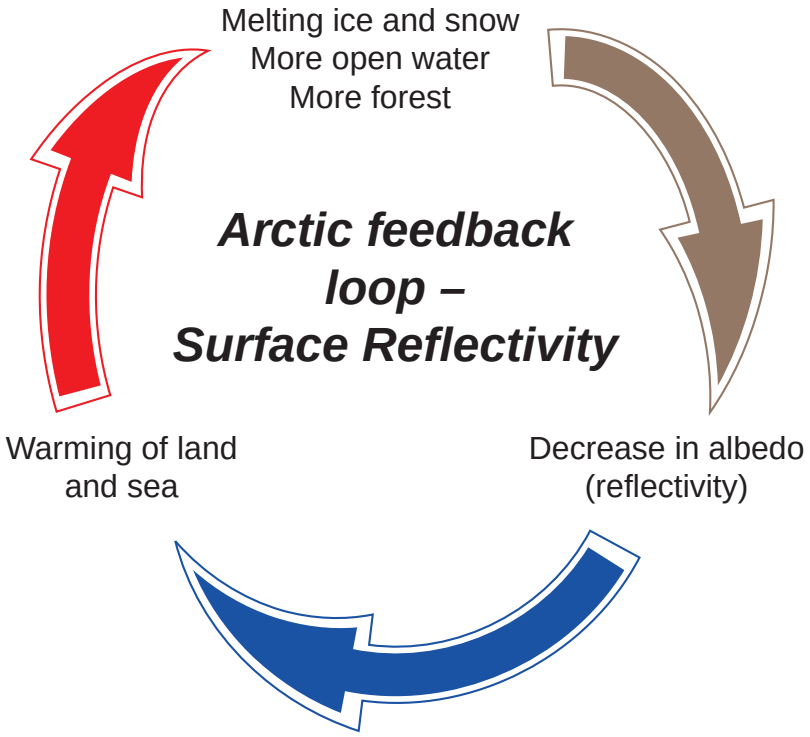
The Polar regions are the areas of the Earth where insolation is the lowest due to the angle of the Earth's axis. In darkness for three months of the year, the long hours of daylight in the summer still do not allow for great rises in temperature because of the dual effects of the low angle of incidence of the sun's rays and the albedo effect.

Resource 4

Insolation



Resource 5



[Turn over

Resource 6

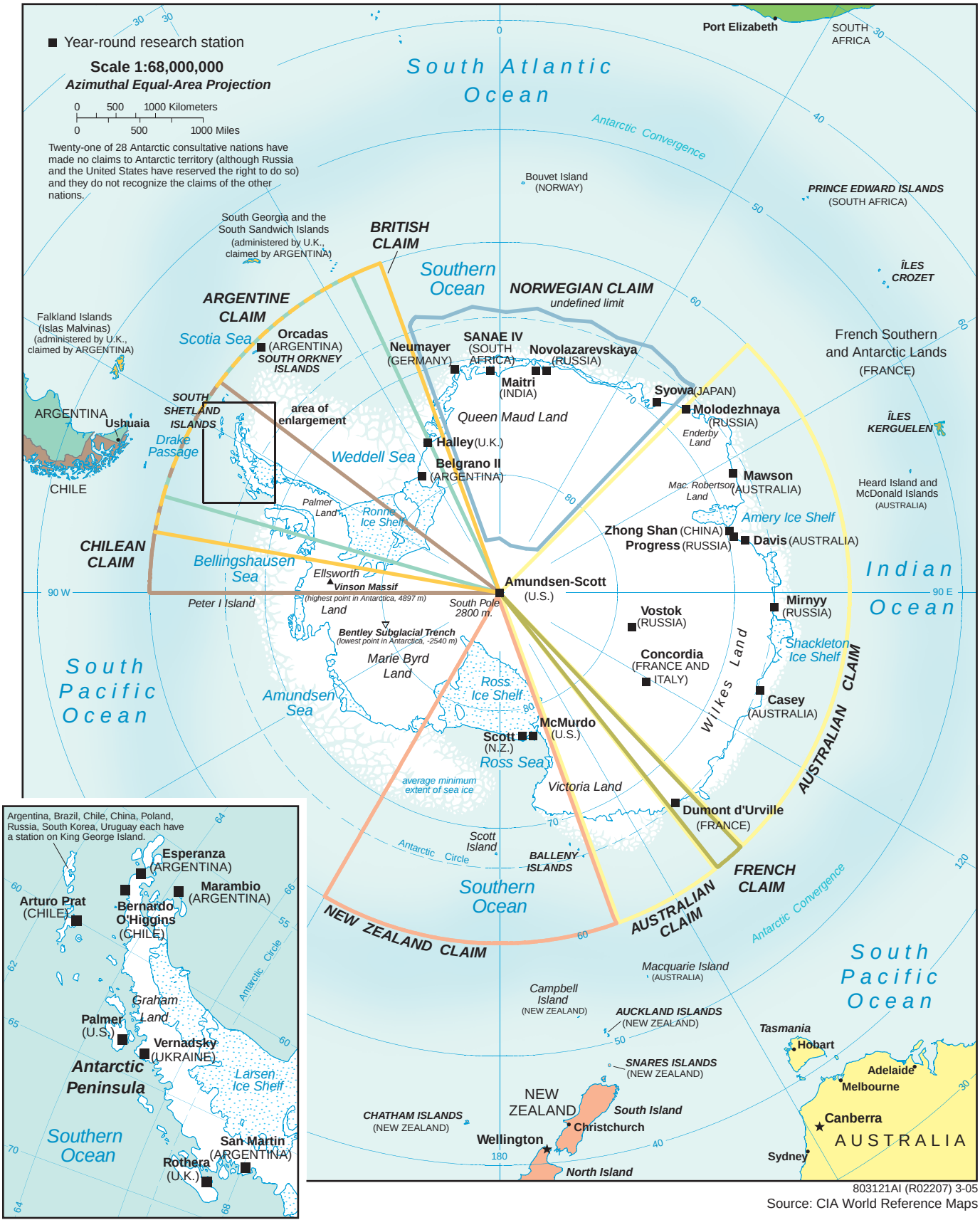
ARCTIC REGION

802916AI (R02112) 6-02

Source: CIA World Reference Maps

Resource 7

ANTARCTIC REGION



803121AI (R02207) 3-05

Source: CIA World Reference Maps

[Turn over

Resource 8

What is Antarctica's climate like?

Except for the Antarctic Peninsula, which extends much further north than the rest of the continent, there is no part of the Antarctic which has a mean temperature above 0 °C in any month of the year. To no great surprise, the lowest temperature ever recorded on earth was in Antarctica, at the Russian station at Vostok in July 1983, when the thermometer recorded minus 89.6 °C . At this temperature steel will shatter and water will explode into ice crystals. At the South Pole winter temperatures average around minus 57 °C. Remember too that temperatures decrease with altitude as well as with latitude. Much of Antarctica has very high average altitude of 2300m, which is an additional reason for its being so cold.

Although Antarctica has more fresh water than any other continent, it also receives the least precipitation. The mean annual equivalent of only 5 cm of rainfall, lower than the precipitation in many desert areas, descends each year as snow or ice crystals. When it does snow in Antarctica, and if there are also strong winds, then the most ferocious conditions prevail – blizzards.

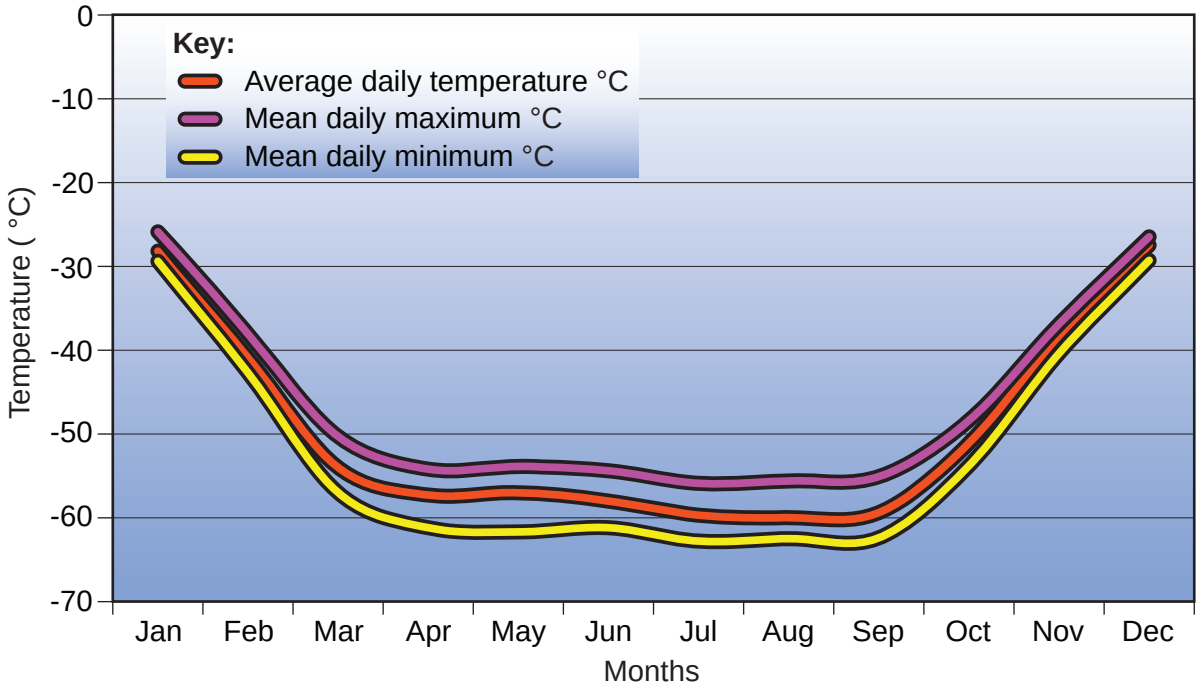
A severe blizzard may last for a week at a time with visibility reduced to a few metres and winds blasting at over 180 kph. While blizzards may carry freshly fallen snow they are more frequently composed of drift snow that is picked up by the violent winds. Eight or ten blizzards a year are not uncommon to coastal areas, and they bring any human outdoor activity to a standstill. Blizzards often cause severe damage to buildings and can bury structures under many feet of drift snow.

High winds combined with low temperatures make Antarctica an inhospitable place for humans, and it is the windiest continent on earth. Very strong winds can blow throughout the year, sometimes reaching speeds of about 320 km per hour. Antarctica's coastal areas are often the windiest because of the cold dense air that flows down off the ice-cap under the influence of gravity. These extremely regular and very strong winds are known as Katabatic Winds and their speed and direction is controlled by the shape of the icecap.

The air in Antarctica is extremely dry. The low temperatures result in a very low absolute humidity, which means that dry skin and cracked lips are a continual problem for scientists and expeditioners working in the field. The extreme cold also means large quantities of water vapour are lost from the lungs, making it necessary to drink frequently to replace the lost fluid. The low absolute humidity also rapidly dries out building timber, contributing to a very high fire risk on Antarctic research stations.

Resource 9

South Pole: average monthly temperatures (1957-88)



Resource 10

How does the climate in the Arctic compare with the Antarctic?

Though generally cold, the weather in Svalbard is actually milder than comparable places at the same latitude in the Arctic or the Antarctic. The average temperature over a year is only –4°C. Average temperature for January is –16°C, and in July it is +6°C The northern arm of the Gulf Stream reaches the west coast of Svalbard. This brings a massive movement of relatively warm water and warm air from the south to the region. At the same time this often creates sharp gradients in temperature, which lead to high wind speeds and rapidly changing weather. Fog is quite common during the summer, since the land is often substantially cooler than the surrounding seas. Though the relative humidity at such times can be high, the air this far north is generally so cold that it can hold very little moisture. This leads to very little precipitation falling in these regions. Large parts of Svalbard can therefore be described as being "arctic desert".

Longyearbyen has midnight sun from April 20th to August 23rd. The sun here is under the horizon from October 26th to February 16th. Since the sun's rays curve through the atmosphere, the time with midnight sun is somewhat longer than the time of darkness. Since sunlight is reflected in the sky, it isn't actually all that dark until the sun is more than 6° under the horizon. The real "Polar Night" (i.e. 24 hours of complete darkness) is therefore only experienced in Longyearbyen between November 14th and January 29th.

What is life like here?

The tundra lands of the Arctic region can be inhabited because of its milder conditions than the Antarctic. Even so, it is still an inhospitable environment. Traditionally societies such as the Inuit in North America, the Sami in Norway and the Nenet in Siberia have survived on a largely subsistence basis. The discovery of oil, particularly in Alaska, has led to the rapid development of towns to house the workers and families of those employed in the industry.

Resource 11

Climate Statistics Svalbard

Month	Average Sunlight (hours)	Temperature (°C)				Relative humidity %	Average Precipitation (mm)	Wet Days (+0.25 mm)
		Average		Record				
		Min.	Max.	Min.	Max.			
Jan.	0	-13	-7	-31	5	83	26	13
Feb.	0	-14	-7	-31	4	82	25	12
March	2	-15	-9	-33	4	83	24	12
April	8	-12	-5	-30	6	81	15	10
May	8	-5	-1	-19	13	81	20	10
June	6	1	4	-6	13	85	19	9
July	5	4	7	-1	16	88	25	11
Aug.	4	3	6	-2	13	87	40	14
Sept.	2	0	3	-9	12	83	36	14
Oct.	1	-5	-1	-16	8	81	39	13
Nov.	0	-8	-3	-27	6	82	37	14
Dec.	0	-10	-6	-27	6	82	31	14

Source: BBC Weather

[Turn over

Resource 12

People in the Polar Regions

It's Getting Crowded Up Here!

There are now approximately 4 million people living permanently in the Arctic, with the vast majority of them having come to the area as populations expanded elsewhere, access and communications were improved, and natural resources were exploited.

Discoveries of oil, minerals, and diamonds in the North, and a growing interest in Arctic tourism and ecotourism are bringing many non-indigenous people to the Arctic to both visit and live.

Indigenous populations now range from about 80% in Greenland 50% in Canada, 20% in Alaska, 15% in Arctic Norway and as little as 3-4% in Arctic Russia.

PICTURE: Qaanaaq, Greenland
(www.arthropolis.com)

In contrast, Antarctica has no indigenous populations. The permanent human population of the Arctic – about 4,000,000. The Antarctic – 0.

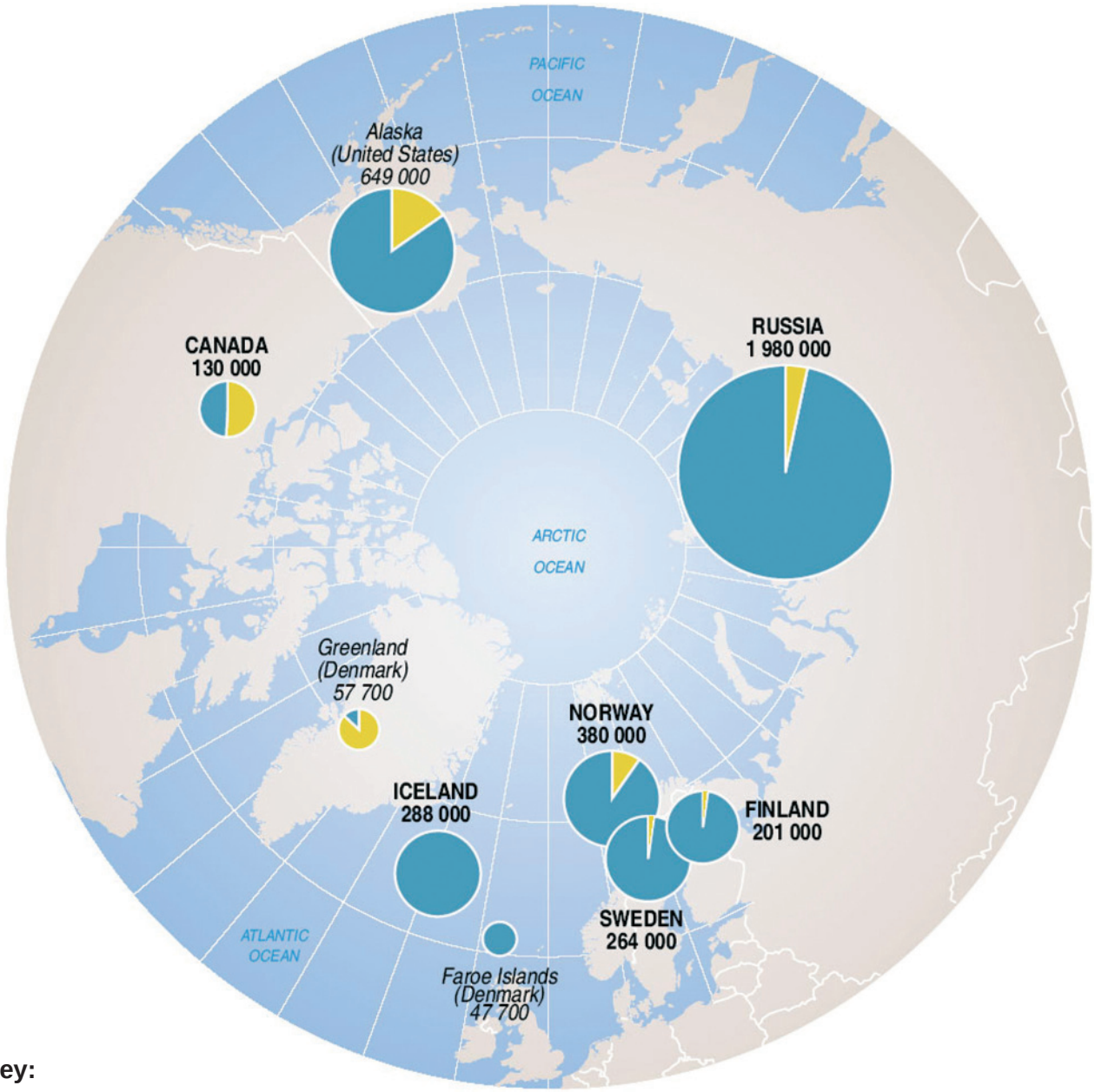
Resource 13

Indigenous peoples in the Arctic

The map on the right shows some of the indigenous peoples of the Arctic. Although there are not many people in total, they have very distinct languages, cultures and customs.

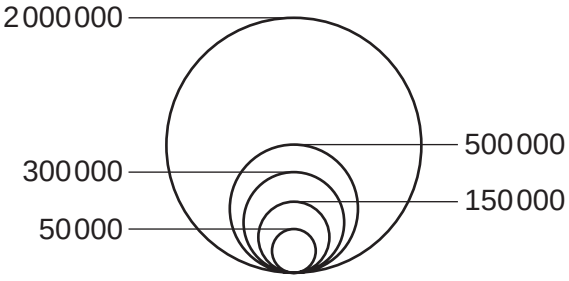
Resource 14

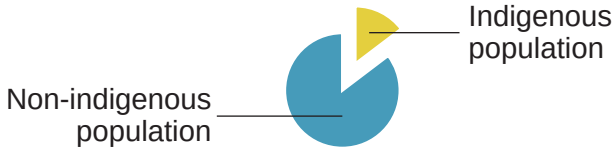
Population of the Arctic



Key:

Number of inhabitants





NB: Figures show the number of inhabitants in the Arctic Human Development report, of each country

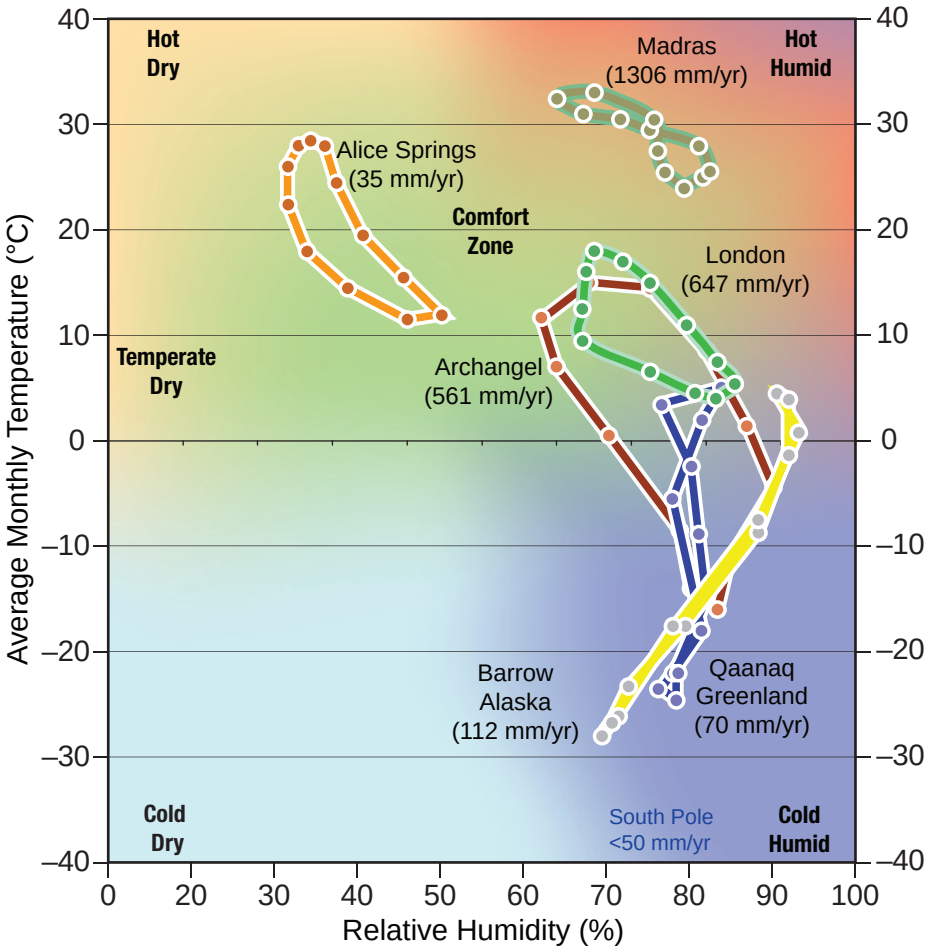
Source: www.vitalgraphics.net

[Turn over

Resource 15

Outside the Comfort Zone…

This resource shows graphs of mean relative humidity against mean monthly temperature for a number of inhabited places in the polar regions and elsewhere. Each dot on each graph represents the average values for a month (in order). The mean annual precipitation is shown for each place in brackets. The places in the polar regions lie outside the comfort zone for human activity outside apart from a very small part of the year. Only the South Pole will not fit on the graph: the temperatures are so low and consequently the atmosphere can hold very little water.



Resource 16

How do Indigenous people live in Polar Regions?

The Nenet people of Siberia are nomadic reindeer herders, living in tepee-like shelters of reindeer skin, eating reindeer meat and using them as pack animals to pull their sleds. The animals also provide the Nenet with clothing. Reindeer graze on the moss, lichen and grasses, foraging beneath the snow during the winter, and fattening on the rapidly growing vegetation during the few short months of summer. Other animals will be hunted for their pelts.

The Sami lived in a similar fashion in northern Scandinavia, and have suffered a degree of persecution over the centuries. Few now live the traditional lifestyle of herding, hunting and fishing, as is the case with the Inuit peoples of North America and Greenland. Proximity to westernised lifestyles, and the invasion of the oil and gas companies has led to rapid loss of tradition.

In the case of the Nenet, the Russian national gas company, Gazprom, is drilling and building pipelines and railway lines across the Yamal peninsula. The fragile ecosystem, in a land where a single vehicle's tracks or discarded tin can might remain for decades, has been disrupted. Grazing areas have been seriously damaged. The River Ob is polluted. Debris cuts into the deer's hooves, causing often fatal infections.

Resource 17

How did the Inuit people traditionally live?

Inuit is a general term for a group of culturally similar indigenous peoples inhabiting the Arctic coasts of Siberia, Alaska, the Northwest Territories, Nunavut, Quebec, Labrador, and Greenland. Until fairly recent times, there has been a remarkable homogeneity in the culture throughout this area, which traditionally relied on fish, sea mammals, and land animals for food, heat, light, clothing, tools, and shelter. Their language is Inuktitut.

The Inuit were traditionally hunters and fishermen, living off the Arctic animal life. They hunted by preference whales, walruses, caribou and seals, although polar bears, musk oxen, birds, and any other edible animal might be turned to during lean years. The Arctic has very little edible vegetation, although Inuit did supplement their diet with seaweed.

Sea animals were hunted from single-passenger, covered seal-skin boats called qajait which were extraordinarily buoyant, and could easily be righted by a seated person, even if completely overturned. Because of this property, the Inuit design was copied—along with the Inuit word—by Europeans who still make and use them under the name kayak. Inuit also made larger, open boats out of skins and bones for transporting people, goods and dogs.

In the winter, Inuit would hunt sea mammals by finding or making a breathing hole in the ice and waiting for the air-breathing seals and walruses to use them when they needed air. According to Inuit tradition, they learned to do this by observing the polar bear, who hunts by seeking out holes in the ice and waiting nearby.

On land, the Inuit used dog sleds for transportation. The husky dog breed comes from Inuit breeding of dogs for transportation. They used landmarks to navigate: where natural landmarks were insufficient, the Inuit would erect stone cairns or other markers to compensate.

Inuit industry relied almost exclusively on animal hides and bones, although some tools were also made out of worked stones, particularly the readily-worked soapstone. Walrus ivory was a particularly essential material, used to make knives. Some Inuit who lived near the tree-line also had native woodworking traditions.

Inuit made clothes and footwear from animal skins, sewn together using needles made from animal bones and threads made from other animal products.

Inuit lived in temporary shelters made from snow in winter (known as igloos), and during the few months of the year when temperatures were above freezing, they lived in tents made of animal skins and bones.

The division of labour in traditional society had a strong gender component. The men were traditionally hunters and fishermen. The women took care of the children, cleaned huts, sewed and cooked. However, there are numerous examples of women who learned to hunt out of necessity and more recently as a personal choice.

There was a larger notion of community, generally several families who shared a place where they wintered. Goods were shared within a household and, to a lesser extent, within a whole community in winter. As with most nomadic people, there was no real conception of ownership of land – if a spot was unoccupied, all were free to hunt or camp there. Animals belonged first to the hunter or trapper, then to his household.

Resource 18

Research in Antarctica

Antarctica is so inhospitable that there are no indigenous peoples. However, since the early years of the 20th century, research bases have been established and now number 57 from 28 different nations. Some are permanently occupied, others are occupied during the summer months only.

In Antarctica, researchers live in specially constructed bases, relying on supplies arriving twice a year by ship. The British Antarctic Survey (BAS) at their Halley Research Station generates its own electricity, uses satellite links for communication, and has a range of buildings constructed on platforms.

[Turn over

Resource 19

Halley Research Station

Position: Latitude 75°35' S, Longitude 26°39' W, Brunt Ice Shelf, Coats Land.

Chief activities: Atmospheric sciences, but also including survey, geology and glaciology.

Occupied: 15 January 1956 to the present.

Halley is the UK's most isolated station and is afloat on an ice shelf on the mainland of Antarctica. In winter there is darkness for 105 days – darkness relieved by magnificent auroral displays. The relief of Halley is a major undertaking with supplies being landed twice a year by ship onto the ice shelf and then towed on sledges by Sno-cats to Halley, some 12 km distant from the ice edge.

Studies at Halley are crucial for a global perspective on ozone depletion, atmospheric pollution, sea level rise and climate change. Ozone has been measured at Halley since 1956. A spring-time depletion in stratospheric ozone was discovered by BAS in 1985, and this led very quickly to the international response to curtail production of CFCs.

The base, through the use of unmanned optical and radar instruments, obtains an unparalleled spatial picture of the consequences of geospace interactions in the upper atmosphere over an area of around three million square km above the South Pole.

The station operates throughout the year with a maximum population of 65 in the summer and an average of 15 over winter. The Emperor penguin colony near Halley, which is present from May to February, is a special attraction, while other recreational trips take members further inland towards the "hinge zone" where the floating ice shelf is joined to the continent.

Halley I to Halley IV were built directly on the snow and were each abandoned within ten years, having been crushed by the overlying ice. Halley V is built to withstand the extreme conditions. Three buildings are located on platforms on steel legs, which are jacked up annually to keep them clear of the accumulated snowfall. An accommodation building and a garage weighing over 50 tons are mounted on skis and towed each year to a new position.

Because of burial by snow and movement of the ice shelf, it was necessary to close Halley I in 1968, when it was 14m below the snow surface. Four further Halley stations were constructed on the Brunt Ice Shelf in 1967, 1973, 1983 and 1992. All but the most recent, Halley V, have been buried under the snow until they were no longer safe to inhabit. Abandoned sub-surface buildings have been lost to sea in icebergs which have calved off the ice shelf. Hazardous wastes were removed from Halley III in 1991 before it became impossible to access safely.

In 2004, the UK decided that Halley V Research Station needed to be replaced because of the growing risk that the part of the ice shelf on which it sits could break off in the next decade and in September 2006 a decision was made to build a new station, Halley VI. The location of the proposed Halley VI Research Station is approximately 30km inland from the northwest seaward edge of the Brunt Ice Shelf. The ice shelf at this point is floating and is approximately 200m thick, and currently moving at a rate of 550m per annum towards the Weddell Sea. As the ice shelf advances towards the coast, the proposed station will periodically be moved back to the same geographic location on the ice and therefore will not move westwards as the current and previous stations have. It is expected that any relocation of the station will coincide with either a major future calving event on the ice shelf, or with the BAS five year science research programme cycle. Relocation is defined as the movement of the facilities over several kilometres (5–10km), a maximum of once every five years with at least one year's notice to prepare.

SECTION B: WHY ARE THE POLAR REGIONS IMPORTANT?

Resource 20

What is the strategic importance of the Polar Regions?

The Polar Regions are significant for a number of reasons. In the Arctic, the 'Great Circle' routes are often the shortest distance for air travel between continents. Should the ice melt, the North-west passage would be a valuable shipping route; taxes could be levied, and more fishing grounds opened, together with possible access to mineral reserves. Strategically the area has already proved controversial and there is a 'race for the Arctic' underway to claim the territory around the North Pole. Under the United Nations Convention of the Law of the Sea, Denmark could lay claim to the North Pole if the Lomonosov Ridge could be proved to be a natural extension of Greenland, with Denmark's Northern frontier reaching much further North than previously. As Denmark and Canada share a common interest in arguing for this natural divide, they have begun negotiations to fund a programme of research to prove their claim. Moscow has based its claims on the sector principle, which would divide the area along lines of longitude, splitting the Pole into several territories.

The presence of diamonds in Canada's Nunavut territory has already fired a mining rush, and the Canadian government is expecting to find major gas and oil reserves in the Beaufort Sea.

Militarily, the U.S. controlled Thule air base has provoked controversy since the displacement of Inuits after World War II. It has become an essential part of Washington's advanced warning system to identify and track enemy missiles.

The Antarctic has been the focus of similar political issues, but has benefited from the internationally agreed Antarctic Treaty System which is explained in a later section.

[Turn over

Resource 21

Why are the Polar Regions important for sustainability?

There is still much that is unknown about how Earth Systems work. The Cryosphere as represented by the Polar Regions is still an area of exploration and discovery. It is understood, however, that these areas of the World are important for a number of reasons. Terrestrial and marine ecosystems found here are very fragile. People, flora and fauna are at risk if the system is upset, not only within the polar latitudes but across the globe. There is already much evidence to support this view, particularly with reference to global climate change which is discussed later.

Apart from the traditional life styles described earlier, the marine ecosystem has a very important role in the balance and supply of food for fish, as illustrated in the figure opposite.

Krill are shrimp-like marine invertebrate animals. These small crustaceans are important organisms of the zooplankton, particularly as food for baleen whales, mantas, whale sharks, crabeater seals and other seals, and a few seabird species that feed almost exclusively on them.

Krill occur in all oceans of the world. They are considered keystone species near the bottom of the food chain because they feed on phytoplankton and to a lesser extent zooplankton. These are converted into a form suitable for many larger animals for whom krill makes up the largest part of their diet. In the Southern Ocean, one species, the Antarctic Krill, makes up a biomass of hundreds of millions of tonnes, similar to the entire human consumption of animal protein. Over half of this biomass is eaten by whales, seals, penguins, squid and fish each year, and replaced by growth and reproduction. Most of the species display large daily vertical migrations making a significant amount of biomass available as food for predators near the surface at night and in deeper waters during the day.

Ecosystems are complex; they are systems within systems or hierarchies of systems. Contaminants may be seen as part of the metabolic systems of a beluga whale; the whale, as part of a population inhabiting a marine environment; the population of whales, as part of a community that is seen as a system of food chains in which the sun's incoming energy drives the whole system. All the subsystems are connected and any of them may affect the others. Some of these systems exist over large areas and for considerable periods of time.

Scientists think of ecosystems as being "driven" by the need to use (or, as scientists say, dissipate) large amounts of energy from the sun. The ecosystem's ability to use incoming energy increases with the complexity of its food webs. Biodiversity contributes to ecosystem complexity. In using incoming energy, an ecosystem may change. Such changes might include new life forms, thus enhancing biodiversity. In the case of Polar regions, changes to solar inputs could have far-reaching effects, as could pollution of the oceans.

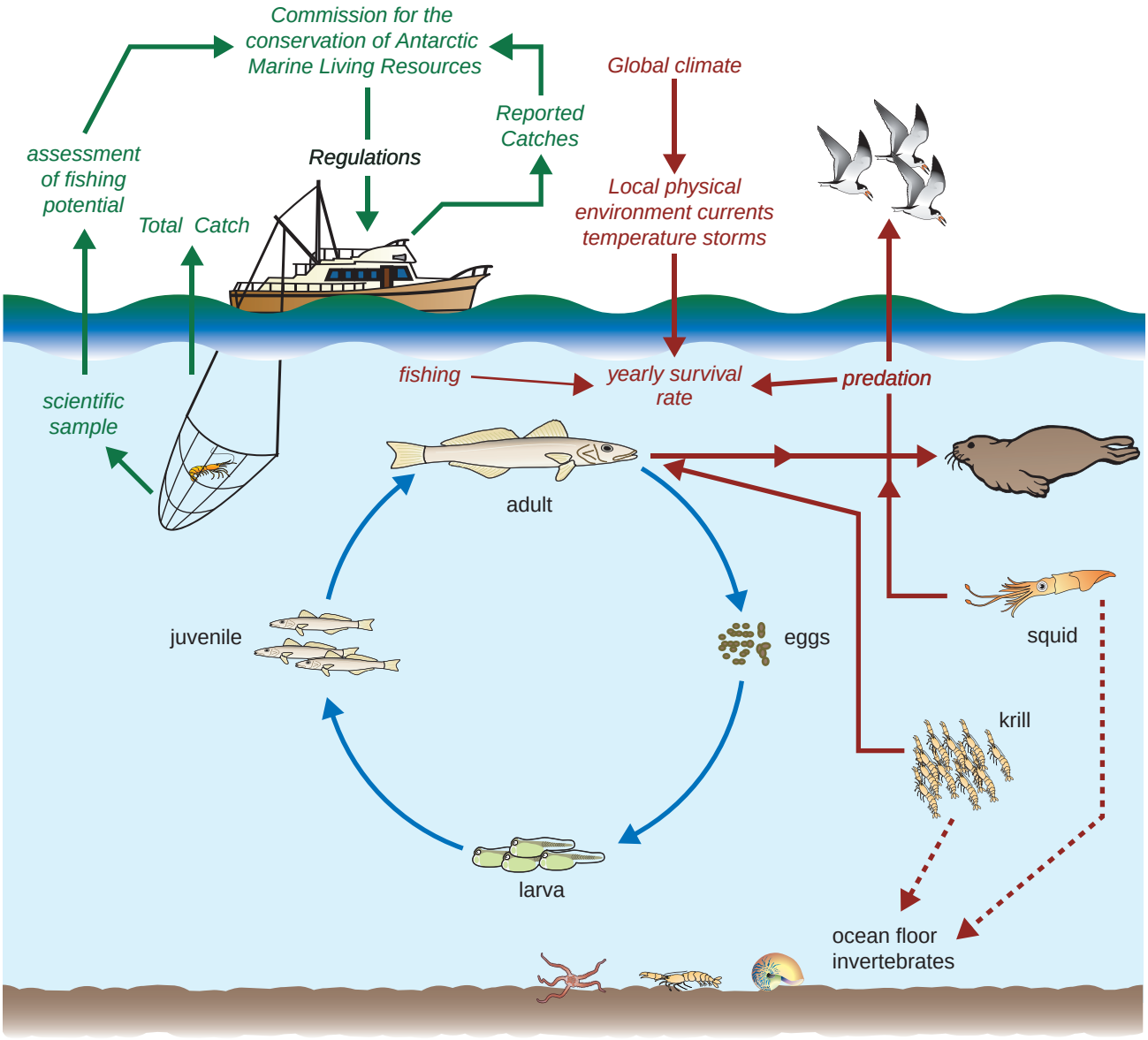
An ecosystem may adapt to stress in several ways. It has been said that ecosystem adaptation consists of a temporary change followed by a return to the previous condition; however, recent thinking suggests a much more varied set of possibilities. Kay identifies five types of ecosystem response to stress:

1. The system can continue to operate as before, even though its operations may be initially and temporarily unsettled.
2. The system can operate at a different level using the same structures it originally had (for example, a reduction or increase in species numbers).
3. Some new structures can emerge in the system that replace or augment existing structures (for example, new species or paths in the food web).
4. A new ecosystem made up of quite different structures can emerge.
5. The ecosystem may collapse and no regeneration occurs.

[Kay, J.J., 1993. "On the Nature of Ecological Integrity: Some Closing Comments," in Woodley, S., J.J. Kay, and G. Francis, Ecological Integrity and the Management of Ecosystems. St. Lucine Press.]

Resource 22

Southern Ocean Ecosystem



[Turn over

SECTION C: WHAT ARE THE THREATS TO THE POLAR ENVIRONMENT?

Resource 23

Direct Threats

Minerals – the Mackenzie Valley

The Mackenzie Gas Project proposes to build a 1220-kilometre pipeline system along the Mackenzie Valley. It would link northern natural gas producing wells to southern markets. Proven reserves in these northern wells could heat all gas-heated houses in Canada for about 6-10 years. The main Mackenzie Valley Pipeline would connect to an existing natural gas pipeline system in northwestern Alberta.

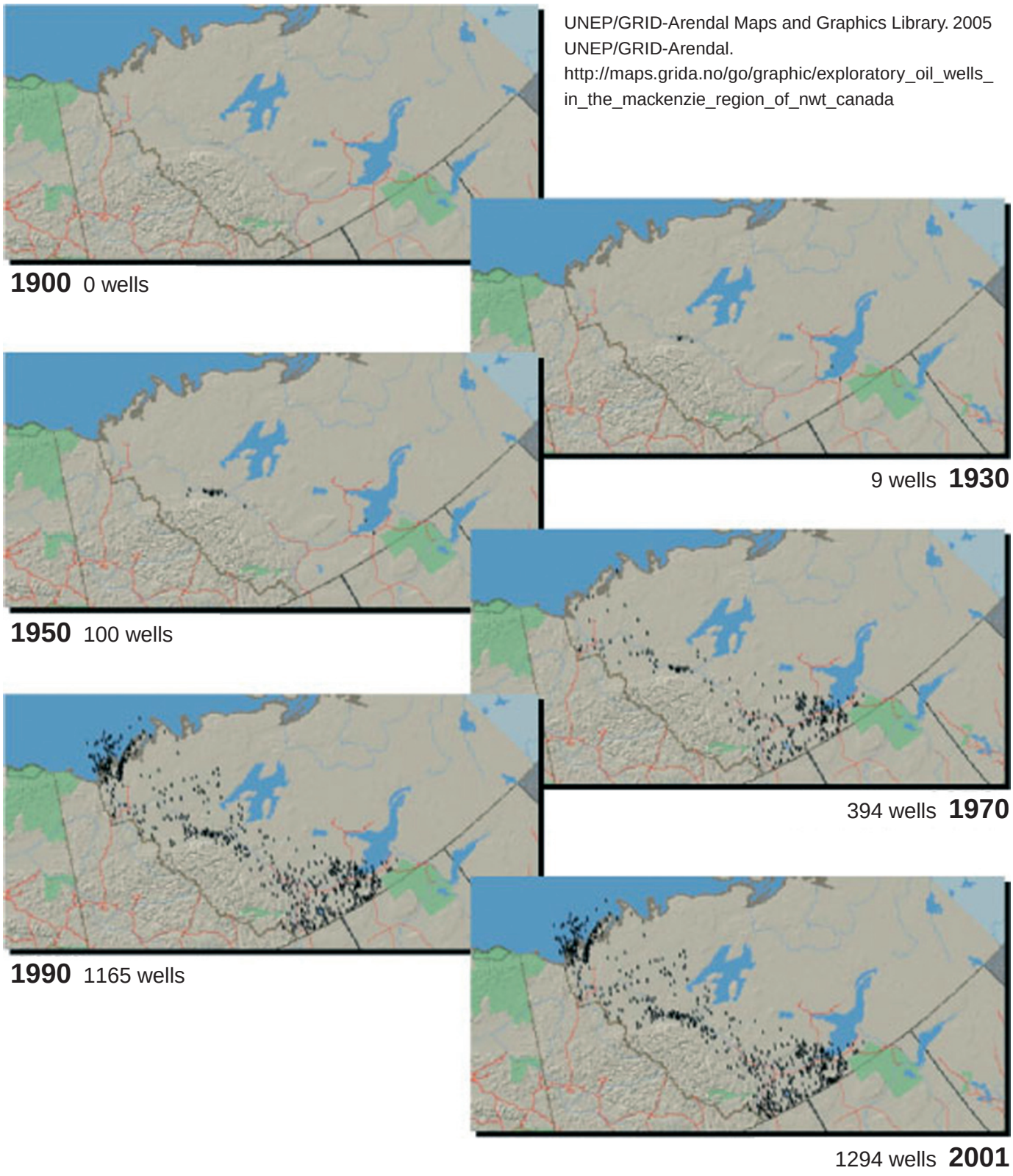
The natural gas exploration and development companies involved in the Mackenzie Gas Project have interests in three discovered natural gas fields in the Mackenzie Delta – Taglu, Parsons Lake and Niglintgak. The companies involved are all part of huge multinationals – Exxon, Shell, Conoco Phillips. Together, they can supply about 800 million cubic feet per day of natural gas over the life of the Project. Other companies exploring for natural gas in the North are also interested in using the pipeline. In total, as much as 1.2 billion cubic feet per day of natural gas could be available initially to move through the Mackenzie Valley Pipeline.

Planning, building and operating the proposed $7 billion Mackenzie Gas Project will take cooperation among many different companies, communities, settlement regions, regulatory agencies and governments.

Source: www.mackenziegasproject.com

Resource 24

Exploratory oil wells in the Mackenzie region of Northwest Territories, Canada



UNEP/GRID-Arendal Maps and Graphics Library. 2005 UNEP/GRID-Arendal. http://maps.grida.no/go/graphic/exploratory_oil_wells_in_the_mackenzie_region_of_nwt_canada

Source: World Wildlife Fund (WWF) Canada 2002 Northwest Territories, Canada Digital Atlas

[Turn over

Resource 25

The Mackenzie Valley pipeline
CBC News Online / January 24, 2006

The proposed gas pipeline from the Beaufort Sea to markets in southern Canada and the United States was billed in the 1970s as “the biggest project in the history of free enterprise.”

It was up to a Canadian judge, Mr. Justice Thomas Berger of British Columbia, to examine the impact of the pipeline on the people who lived in its path.

On May 9, 1977, Berger’s report was released in Ottawa. Significantly, Berger titled his report Northern Frontier, Northern Homeland, for above all he wanted the world to know that though the Mackenzie Valley may be the route for the biggest project in the history of free enterprise, people also live there.

Berger warned that any gas pipeline would be followed by an oil pipeline, that the infrastructure supporting this ‘energy corridor’ would be enormous - roads, airports, maintenance bases, new towns - with an impact on the people, animals and land equivalent to building a railway across Canada. Some dismissed the impact of a pipeline, saying it would be like a thread stretched across a football field. Those close to the land said the impact would be more like a razor slash across the Mona Lisa.

“We are now at our last frontier,” the report began. “It is a frontier that all of us have read about, but few of us have seen. Profound issues, touching our deepest concerns as a nation, await us there.”

Berger continually referred back to his chosen title, as when he wrote:

“I discovered that people in the North have strong feelings about the pipeline and large-scale frontier development. I listened to a brief by northern businessmen in Yellowknife who favour a pipeline through the North. Later, in a native village far away, I heard virtually the whole community express vehement opposition to such a pipeline. Both were talking about the same pipeline; both were talking about the same region - but for one group it is a frontier, for the other a homeland.”

Berger’s main recommendation was that any pipeline development along the Mackenzie River Valley be delayed 10 years, and that no pipeline ever be built across the northern Yukon. The pipeline was delayed far longer than 10 years. Recently there has been a resurgence of interest in a gas pipeline up the Mackenzie Valley, and many of those now pushing for the pipeline were the young radicals who opposed it with such vehemence 25 years ago.

By early 2004, the push to get the pipeline built was gathering steam – but meeting resistance as negotiations between governments, potential pipeline builders and native groups stalled. Those obstacles began to be resolved later that year, and on July 18, 2005, the federal government announced it would spend $500 million over 10 years to address the socio-economic issues of the northern First Nations.

By mid-November 2005, a tentative deal on access to land by the pipeline’s developers and benefits for local people had been reached with groups in the Sahtu region of the Northwest Territories.

Resource 26

[Turn over

Resource 27

Marine Resources: What about whaling?

In 2006, Iceland, Japan and Norway are engaged once more in whaling. Norway resumed commercial whaling of minke whales in 1993 in defiance of the commercial whaling moratorium. Japan has also started commercial whaling again in 2006.

While there are several cultures that have historically depended on the hunting and trading in whales and their products, these traditions began in eras when there were fewer people, fewer negative human impacts on the marine environment, and less efficient ways to hunt whales (thus limiting the scope of any hunt).

Cultures change as environments change. Some cultural practices are highly damaging to the environment and thus their preservation would most certainly be unsound environmental policy (the slash and burn method of farming in the rain forest, a cultural practice, is a case in point). Today, the negative impacts of human activities on the marine environment increase with each passing year. The modern efficiency with which humans utilize marine resources has proven again and again to be unsustainable.

During its 52 years of existence, the IWC has evolved from an international institution whose primary focus was the apportionment of whaling quotas, to an institution that recognizes the complexities of ocean ecosystems and the IWC's role in protecting and ensuring the duration of whales for present and future generations. While Norway and Japan argue that the purpose of the IWC is to regulate the hunting of whale populations for food and other products for human consumption, there are clear indications that both the IWC and the greater civil society have moved beyond the initial stage of conquest of the natural world and consumption of natural resources to a respect for the role played by wildlife in complex ecosystems.

Moreover, there is an increasing volume of scientific research that provides clear warning of the possible catastrophic consequences to whale populations from a variety of environmental threats. There is now greater cause for concern that whale populations will not be able to withstand direct hunting in addition to these threats. Therefore, it would be not only illogical but also irresponsible of the IWC to issue quotas just to satisfy the luxury food market in Norway and Japan with whale meat.

Why go whale watching?

There's something mysterious, elemental and deeply moving about seeing a whale at sea for the first time. The boat trip, the anticipation, the first glimpse, the sudden realisation that you are seeing one of the world's most extraordinary animals in an alien environment. It all adds up to one of those never-to-be-forgotten moments in life. And there's now more reason than ever to go. It's not just good fun; whale watching is good for conservation too.

Whale watching and conservation

WWF encourages carefully controlled whale watching because we believe it can promote whale, dolphin and porpoise conservation. For example, in the Andenes and Tysfjord areas of northern Norway, where sperm whales and orcas are commonly seen, WWF has helped develop whale watching. And in Iceland, WWF provides funding for The Whale Centre, an interactive museum devoted to whales and the history of whaling in Husavik.

In Iceland, whale watching passenger numbers have grown from 100 in 1991 to 45,400 in 2000.

Whale watching - a booming industry

Around 10 million people a year go whale watching, spending more than $1.25 billion. The number of whale watchers is increasing at 12 percent a year, three times faster than overall tourism numbers. Four hundred and ninety-five communities in 87 countries and overseas territories now have whale watching tours.

The number of whale watchers in the Arctic areas of Alaska, Canada, Greenland, Iceland, Norway and Russia is about 140,000 a year. Tourists to the area are estimated to spend $147 million.

Resource 28

Is Polar tourism acceptable?

Tourism is developing rapidly in the Antarctic. Ship-borne tourists increased from 4698 in the 1990/91 season to more than 29 000 in 2005/6 (IAATO 2006). In addition to the tourists there are a further 19 000 staff and crew, many of whom also land. Although most tourists arrive in Antarctica by ship, a few travel by air and yacht. Most tourism cruises (96 of the 102 in 1998/99) are in the Antarctic Peninsula area, with the remainder generally in the Ross Sea region. The sub-Antarctic islands are also visited on many Antarctic voyages.

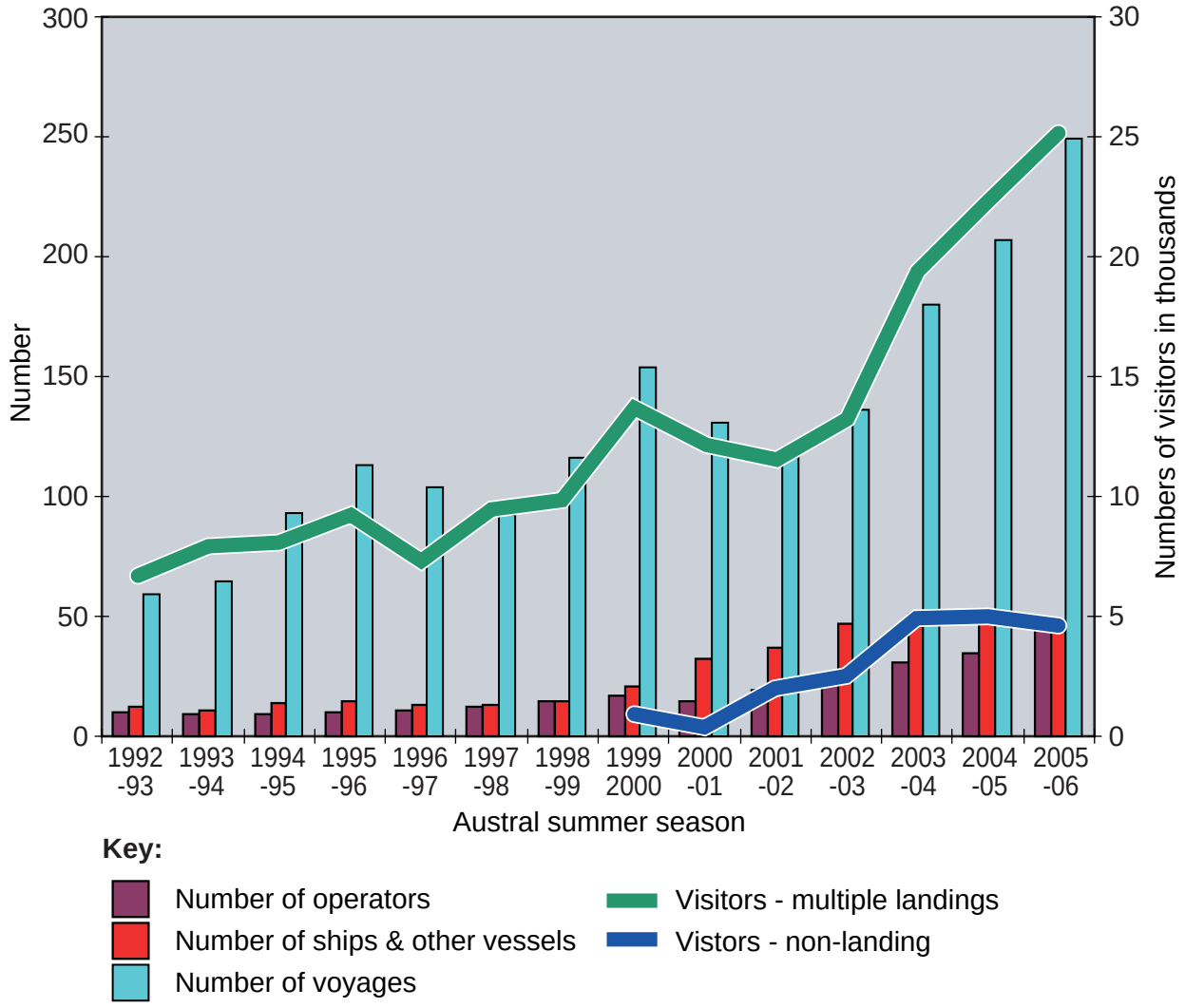
Although the length of tourists' stays is much shorter than for personnel of national Antarctic programmes, tourists can cause adverse environmental impacts, particularly on the Antarctic Peninsula. Measures to assess, mitigate and prevent these impacts, as well as to respond to emergencies, are taken by industry (IAATO), by the Antarctic Treaty System (AT 1994) and by individual states. For the Antarctic Peninsula, a guide to regular tourist sites has been produced which identifies environmental sensitivities.

Air tourism is starting: some operators now land people at national bases and there are also overflights from Argentina and Australia.

Source: International Association of Antarctic Tour Operators, www.iaato.org

Resource 29

Seaborne tourism in the Antarctic



Source: International Association of Antarctic Tour Operators 2006

[Turn over

Resource 30

Indirect Threats to the Polar Environment

What is Climate Change?

There is a growing body of evidence to support the view that the natural process of climate change is speeding up because of human activity; the models indicate that feedback systems could accelerate the process. The global average temperature is currently in the region of 15°C. Geological and other evidence suggests that, in the past, this average may have been as high as 27°C and as low as 7°C. Studies of tree rings, pollen analysis, ancient coral formations and ice cores all reveal that the world's climate has changed frequently, but it has not been as warm as it is now for a millennium or more. The three warmest years on record have all been within the last decade; 19 of the warmest 20 since 1980. Earth has probably never warmed as fast as in the past 30 years. During this period natural influences such as solar cycles and volcanic eruptions should have cooled us down.

The **greenhouse effect**, the role played by atmospheric gases in the trapping of energy from the sun, is necessary to sustain life on Earth. The most important of these gases is water vapour, but this is fairly constant in its proportion. It is the other human-induced gases that are increasing in concentration, particularly carbon dioxide which has risen by more than 30% since 1800. Such concentrations could be enough to raise global temperatures by around 2°C to 5°C.

Where is the evidence?

Recent Scientific Findings and Facts: (From WWF Climate Change Programme)

- Global atmospheric carbon dioxide (CO^2) concentrations have increased from pre-industrial levels of 280 parts per million to 378 parts per million at the end of 2004, a 36% increase (NOAA Climate Monitoring and Diagnostics Laboratory, 2005)
- The Earth is now absorbing substantially more energy (heat) from the sun than emitting to space, primarily due to human-caused, increased greenhouse gas concentrations in the atmosphere and is responsible for recent global warming trends (Hansen et al., 2005)
- The average global surface temperature has warmed 0.6°C over the 20th century (IPCC, 2001)
- Glaciers on the Antarctic Peninsula are melting at unprecedented rates - 87% of 244 glaciers recently measured have retreated during the last 50 years (Cook et al., 2005)
- Flowering and migration of species in the Northern Hemisphere are occurring on average 3.2 days earlier per decade in the spring and 5 days/decade earlier for just European species (Root et al., 2005)
- North Sea fish distributions have changed; nearly 2/3 of exploited (e.g. Atlantic cod, Gadus morhua, and common sole, Solea solea) fishes have shifted their ranges due to ocean warming, from 48 to 403 km and almost all of these shifts (13 of 15) were northward (Perry et al., 2005)
- Springtime snowmelt and streamflow have become earlier in North America by 1-4 weeks (Stewart et al., 2005) impacting water management in some regions.

What other changes could be expected?

Globally, we can expect more extreme weather events, with heat waves becoming hotter and more frequent. Scientists predict more rainfall overall, but say the risk of drought in inland areas during hot summers will increase. More flooding is expected from storms and rising sea levels. There are, however, likely to be very strong regional variations in these patterns, and these are difficult to predict.

What will the effects be on Polar Regions?

Most glaciers in temperate regions of the world, in Greenland and along the Antarctic Peninsula are in retreat; records show Arctic sea-ice has thinned by 40% in recent decades in summer and autumn. There are anomalies however – parts of the Antarctic appear to be getting colder, and there are discrepancies between trends in surface temperatures and those in the troposphere (the lower portion of the atmosphere). More research is required.

What don't we know?

We don't know exactly what proportion of the observed warming is caused by human activities, or whether feedback systems will result in increasing or decreasing temperatures. The precise relationship between concentrations of carbon dioxide (and other greenhouse gases) and temperature rise is not known, which is one reason why there is such uncertainty in projections of temperature increase. Scientists are reasonably certain that global warming will cause some changes which will speed up further warming, such as the release of large quantities of the greenhouse gas methane as permafrost melts. Other factors may mitigate warming; for example, it is possible that plants may take more CO_2 from the atmosphere as their growth speeds up in warmer conditions, though this remains in doubt.

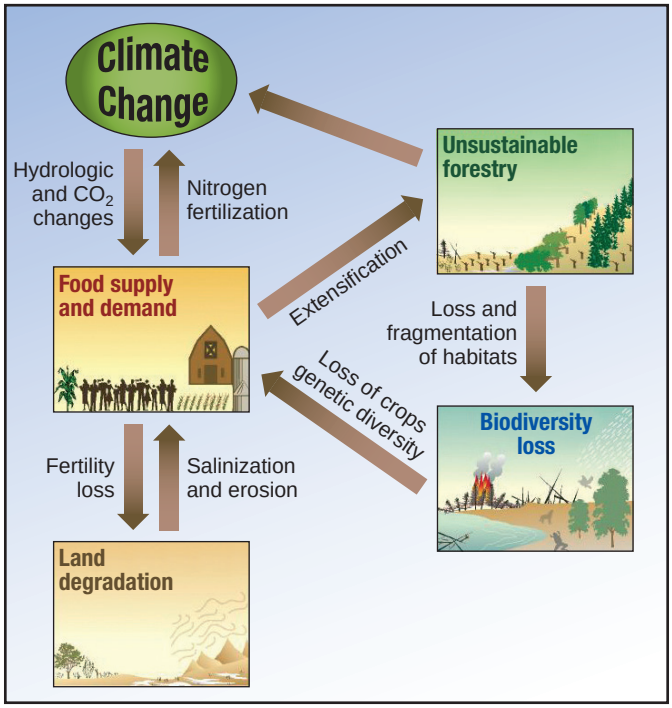
Is everyone in agreement?

'Global warming sceptics' fall into three broad camps:

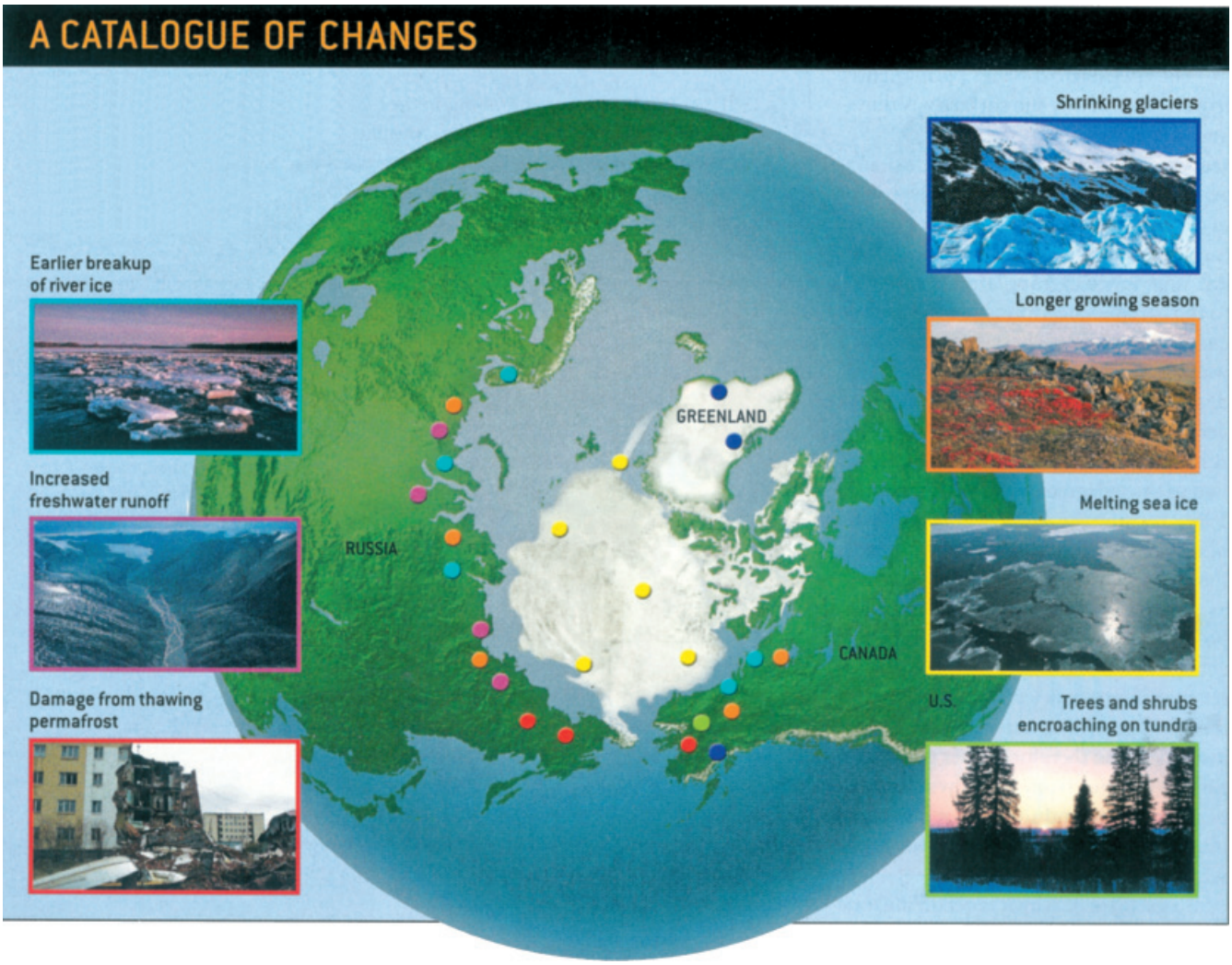
- those who maintain temperatures are not rising
- those who accept the climate is changing but suspect it is largely down to natural variation
- those who accept the theory of human-induced warming but say it is not worth tackling as other global problems are more pressing.

Resource 31

Climate change and food



Resource 32



Resource 33

Extent of Arctic Sea Ice 1986, 1996 and 2006

	January	September
1986		
1996		
2006		

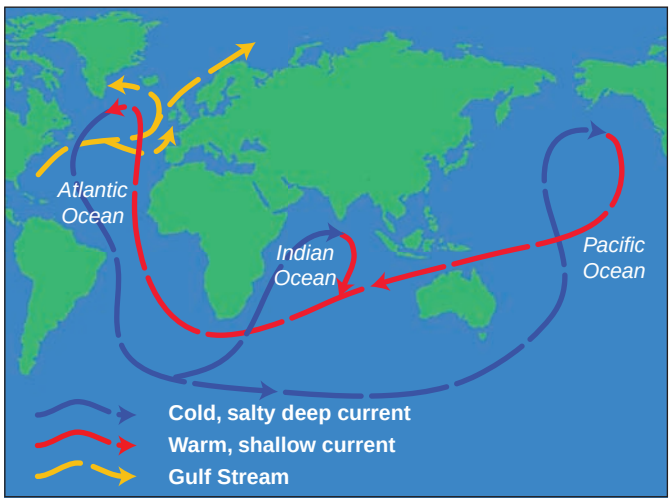
Source: www.nsidc.org

[Turn over

Resource 34

The overturning circulation and the Gulf Stream

The Gulf Stream and the overturning circulation both bring warm tropical water northwards. The Gulf Stream is mostly a wind-driven surface current. Eventually the current splits in two. One current turns back south, always on the surface. The other continues northwards into the Arctic Zone with the overturning circulation. Here it sinks down to form cold, deep waters. The Gulf Stream has not slowed down.



The overturning circulation is a much larger, slower current, beneath the Gulf Stream. It is part of the global circulation, the thermohaline circulation redistributing equatorial heat to the poles. As its name suggests, this current is driven by heat (thermo) and salinity (haline, or saltiness). Cold, salty arctic waters are denser than warm waters from the equator, so sink, pulling warm water northwards. The Arctic Ocean has become less salty in recent years so less cold water sinks. This could be due to melting sea ice and glaciers pouring fresh waters into the Arctic Ocean. Scientists are concerned that this could slow or stop the circulation, as has happened before.

There is no comparable current in the Pacific Ocean, so similar latitudes in Canada and the USA suffer more extreme winter temperatures than north-western Europe. But that could change.

Source: NERC Planet Earth Winter 2005

Resource 35

Types of adaptation to climate change

	Anticipatory	Reactive
Natural Systems		• Changes in length of growing season • Changes in ecosystem composition • Wetland migration
Human Systems – Private	• Purchase of insurance • Construction of houses on silts • Redesign of oil rigs	• Changes in farm practices • Changes in insurance premiums • Purchase of air-conditioning
Human Systems – Public	• Early-warning systems • New building codes, design standards • Incentives for relocation	• Compensatory payments, subsidies • Enforcement of building codes • Beach nourishment

From Inter-governmental Committee on Climate Change

Resource 36

Arctic haze pollution thickens despite Russian cuts

By Alister Doyle
Environment Correspondent

OSLO, October 26 – Haze polluting the Arctic has thickened in the past decade despite lower emissions by Russian factories, perhaps because of more forest fires or pollution from Asia, an international report said on Thursday.

Arctic haze was first noted in the 1950s by Canadian pilots puzzled by low visibility over the pristine ice.

Studies showed it comprised tiny particles mainly blown from industrial centres far to the south. Haze can blanket areas up to 200 km (120 miles) across and cut visibility to a few km.

The study said the worst sulphur pollutants in the Arctic, by Russian metals smelters and industries far to the south, had declined in recent years with lower emissions. Many lakes and soils blighted by acid rain and snow were recovering, it said, and the acidity killed fish and destroyed lichen.

But some other toxins in the almost uninhabited region, including nitrogen oxides that may be carried by winds from industries or forest fires to the south, seemed to be rising.

The brownish haze, which can cut visibility in the near pristine Arctic in spring, had started to increase in the late 1990s after clearing since the 1970s, according to measurements in Barrow, Alaska. Haze levels were still below the 1980s.

"The cause of this recent increase is not yet known," the report said.

Reiersen told Reuters one theory was that: "The haze might be linked to climate change -- with increased temperatures there are more forest fires. That means more soot in the atmosphere."

Warmer temperatures in recent decades mean the forest fire season in northern forests starts earlier and ends later. Most scientists say fossil fuels burnt in power plants, factories and cars release heat-trapping gases that are raising temperatures.

Pollution from growing economies such as China may be adding to haze, whose particles can also fall as acid rain or snow. "The importance of Asian sources to acidification and Arctic haze pollution is not yet clear," the report said.

An opening of the Arctic region to oil firms, and to sea transport if the polar ice shrinks with higher temperatures, may also bring more pollution. Some U.S. studies say the Arctic may contain a quarter of the world's undiscovered oil and gas.

Source: Reuters 26 October, 2006 09:

[Turn over

SECTION D: WHAT STRATEGIES EXIST TO PROTECT POLAR ENVIRONMENTS?

Resource 37

The Arctic Council

The Arctic Council is an intergovernmental forum for addressing many of the common concerns and challenges faced by the Arctic states; [See Resource 6].

Six international organizations representing many Arctic indigenous communities have the status of Permanent Members of the Arctic Council and are involved in the work of the Council in full consultation with governments. The indigenous populations in the Arctic are represented by:

Aleut International Association

Arctic Athabaskan Council

Gwich'in Council International

Inuit Circumpolar Conference

Russian Association of Indigenous Peoples of the North

Sami Council

Observers to the Arctic Council include European non-arctic countries, international organisations and NGOs.

Objective of the Arctic Council

The Arctic Council is a regional forum for sustainable development, mandated to address all three of its main pillars: environmental, social and economic.

History

The Arctic Council grew from the earlier agreement in 1991. New opportunities for Arctic circumpolar cooperation emerged in the late 1980s during the final reformist phase before the dissolution of the Soviet Union. Environmental cooperation was identified as a first step in promoting comprehensive security in the region so the eight Arctic countries adopted an Arctic Environmental Protection Strategy (AEPS) in 1991. Five years later, in 1996, Foreign Ministers of the Arctic states agreed in the Ottawa Declaration, to form the Arctic Council with a mandate to undertake a broad programme to include all dimensions of sustainable development. From the beginning, Arctic governments and indigenous peoples joined together to make environmental monitoring and assessment a key element of the Arctic Council's agenda.

The AEPS was begun because:

- Reports coming out of the former Soviet Union of past Arctic Ocean dumping of radioactive and other hazardous materials, which called international attention to potential threats to human health and the environment;
- The openness of the Russian Federation to discussing these problems in their search for bilateral and multilateral assistance to clean up and manage present and future environmental problems; and
- Scientific findings of abnormally high persistent organic pollutants and heavy metals in Arctic indigenous people and their food sources.

The AEPS, and then the Arctic Council, had no enforcement powers, was funded by ad hoc contributions of member nations, and implemented its activities (other than research) through other international forums [for example, the United Nations Environment Program (UNEP) and the International Maritime Organization (IMO)] or through bilateral and/or multilateral agreements.

The deliberations prior to the signing of the Arctic Council were in large part filled with controversy with respect to the nature and scope of the Arctic Council's sustainable development activities. There were many who felt that, contrary to what the ministers may have officially stated, the goals of the Rio summit's statement on sustainable development were at risk of being diluted. Further, there are excellent successes among indigenous people and wildlife conservation agencies co-managing natural

resources and having limited environmental impacts.

The scientific work of the Arctic Council is carried out in five expert working groups focusing on such issues as monitoring, assessing and preventing pollution in the Arctic, climate change, biodiversity conservation and sustainable use, emergency preparedness and prevention in addition to the living conditions of the Arctic residents

- Emergency, Prevention, Preparedness and Response (EPPR)
- Conservation of Arctic Flora and Fauna (CAFF)
- Protection of the Arctic Marine Environment (PAME)
- The Arctic Monitoring and Assessment Programme (AMAP)
- The Sustainable Development Working Group (SDWG)

Co-operation with international organisations

The Arctic Council cooperates with international organisations. One example is the United Nations Environment Programme (UNEP), where the Arctic Council had a role in placing the problem of mercury pollution on the agenda. The Arctic Council has contributed to the development of the new European Union's Second Northern Dimension Action Plan, and has, among other things, encouraged the EU to work with the Council in an effort to combat long-range transboundary pollution.

The Antarctic Treaty System

The Antarctic Treaty and related agreements, collectively called the Antarctic Treaty System or ATS, regulate the international relations with respect to Antarctica, Earth's only uninhabited continent. For the purposes of the treaty system, Antarctica is defined as all land and ice shelves south of the southern 60th parallel. The treaty set aside Antarctica as a scientific preserve, established freedom of scientific investigation and banned military activity on that continent. This was the first arms control agreement established during the Cold War.

The main treaty was opened for signature in 1959, and officially entered into force in 1961. The original signatories were the 12 countries active in Antarctica during 1957-58 and willing to accept a US invitation to the conference at which the treaty was negotiated. These countries were Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, the USSR, the United Kingdom and the United States.

The Protocol on Environmental Protection to the Antarctic Treaty was signed in 1991 and entered into force in 1998; this agreement prevents development and provides for the protection of the Antarctic environment through five specific annexes on marine pollution, fauna and flora, environmental impact assessments, waste management, and protected areas. It prohibits all activities relating to mineral resources except scientific research.

Its objectives are simple yet unique in international relations. They are:

- to demilitarize Antarctica, to establish it as a zone free of nuclear tests and the disposal of radioactive waste, and to ensure that it is used for peaceful purposes only;
- to promote international scientific cooperation in Antarctica;
- to set aside disputes over territorial sovereignty.

The treaty remains in force indefinitely. The success of the treaty has been the growth in membership. Forty four countries, comprising 80% of the world's population, have acceded to it. Consultative (voting) status is open to all countries who have demonstrated their commitment to the Antarctic by conducting significant research.

[Turn over

The five international agreements are:

- Agreed Measures for the Conservation of Antarctic Fauna and Flora (1964)
- Convention for the Conservation of Antarctic Seals (1972)
- Convention on the Conservation of Antarctic Marine Living Resources (1980)
- Convention on the Regulation of Antarctic Mineral Resource Activities (1988)
- Protocol on Environmental Protection to the Antarctic Treaty (1991)

An example of one of the principles of environmental protection:

The protection of the Antarctic environment and associated ecosystems, including its wilderness and aesthetic values and its value as an area for the conduct of scientific research essential to the understanding of the global environment, shall be fundamental considerations in the conduct of all activities in the Antarctic Treaty area.

Resource 38

What is being done? Chronology of events over the last decade.

1997:	Kyoto Protocol agrees legally binding emissions cuts for industrialised nations, averaging 5.4%, to be met by 2010. The meeting also adopts a series of flexibility measures, allowing countries to meet their targets partly by trading emissions permits, establishing carbon sinks such as forests to soak up emissions, and by investing in other countries. The precise rules are left for further negotiations. Meanwhile, the US government says it will not ratify the agreement unless it sees evidence of "meaningful participation" in reducing emissions from developing countries.
1998:	Follow-up negotiations in Buenos Aires fail to resolve disputes over the Kyoto "rule book", but agree on a deadline for resolution by the end of 2000. 1998 is the hottest year in the hottest decade of the hottest century of the millennium.
2000:	IPCC scientists re-assess likely future emissions and warn that, if things go badly, the world could warm by 6°C within a century. A series of major floods around the world reinforce public concerns that global warming is raising the risk of extreme weather events. But in November, crunch talks held in The Hague to finalise the "Kyoto rule book" fail to reach agreement after EU and US fall out. Decisions postponed until at least May 2001.
2001:	The new US president, George W Bush, renounces the Kyoto Protocol because he believes it will damage the US economy. After some hesitation, other nations agree to go ahead without him. Talks in Bonn in July and Marrakech in November finally conclude the fine print of the protocol. Analysts say that loopholes have pegged agreed cuts in emissions from rich-nation signatories to less than a third of the original Kyoto promise. Signatory nations urged to ratify the protocol in their national legislatures in time for it to come into force before the end of 2002.
2002:	Parliaments in the European Union, Japan and others ratify Kyoto. But the protocol's complicated rules require ratification by nations responsible for 55% of industrialised country emissions, before it can come into force. After Australia joins the US in reneging on the deal, Russia is left to make or break the treaty, but hesitates. Meanwhile, the world experiences the second hottest year on record.
2003:	Globally it is the third hottest year on record, but Europe experiences the hottest summer for at least 500 years, with an estimated 30,000 fatalities as a result. Researchers later conclude the heat wave is the first extreme weather event almost certainly attributable to man-made climate change. Extreme weather costs an estimated record of $60 billion this year. 2003 also sees a marked acceleration in the rate of accumulation of greenhouse gases. Scientists are uncertain if it is a blip or a new, more ominous trend. Meanwhile Russia blows hot and cold over Kyoto.
2004:	A deal is struck on Kyoto. President Putin announces in May that Russia will back the Protocol – and the EU announces it will support Russia's membership of the World Trade Organization. On 18 November, the Russian parliament ratifies the protocol, paving the way for it to come into force in 2005.
2005:	Second warmest year on record. Researchers link warming to a record US hurricane season, accelerated melting of Arctic sea ice and Siberian permafrost, and apparent disruption of the global ocean current that warms Europe. The Kyoto Protocol comes into force. In December, Kyoto signatories agree to discuss emissions targets for the second compliance period beyond 2012, while countries without targets, including the US and China, agree to a "non-binding dialogue" on their future roles in curbing emissions.

Updated January 2006
NewScientist.com news service

[Turn over

Conclusions

How far are our current systems sustainable?

James Lovelock in his Gaia hypothesis stated the following:

> *"The chemical and physical conditions of the Earth, of the atmosphere and of the oceans has been made fit and is actively made fit and comfortable by the presence of life itself."*

Until recently, Earth has had to adapt to natural changes. Now it is having to cope with human-induced pollution of land, sea and air. 50 million years ago, the planet had little ice, yet global temperatures were, on average, no more than 5°C warmer than today. CO2 levels were probably no higher, and sea levels were several hundred metres higher. The first ice sheets formed over Antarctica 34 million years ago, and as the Earth cooled, 2.5 million years ago, ice sheets formed over Greenland (reducing sea levels considerably). The main problem is that we do not yet understand what may tip the balance of Earth's current state. How should we act to ensure the sustainability of life both within the Polar Regions and throughout the World?

The 1992 United Nations Conference on Environment and Development held in Rio de Janeiro highlighted that climate change is a serious problem. Agenda 21 was conceived as a way in which people could act locally in the interests of global well-being. The legal and ethical bases of the agreed principles are evident in the following extract:

Principle 1: Human beings are 'at the centre of concerns for sustainable development.'

Principle 2: States 'have the sovereign right to exploit their own resources' but a 'responsibility to ensure that activities within their jurisdiction…do not cause damage to the environments of other states or of areas beyond the limits of national jurisdiction.'

Principles 15 & 16: endorse the Precautionary and Polluter Pays principles.

The Polar Regions may hold the key to our understanding of how the Earth system works. If life on Earth is to continue sustainably, they are areas that must be treated with care.

OCR Geography Specification B

Module 2692: Issues in Sustainable Development

(The synoptic module)

A guide to using the resource booklet during the study period

You have several weeks in which to study the chosen issue, but you will probably already have undertaken some work on it in class. You will spend some of the study time working on your own, but it would be best if some of the activities listed below could be done as part of group discussions. There is no reason either why the group should not share the search for other resources.

Remember as you use these resources that many are not taken from textbooks. They come from original sources and are written in language suitable for a particular purpose – you might like to discuss that purpose to see if any bias is evident.

Suggestions for studying:

- To begin with, pick out the different sections of the booklet and skim read them to check that you have a good idea of what each is about. Start with Section A.
- Now read each section more carefully. Try to summarise in as few words as possible the key points in the text, tables or figures.
- List all the technical and geographical terms used. Make sure you understand the meaning of any ones new to you.
- Look out especially for those parts concerned with location, spatial patterns and people/environment interactions - the geography.
- Now try out some of these questions on the different parts of the booklet;
  - How are human activities affecting the physical environment?
  - What are the interactions between physical and human processes?
  - To what extent are the situations described sustainable or unsustainable? What solutions to the issue are proposed?
  - What solutions, or mix of management strategies, would best meet the criteria for sustainable development?
- Look at previous question papers, noting how the questions are phrased to encourage you to draw upon your whole understanding of geography and to use the resources selectively to illustrate your answers.
- Think about how your studies in other parts of your A level course, as well as in the Issues in Sustainable Development module, might contribute to your understanding of this issue.
- Extend your knowledge of this issue by finding out what is happening in your home area or a different context from that presented in the resource. You could also search for other sources. These may include texts, articles, websites and official reports. Some starting points are given in the resources.

BLANK PAGE

BLANK PAGE