Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number | | | | | |

Candidate Number | | | | |

Geography

Advanced
Unit 3: Contested Planet

Monday 15 June 2015 – Morning
Time: 2 hours 30 minutes

Paper Reference
6GE03/01

You must have:
Resource Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **TWO** questions in Section A and **ALL** parts of Section B.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- The quality of your written communication will be assessed in ALL your responses
  – *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

Advice

- Read each question carefully before you start to answer it.
- Spend approximately 80 minutes on Section A and 70 minutes on Section B.
- Check your answers if you have time at the end.

Turn over ▶

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SECTION A

Answer TWO questions in this section.

You are reminded of the need to use examples to support your arguments.

You are advised to spend approximately 80 minutes on Section A.

Energy Security

1 Study Figure 1.

(a) Using Figure 1, suggest reasons for the differences in energy use shown in 2009.

(10)

(b) To what extent do all **renewable** and **recyclable** energy resources have environmental and social costs associated with their development?

(15)

(Total for Question 1 = 25 marks)

Water Conflicts

2 Study Figure 2.

(a) Using Figure 2, explain why some options for increasing water supply may be more desirable than others.

(10)

(b) Using named examples, assess the extent to which the development of **transboundary** water sources always leads to conflict.

(15)

(Total for Question 2 = 25 marks)

Superpower Geographies

3 Study Figure 3.

(a) Using Figure 3, comment on the value of the **three** different ways of measuring superpower status.

(10)

(b) Assess the extent to which the rise of the BRICs is both a threat and an opportunity for the rest of the **developing** world.

(15)

(Total for Question 3 = 25 marks)

Bridging the Development Gap

4 Study Figure 4.

(a) Using Figure 4, suggest reasons for both the **differences** and **trends** in poverty levels in Vietnam between 1994 and 2006.

(10)

(b) Using named examples, evaluate the view that the economic gains from development are often outweighed by social and environmental costs.

(15)

(Total for Question 4 = 25 marks)

The Technological Fix?

5 Study Figure 5.

(a) Using Figure 5, suggest why the three people shown have contrasting views of technology.

(10)

(b) To what extent does a global 'north-south divide' still exist in terms of access to technology?

(15)

(Total for Question 5 = 25 marks)

Put a cross in the box indicating the first question you have chosen to answer ☒.
If you change your mind, put a line through the box ☒
and then put a cross in another box ☒.
You will be asked to indicate your second question choice on page 11.

Chosen Question Number:

Question 1 ☐ **Question 2** ☐

Question 3 ☐ **Question 4** ☐

Question 5 ☐

(Total for Question = 25 marks)

Put a cross in the box indicating the second question you have chosen to answer ☒.
If you change your mind, put a line through the box ☒
and then put a cross in another box ☒.

Chosen Question Number:

Question 1 ☒ **Question 2** ☒

Question 3 ☒ **Question 4** ☒

Question 5 ☒

(Total for Question = 25 marks)

TOTAL FOR SECTION A = 50 MARKS

SECTION B

Answer ALL parts of this section, referring to the advance information you have been asked to study.

You are reminded of the need to use examples from any part of your GCE Geography course to support your answers.

You are advised to spend approximately 70 minutes on Section B.

Biodiversity Under Threat

6 (a) Explain why the Arctic's physical systems and ecological resources are of great value to the planet and its people.

(12)

(b) Evaluate the relative importance of the threats to the future health of the Arctic environment and its biodiversity.

(16)

(c) Study Figure 9.

Assess the strengths and weaknesses of the three approaches to the future management of the Arctic.

(12)

(Total for Question 6 = 40 marks)

TOTAL FOR SECTION B = 40 MARKS
TOTAL FOR PAPER = 90 MARKS

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Do not return the Resource Booklet with the question paper.

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SECTION A

The following resources relate to Questions 1–5

Country	Total energy use per person (tonnes of oil equivalent per year)	Average annual growth in energy use 2000–2008	Percentage of total energy use from different energy sources			
			Fossil fuels	Nuclear	Biofuels	Renewables
Ethiopia	0.4	7.8%	4%	–	95%	1%
China	1.7	10.1%	85%	2%	8%	5%
Sweden	4.9	0.3%	33%	30%	23%	14%

Note:

- Biofuels include traditional biomass (wood, dung, crop waste) and refined biomass (biodiesel, bioethanol)
- Renewables include HEP, wind, solar and geothermal

(Source: IEA Energy Statistics, 2009)

Figure 1

Energy use data for three countries in 2009

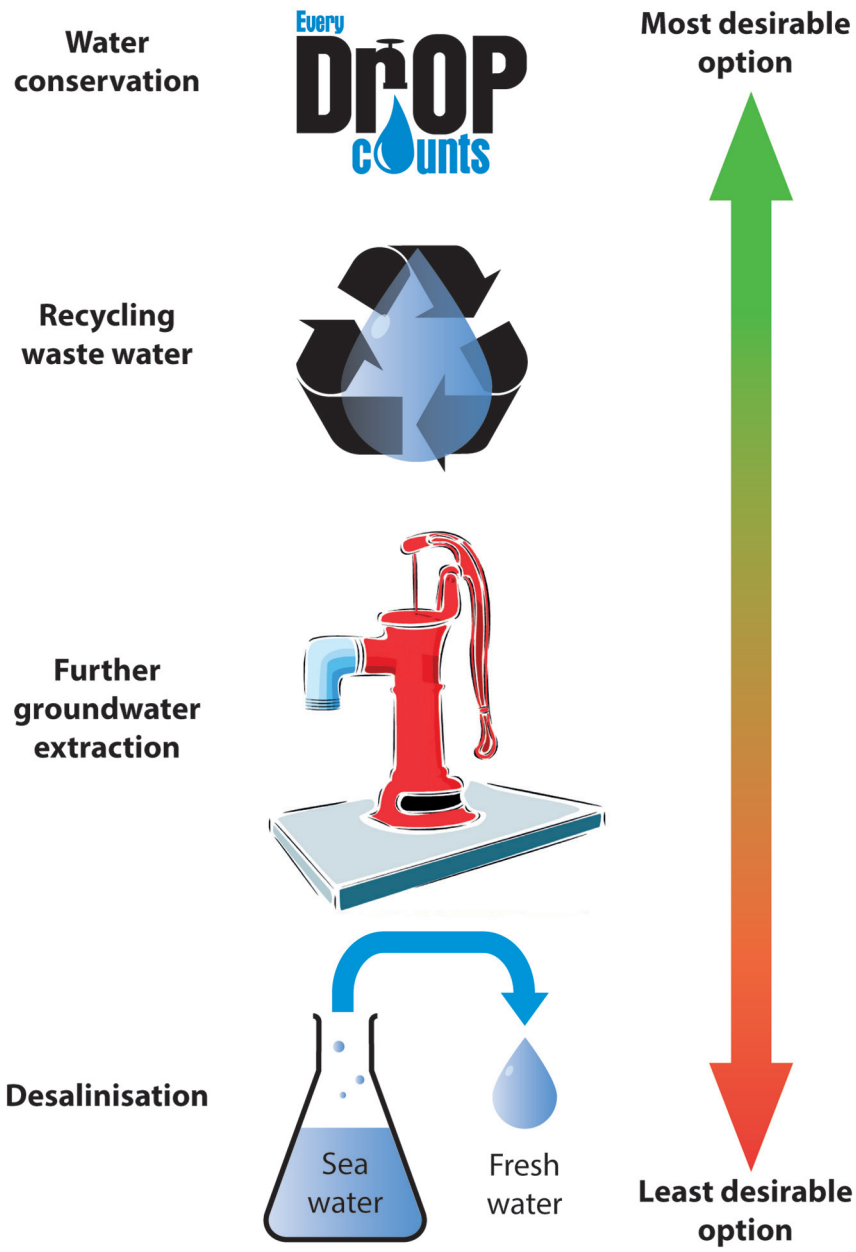


Figure 2

A spectrum of options for increasing water supply

Country	Top four countries by military spending in 2012 (US $, billions)
USA	711
China	143
Russia	72
UK	63

(Source: SIPRI Yearbook, 2012)

Country	Top four countries in the 2012 Summer Olympic Games medal table		
	Gold 	Silver 	Bronze 
USA	46	29	29
China	38	27	23
UK	29	17	19
Russia	24	26	32
Note: medal table position is determined by the number of gold medals, not the total number of medals.			

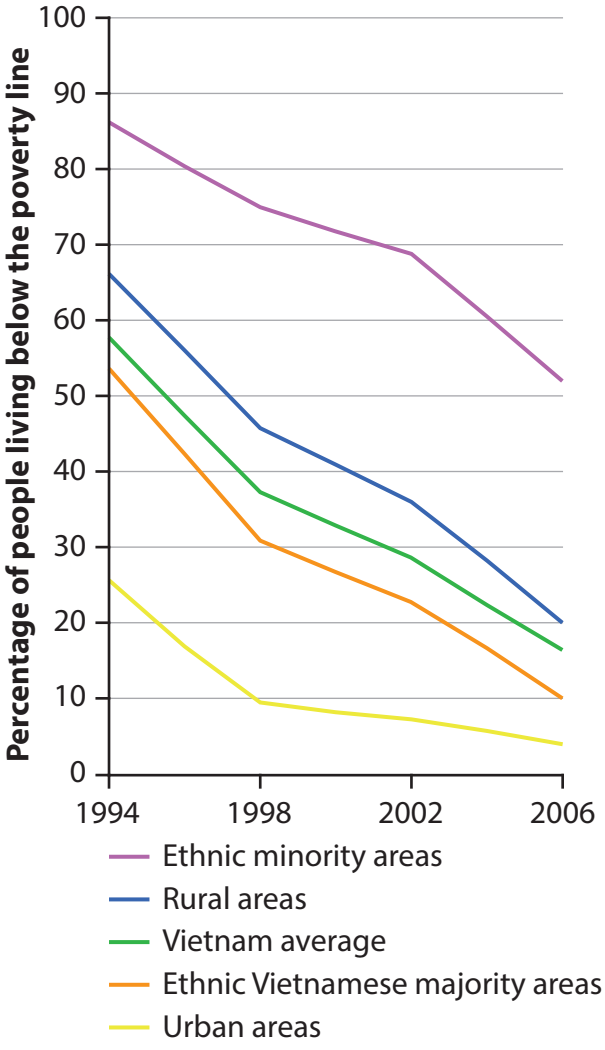
(Source: IOC, 2012)

Country	Top four countries by number of patent applications for new inventions, materials and processes in 2011
USA	48,600
Japan	38,900
Germany	18,600
China	16,400

(Source: WIPO, 2012)

Figure 3

Three measures of superpower status



(Source: Country Social Analysis, Ethnicity and Development in Vietnam, 2009, World Bank)

Figure 4

Trends in poverty levels for Vietnam, 1994 to 2006

"By the 2020s technology will provide tools to effectively combat poverty, clean up our environment, overcome disease and extend human longevity."

Ray Kurzweil
(author and futurist)

"Complex technology of any sort is an assault on human dignity. It would be little short of disastrous for us to discover a source of clean, cheap, abundant energy, because of what we might do with it."

Amory Lovins
(Physicist and environmental scientist)

"Technology is neither good nor bad; nor is it neutral."

Melvin Kranzberg
(Professor of the history of technology)

Figure 5

Three views of technology

SECTION B

Biodiversity under Threat

Arctic on the Edge

The Arctic region is an ocean area fringed by landmasses and islands. The centre of the **Arctic Ocean** is sea ice covered year-round, and snow and ice are present on land for much of the year. In some locations, permanent **ice caps** are present. The limit of the Arctic region is the Arctic Circle at 66° 32′ N (Figure 1). North of this line, the Sun does not set on the day of the summer solstice and does not rise on the day of the winter solstice. Nearer the Pole periods of continuous daylight or night last up to six months. The Arctic can also be defined as:

- the area north of the tree line.
- high latitudes where the average daily summer temperature does not rise above 10°C.

Eight countries have land and sea territory within the Arctic Circle (Figure 1).

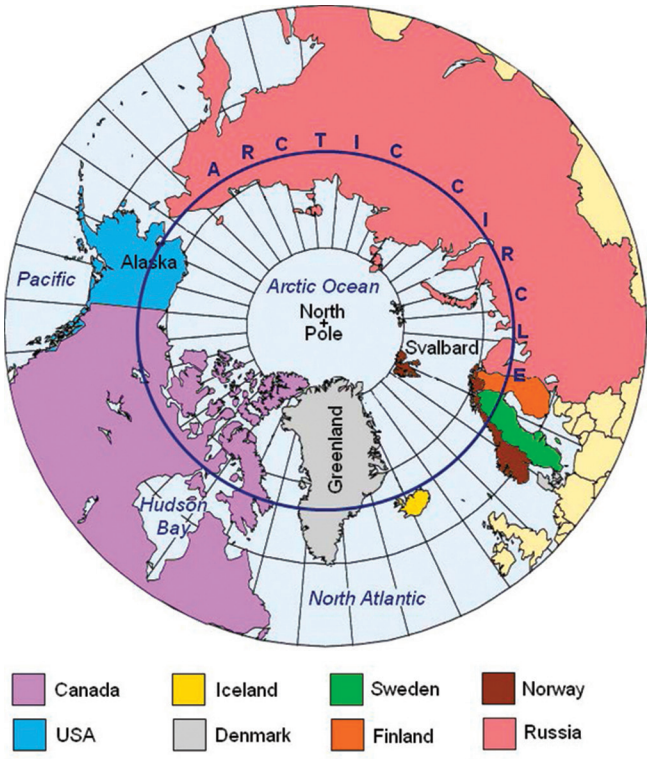


Figure 1: Countries of the Arctic

The Arctic covers an area of 14.8 million km^2 of land, including huge wilderness areas with almost no human inhabitants, and 13 million km^2 of ocean. In total, the Arctic has around 4 million inhabitants, including 40 different **indigenous** ethnic groups (about 10% of the total Arctic population). Indigenous Arctic people often have a specific connection to the land they inhabit, as well as distinctive languages, cultures and traditional livelihoods such as reindeer herding, fishing and hunting.

The Arctic contains a number of different **biomes**. Between about 50°N and 70°N **boreal forest** dominates with coniferous pine, spruce and fir (Figure 2) as well as some deciduous species like birch and larch. These forests account for about 25% of the world's forest cover. The central Siberian forests contain over 2300 species of vascular plants. Canada's boreal forest is home to 300 bird species, 85 different mammals and over 30,000 insect species.

White spruce | **White birch** | **Northern hawk owl** | **Woodland caribou**

Figure 2: Boreal forest species

Northwards, boreal forest gradually gives way to tundra beyond the **tree line**. Dwarf shrubs, mosses, lichens, grasses and sedges growing in thin soil above permafrost dominate the vegetation. Biodiversity is low, but not universally so (Figure 3).

Group	Number of species	% of world total
Mammals	75	1.7
Birds	240	2.9
Insects	3300	0.4
Springtails	400	6.0
Flowering plants	1735	0.7
Lichens	2000	11.0
Mosses	600	4.1

Figure 3: Number of species in the tundra

North of the tundra are **polar deserts**. These areas have less than 250 mm of precipitation per year and the warmest month is below 10°C. These are areas of bare rock and gravel with less than 5% vegetation cover and perhaps 250–300 plant species in total. Some parts of the Arctic have permanent **ice cover**. These include the **Greenland ice sheet** plus numerous small ice caps and glaciers.

The Arctic Ocean has relatively low **biological productivity** although in the Barents Sea and Bering Sea there are important cod fisheries. Blooms of phytoplankton and zooplankton provide food for the small capelin fish, which in turn is eaten by cod and birds (Figure 4).

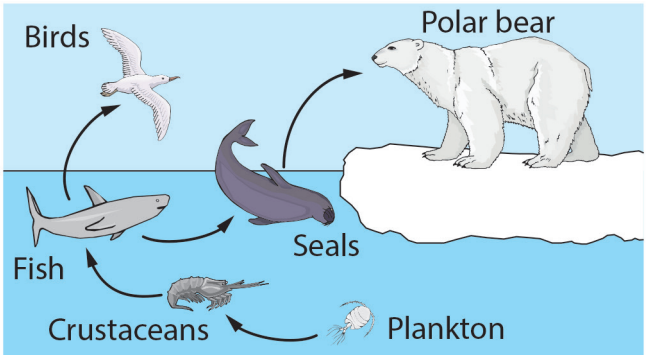
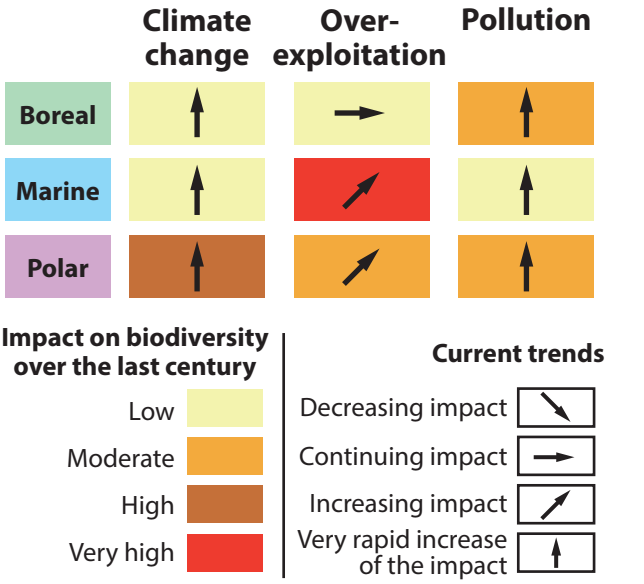


Figure 4: The Arctic Ocean ecosystem

Migration is an important component of Arctic ecology. Many bird species, including ducks and geese, fly north in the spring to breed in the short Arctic summer, and then migrate south in the winter. Caribou undertake similar, but shorter, migrations. Wetlands, peatlands and lakes cover up to 70% of the Arctic land area. These ecosystems are an important carbon sink as they store undecomposed organic matter as well as protecting permafrost. Arctic soils, permafrost and seabeds also store methane. Some estimates suggest up to 1400 gigatonnes of methane are stored in the Arctic.

Whilst appearing to be isolated and remote, the Arctic is integrated into the **global climate system**. The heat deficit of polar regions is balanced globally by **atmospheric circulation**. This moves excess tropical heat towards the poles. The **thermohaline circulation** transfers ocean warmth north and discharges cold Arctic waters south. The high **albedo** of Arctic sea ice, snow cover and glacier ice reflects 85–90% of incoming solar energy back into space. This has a significant cooling effect on the planet.

The results of the **2005 Millennium Ecosystem Assessment** on the state of boreal, marine and polar biomes are shown in Figure 5. Whilst there are widespread concerns about the health of global biomes, there is particular concern about the Arctic.



(Source: Millennium Ecosystem Assessment)

Figure 5: Millennium Ecosystem Assessment key findings

In 2011, results of research published in the journal Polar Biology suggested that between 1950 and 2006 some 950,000 tonnes of **fish** were caught in US, Canadian and Russian Arctic waters versus the 12,700 tonnes that was reported to the UN as having been caught. Atlantic cod (*Gadus morhua*) were caught in the non-Arctic

Northwest Atlantic until the mid 1990s (Figure 6), and are still caught in the Northeast Atlantic, which includes the Barents Sea. The Arctic cod (*Arctogadus glacialis*) fishery is small and the fish is not as commercially valuable as Atlantic cod. In the future, some fish species are expected to extend their current geographical range north and fishing may become viable in areas currently sea ice covered for much of the year.

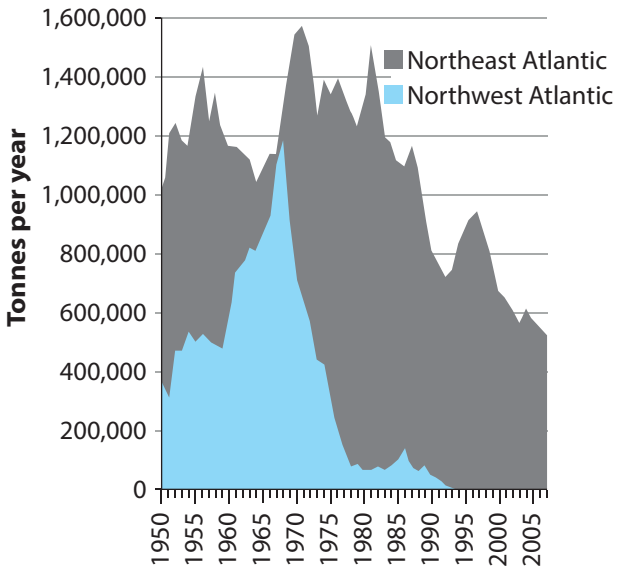


Figure 6: Commercial cod catch in the North Atlantic 1950–2007 (FAO Fishstat)

About 1.5 million people visit the region as **tourists** each year, a small number for such a vast wilderness, but large relative to the local population. The number of Arctic cruise ships in Greenland grew from 13 in 2003 to 39 in 2008 and further growth is expected as sea ice cover retreats. Most tourists travel by cruise ship. Whale, seal and bird watching are very popular but activities such as kayaking and trekking are increasing in popularity. Currently tourism is centered around Disko Bay off Greenland's west coast, the Barents Sea and the Alaskan coast.

Purpose built icebreaker vessels are generally required in the Arctic Ocean and **shipping** is only possible in the summer months. The Arctic Ocean does represent a major 'short cut' (of around 10 days sailing) for shipping between Europe and Asia, via one of two routes (Figure 7). As ice cover lessens, shipping routes are increasingly viable. In 2011 the 160,000 ton Suezmax-class Vladimir Tihkonov became the first supertanker to use the Northern Sea Route. Between 1995 and 2004, 43 ships sank in the Arctic, 22 were involved in collisions and 68 became grounded. A 2010 study estimated that by 2030 Arctic shipping routes could transport 1.4 million twenty-foot containers, rising to 2.5 million by 2050. There are concerns that increased shipping will **pollute** Arctic air and waters.

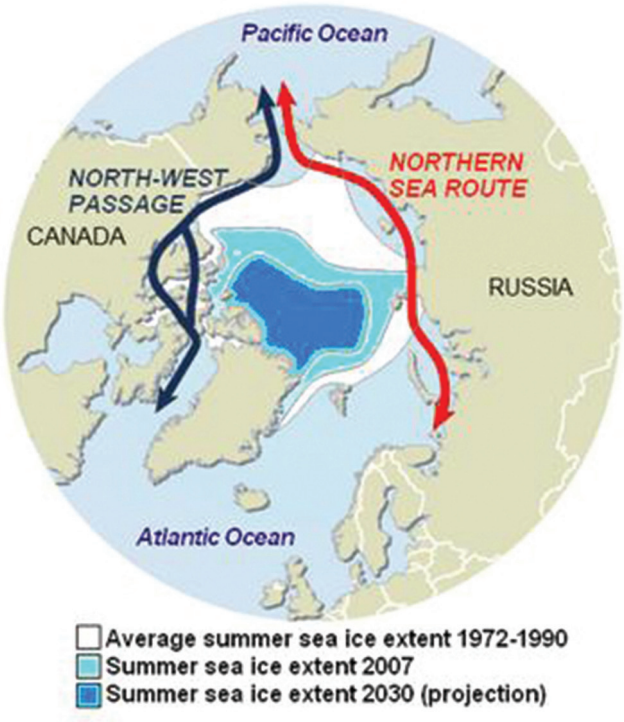


Figure 7: Sea ice and shipping routes

Arctic shipping is likely to increase due to increased **mineral and fossil fuel** exploitation. Oil has been exploited from Alaska's North Slope since its discovery in 1968. A major study by the USGS in 2008 estimated that the Arctic contained 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids. 84% of these resources are in **offshore** areas. On Baffin Island, in Canada, Baffinland Iron Mines Corporation plans to extract over $20 billion of iron ore (18–30 million tonnes per year) from an opencast mine at Mary River.

In some locations it is not entirely clear who owns parts of the Arctic Ocean. Under the United Nations Convention on the Law of the Sea (UNCLOS) countries can claim the right to exploit resources in an area 200 nautical miles beyond their coastline (called the Exclusive Economic Zone or EEZ). In the Arctic the extent of this EEZ is disputed in some cases. This combined with the mineral resources in the region has led to

increased geopolitical tensions and a renewed interest and activity in the region:

- 2002: Canada recommenced military exercises in the Arctic that are now conducted annually.
- 2003–2007: Norway built five Fridtjof Nansen class frigates.
- 2007: Russian submarine planted a Russian flag at the North Pole and Russia restarted long-range Arctic bomber patrols.
- 2009: USA released its National Arctic Policy placing Arctic security as the number one priority.
- 2009: Denmark published plans to create both an Arctic military command and an Arctic Response Force.
- In 2012, a Chinese icebreaker, the Xuelong, navigated the Northern Sea Route for the first time.

The Arctic's **changing climate** provides the context for many other changes in the region. The Köppen climate classification Tundra Climate area has shrunk by about 20% since 1980. Figure 8 is a summary of some of the 2005 **Arctic Climate Impact Assessment**'s key findings.

Average annual Arctic temperature has increased almost twice as fast as the rest of the world over the last few decades.	Habitats for polar bears, seals and some sea birds will shrink drastically and some species could become extinct.
The Arctic is expected to warm by 4–7°C over the next 100 years.	The tree line is expected to move northwards and to higher elevations.
Insect outbreaks and forest fires are likely to increase as are the number of invasive alien species.	Caribou, reindeer and other land mammals will be affected by changes to food supply, migration routes and breeding grounds.

Figure 8: ACIA key findings

Managing the Arctic is a significant challenge. Three possible management approaches are outlined in Figure 9. They are supported by different **players**, who hold contrasting views on the future **management** of the Arctic.

1. Business as usual

This approach leaves the Arctic as it currently stands, with national governments responsible for:

- managing their own fish stocks, possibly by using quotas and other sustainable methods.
- deciding which areas of the Arctic to protect as National Parks or other types of protected area (in 2010 around 11% of Arctic land was protected).
- settling territorial disputes through bilateral agreements or supra-national organisations such as UNCLOS.
- self-regulation on environmental issues such as pollution control and meeting standards set down by international agreements such as MARPOL (International Convention for the Prevention of Pollution From Ships).

2. Arctic framework

The **Arctic Council** is the intergovernmental forum for issues facing Arctic governments and indigenous people of the Arctic. It has eight members (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, USA) and was set up by the 1996 Ottawa Declaration as a forum to promote cooperation among the Arctic States. It consults indigenous communities on issues such as sustainable development and environmental protection.

The Arctic Council could be made into a **Treaty-based organisation** with **regulatory powers** in order to directly manage issues such as shipping, territorial claims, fishing rights and quotas, and biodiversity management.

3. Arctic Global Sanctuary

At the 2012 Rio+20 Earth Summit, the environmental organisation Greenpeace launched a call to create a 'Global Sanctuary' in the Arctic stating that:

"The best way to maintain the peace there, is to make its resources off-limits. That is why we are campaigning for a global sanctuary and a ban on oil drilling and industrial fishing. Just like in Antarctica, we need an Arctic Ocean dedicated to peace and science. No country owns the Arctic. It should stay that way."

(Greenpeace International, campaign briefing, 2012)

The geographical extent of the Global Sanctuary would be the area more than 200 nautical miles from the coastlines of the Arctic States. Greenpeace envisages an **Antarctic Treaty** style agreement to leave this area untouched.

Figure 9: Three approaches to managing the Arctic in the future

View 1:

"Called 'America's Serengeti' for its tremendous biological productivity and diversity, the coastal plain of the Arctic National Wildlife Refuge is one of the most intact and untouched ecosystems in America."

National Audubon Society website

View 2:

"Since 1951 the Arctic has warmed roughly twice as much as the global average. In that period the temperature in Greenland has gone up by 1.5°C, compared with around 0.7°C globally. A 2°C increase in global temperatures would mean Arctic warming of 3–6°C."

The Economist, 2012

View 3:

"There isn't sufficient baseline information about Arctic marine waters to make informed decisions regarding the opening of fisheries in the Arctic. Arctic fisheries provide healthy food and a spiritual connection to the Inupiaq people who permanently inhabit the Arctic."

Comments of indigenous Alaskan people, 2009

View 4:

"The United States and Canada still disagree on the setting of the boundaries in the Beaufort Sea – an area of intense interest to oil drillers. Similarly, Canada has yet to resolve a dispute with Denmark over the ownership of Hans Island and where the control line should be drawn in the strait between Greenland and Ellesmere Island. Meanwhile the US and Russia still have a disagreement over the exact maritime border from the Bering Sea into the Arctic Ocean. A deal was signed with the then USSR, but Russia has refused to ratify it. All Arctic nations still have a major disagreement over who owns bits of the continental shelf in the Arctic Ocean, most particularly the 1,800 km Lomonosov Ridge. Claims are being submitted under the Law of the Sea Convention."

Guardian, 2011

View 5:

"In 2010, the loss of Arctic snow, ice and permafrost is estimated to have cost the world between US$61 billion and US$371 billion in lost climate cooling services. By 2050, the cumulative global cost is projected to range from US$2.4 trillion to US$24.1 trillion and by 2100, the cumulative cost could total between US$4.8 trillion and US$91.3 trillion."

Arctic Treasure: Global Assets Melting Away, Oceans North: Protecting Life in the Arctic Pew Environment Group, 2010

Websites for further research:

Website of Arctic Biodiversity Trends, part of CAFF (biodiversity working group of the Arctic Council): http://www.arcticbiodiversity.is/index.php/en/home

Website of the Arctic Climate Impact Assessment: http://amap.no/acia/

Greenpeace website: http://www.savethearctic.org/

Arctic Council website: http://www.arctic-council.org/index.php/en/