Arctic Bulletin

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Building in the Arctic p. 18–19

Contents

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Editorial

Wishful thinking

As the saying goes, you should be careful what you wish for, because you just might get it. The Arctic Council is an obscure but high-level forum for arctic governments, indigenous peoples and other stakeholders.

For the last six years, participants have wished for more political and media attention for the Council. This year that wish came true, though perhaps not as governments would have liked. Political conflicts over the Council's Arctic Climate Impact Assessment (ACIA) (see p. 5) drew global media attention and shone an uncomfortable spotlight on the Bush administration's efforts to water down an Arctic Council policy statement on arctic climate change.

ACIA revealed the strengths and weaknesses of the Arctic Council, and indeed other forms of arctic cooperation. The Council is able to produce ground-breaking, politically relevant scientific assessments, such as earlier reports on arctic pollution, ACIA and the Arctic Human Development Report (www.svs.is/AHDR/). These tell us pretty clearly what the problems are in the region and what is causing them. But when it comes to acting on the science, the Arctic Council is still a weak institution with a low level of political ambition.

As the ACIA policy process unfolded, government spokespeople tried to manage expectations by pointing out that climate policy is not made in the Arctic Council. The final version of the ACIA policy recommendations certainly proved that point. At the same time, one can ask why, then, Ministers agreed in 2000 to produce policy recommendations on climate change. And one can also ask why Ministers of Foreign Affairs, indigenous leaders, high-ranking government officials, and even observers need to meet on a regular basis in the Arctic Council if no policy-making will take place.

Five Foreign Ministers, two Ministers of Environment, the deputy Prime Minister of Greenland and the US Undersecretary of State showed up in Iceland in November for the fourth Arctic Council Ministerial. This high-level participation and the attendant media coverage were a record for the Council. They were also an indication that something politically relevant was happening – even if climate policy wasn't being made.

SAMANTHA SMITH
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There are many key arctic issues that are less politically sensitive than climate change. The Arctic Council could try to focus on these. Events, however, are overtaking both the region and the Council. Climate change will not go away. It will bring with it a host of new challenges, such as increased arctic shipping and disputes over marine territories. Oil and gas development in the region is increasing, and is projected to grow very rapidly over the next decade. And the Arctic's indigenous peoples are using their new-found political power to demand rights to manage resources and have a say in the region's development. In short, the Council may find it hard to ignore what is happening on the ground around the region.

WWF would like to make a few wishes of its own, too. We'd like governments of industrialised countries to follow the United Kingdom's example and commit to big, long-term cuts in carbon dioxide emissions. We'd like to see arctic countries live up to their commitment to create a circumpolar network of protected areas – a commitment that Ministers reaffirmed in November in Reykjavik. Finally, we'd like to see the Arctic live up to its huge potential as a region where people live in harmony with nature. This is the last place on Earth where sustainable economic development can still coexist with wildlife, intact habitats and vibrant communities.

Ministers and SAOs meet

The Arctic Council is the only circumpolar government cooperation in the Arctic. It covers environment and sustainable development issues, and includes the eight arctic countries, arctic indigenous organizations, and a wide range of observers, including WWF.

Every two years, arctic Foreign Ministers and indigenous leaders meet for the Arctic Council Ministerial, where countries agree on the Council's activities for the next two years. Between Ministerial meetings, Senior Arctic Officials (SAOs) – high-level representatives from the Ministries of Foreign Affairs – run the show and carry out Ministerial directives. The 2004 Ministerial was held in Reykjavik, Iceland on november 24.

Photo: Marita Oury, WWF Arctic Programme

Iceland hosted the Arctic Council Ministerial. Shown are Iceland's Minister for the Environment, Ms. Sigridur Anna Thordardottir, and Minister for Foreign Affairs, Mr. David Oddsson.

Ice sculpture of polar bear displayed by WWF at the Reykjavik Ministerial. The sculpture symbolically melted during the proceedings.

Photo: Marita Oury, WWF Arctic Programme

Protected areas – a bright spot for biodiversity

At the last minute, Ministers decided to renew and reinforce their 1997 commitment to creating a network of protected areas in the Arctic. This network, known as the Circumpolar Protected Areas Network (CPAN), has lain more or less dormant for the last five years. If completed, CPAN would fulfil some of the ambitious global protected areas targets under the Convention on Biological Diversity and the World Summit on Sustainable Development.

Arctic Climate Impact Assessment follow-up unclear

Though a number of ideas were floated for follow-up of ACIA, Ministers were unable to agree on next steps. There may or may not be a second climate assessment in ten years. The Senior Arctic Officials must appoint a focal point for follow-up of ACIA, but it's not clear what this person or group will do. The Arctic Council's working groups must review their activities in light of ACIA, and they have two years to do this and report back to Ministers.

From climate to oil and gas

ACIA states that human emissions of carbon dioxide are now the predominant cause of climate change in the Arctic. Oil and gas consumption is a major source of global CO_2 emissions. It's thus ironic that the new big assessment from the Council will look at the impacts of oil and gas development in the region – excluding climate change but including social and economic impacts, including benefits.

The Arctic Monitoring and Assessment Program (AMAP), a working group of the Arctic Council, leads the assessment. Lead countries are Norway and the US. From the start 18 months ago, the

Arctic countries miss opportunity

Arctic countries have failed to show leadership in their response to the Arctic Climate Impact Assessment (ACIA).

ACIA is the first full-scale assessment of the impacts of climate change in the Arctic. It shows that climate change is already having serious impacts in the Arctic, with dramatic and far-reaching changes to come unless countries reduce global carbon dioxide emissions (see pages 12–15).

Ministers of Foreign Affairs and Environment from arctic countries met in Iceland on November 24th, at the biennial Arctic Ministerial meeting, to sign off on a set of policy recommendations on arctic climate change.

The policy document notes with concern the impacts in the ACIA report and the important role that the Arctic plays in the global climate. It does not, however, support stronger mandatory measures to reduce CO_2 emissions, which are essential to avoid many of the impacts outlined in the report.

Samantha Smith, director of the WWF International Arctic Programme, said: "The arctic nations had an opportunity to show real leadership in response to

in Iceland

assessment has attracted significant interest from the US federal government, including the State Department. A team of authors, appointed by arctic countries and including oil industry representatives, has already produced first drafts. A symposium on oil and gas development in the Arctic will be held in Russia in the fall of 2005.

The Ministers directed AMAP to continue work on the assessment, for delivery in 2006. AMAP will also lead development of "effective measures" for oil and gas impacts. Given the difficulties producing policy recommendations on climate change, the Arctic Council may be in for another tough two years.

Finally ready for shipping?
Ministers directed another Arctic Council working group, Protection of the Arctic Marine Environment (PAME), to lead a "comprehensive Arctic marine shipping assessment" with Canada, Finland and the US as lead countries. This would be the second arctic shipping assessment under the Arctic Council. The first, led by Norway, was in the end whittled down to a "snapshot" of shipping issues.

The shipping assessment is timely, as is a commitment to taking a closer look at governance and management of arctic seas.

Stockholm Convention – so important that it should be ratified?
Ministers welcomed the entry into force of the only global agreement on persistent organic pollutants, the Stockholm Convention, and acknowledged its importance for the Arctic. However, neither the US nor Russia have yet ratified the Convention.

Nor did Ministers suggest any next steps after the completion of the Persistent Toxics Substances (PTS) project, a study led by the Russian Association of Indigenous Peoples of the North and AMAP. The PTS project found very high levels of toxic chemicals, particularly DDT and PCBs, in some Russian arctic indigenous communities. It also found health effects.

The PTS project report includes a number of recommendations that would help to reduce toxic exposures in these communities. These deserved endorsement from the Ministers and a commitment to follow-up, including funding.

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Report of the Senior Arctic Officials:
http://www.arctic-council.org/files/messageslistpage/1/SAO_REPORT.doc

Reykjavik Ministerial Declaration:
http://www.arctic-council.org/files/messageslistpage/1/MINISTERIAL%20DECLARATION%20241104.doc

ACIA and support bigger cuts in CO_2 emissions. They missed this opportunity."

But through the policy document, even the Bush Administration in the US has acknowledged what the scientists and people who live in the Arctic are telling us – climate change is real, it's happening quickly, and it's going to get worse unless we cut emissions."

Jennifer Morgan, director of WWF's Global Climate Change Programme, said:

"All of the arctic countries, except for the US, have already ratified the Kyoto Protocol, thus taking the first necessary steps towards cutting CO_2 emissions. We challenge them to take steps beyond these to save the Arctic, by committing to much deeper cuts at the next round of climate negotiations in December in Buenos Aires.

"As for the US, the Bush Administration must reassess its current climate change positions in light of this new science. It is time for the United States to take serious action on climate change."

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NEW WEBSITE FOR ARCTIC YOUTH

A new website for young people in the Arctic has just been launched. The website, *On Top of the World*, www.ookpik.org, provides a forum for youth to chat about ideas and issues unique to them. The website includes facts and stories about the circumpolar world, issues affecting the Arctic, information about conferences, work, internship experiences and travel opportunities.

POLAR BEAR REGULATION

WWF, the All-Russian Scientific Research Institute of Nature, the IUCN Polar Bear Specialist Group and the Association of Traditional Hunting of Chukotka, are developing regulations for the harvest and use of the Chukchi-Alaskan population of polar bears. The parties agreed on the need for community involvement in the management and protection of the polar bear population, and to restore those hunting traditions that help conserve natural resources.

NEW NOAA WEBSITE

A new US National Oceanic and Atmospheric Administration (NOAA) website is a useful resource for past and present arctic climate data. The website provides information about ice, land, climate, marine ecosystems and human effects, all within a historical context. The website is at: www.arctic.noaa.gov/detect/

ICELANDERS FAVOUR NEW NATIONAL PARK

An opinion poll, conducted by Gallup Iceland on behalf of the Iceland Nature Conservation Association (INCA), shows that 69.7 percent of Icelanders support a new national park, north of the Vatnajökull Glacier, 11.5 percent are opposed and 18.8 percent do not have an opinion.

And 66.6 percent are in favour of protecting Jökulsá á Fjöllum, the only glacial river left north of the glacier, 14.7 percent are against and 18.7 percent do not have an opinion. Arni Finnsson of INCA, said: "This is very strong public support in favour of conservation and for a new national park north of the glacier."

CORRECTION

In the last issue of the *Arctic Bulletin,* we incorrectly captioned the photo on pages 12–13. It showed the Mountain River, a tributary of the Mackenzie, in Canada's Northwest Territories. The photographer is Paul Nopper of Aerial Imaging & Video Adventures (AIVA) – apologies to Paul.

UPDATED CRUISE DATA AND REPORT AVAILABLE ONLINE

Some of the figurers in the last *Arctic Bulletin*'s article *Impact of cruise tourism on Svalbard* were changed after the *Arctic Bulletin* went to print. The full report including the updated figurers can be found in the publication section of the WWF International Arctic Programme's website, www.panda.org/arctic.

Photo: Miriam Geitz

Chukchi reindeer herders watch a cultural performance outside their yaranga (tent). Chukotka, Russia.

Chukotka set for tourism?

Chukotka is not yet a tourist destination, but both local Russian government officials and people believe the natural and cultural features of the region make tourism a real possibility.

Yet making a fledgling tourism industry beneficial for the local community and compatible with nature conservation remains a challenge.

This was the topic of a three-day workshop in Anadyr in September 2004, organised by WWF, where experts on arctic ecotourism from Sweden, Canada and Alaska, shared their knowledge and exchanged experiences with local entrepreneurs, community representatives, cultural institutions and NGOs.

Discussions focussed on community involvement, training local people, product development and delivery, as well as the importance of protected areas and spatial planning for long-term sustainable tourism activities.

Discussions were summarized in a document suggesting practical steps and concrete activities, but also policy decisions that support sustainable tourism in Chukotka. The document will be available on www.panda.org/arctic early in 2005.

The Chukotkan government, which supported the workshop as part of its training program for local people, is also active in marketing the region abroad.

Miriam Geitz, tourism officer for the WWF International Arctic Programme, said: "Interest from travellers to come to Chukotka seems to be growing. However, to make this interest a much-needed contributor to the local economy will not only require good tour operators but also a commitment to conservation and planning security from authorities."

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US election

The recent elections in the US could have profound impacts on conservation initiatives in Alaska.

With the election of former oilman President George W. Bush to a second term, proponents of oil development have redoubled their efforts to persuade Congress to pass legislation authorising drilling in the coastal plain of the Arctic National Wildlife Refuge.

The Bush Administration also is opening vast areas in the National Petroleum Reserve-Alaska and offshore in the Beaufort Sea to oil and gas leasing.

More Republicans were elected to Congress giving the President additional allies for his pro-development agenda.

Senator Lisa Murkowski was elected to a six-year term after

Crackdown on

Poachers in Russia suffered a setback recently when the Russian government, with support from WWF, carried out anti-poaching raids in the north-eastern Russian province of Yakutia (Sakha Republic).

Twenty-one poachers were fined and further legal action taken against eight for violations of hunting and fishing laws. Two criminal cases have been started against poachers for illegal hunting of wild reindeer and brent geese, and illegal fishing.

In one raid, inspectors visited the village of Chokurdakh where they examined fishing boats and fishing grounds. Fishermen and locals were prosecuted for minor violations.

Inspectors also prosecuted a fisherman from Russian Uste, who was found with wild reindeer carcasses, and wolverine and arctic fox skins.

Another fisherman from Yakut-Zelye was found with wild reindeer carcasses, brent geese, bean geese,

may spell trouble for Arctic

serving in the US Senate for two years, thanks to an appointment by her father, former Senator and now Alaska Governor Frank Murkowski.

Both US senators from Alaska, Governor Murkowski and Republican Don Young in the US House of Representatives, are outspoken and tireless advocates for expanding oil development in the State, especially on the North Slope, where the infrastructure is already in place around the vast oilfields near Prudhoe Bay.

The Alaska delegation has considerable clout in Congress. They are members of the Republican party that controls the congressional schedule and agenda.

Conservationists anticipate the first votes on legislation to open the Arctic Refuge to come early in 2005 when the House and Senate consider budget legislation.

In recent years, proponents of refuge drilling have been unsuccessful in their efforts to include a provision in the budget bill to allow development in the Reserve. The Senate, by a narrow margin, has twice voted against drilling.

However, with the election of several new senators who have publicly stated their support for developing the Refuge, conservationists face an uphill battle to block a drilling bill.

But the conservation community and a bipartisan group in Congress are determined to do everything possible to stop development legislation from being sent to the President for his signature.

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Oil companies moving ahead in Alaska's North Slope

■ BP and Conoco recently announced plans to continue exploration and development of oil and gas reserves in Alaska's North Slope. BP announced that it will spend over ten billion dollars on capital projects near existing infrastructure in the next decade. Conoco will be investing up to $500 million in current projects and will be exploring for new reserves as well. BP and Conoco run all the North Slope oil fields. With the Republican boost after the last election, the US government and oil companies will be pursuing an aggressive agenda of exploration and development in Alaska's environmentally sensitive North Slope, as well as trying to open the Arctic National Wildlife Refuge.

Russian poachers

white-fronted geese, and Siberian white salmon.

The anti-poaching raid was made up of the inspection team of the Ministry of Nature Conservation (Yakutia) and inspectors from the State Fishing Inspection and Ministry of Interior Affairs of Yakutia.

The anti-poaching inspectors covered more than 3,100 square kilometres during their raids, including the Katalyk Resource Reserve. The reserve is one of the largest in the Russian Arctic, the site of the largest mass moulting of geese in the region, and the nesting place of the endangered Siberian white crane.

A land of rivers and lakes, Yakutia is one of the most inaccessible places on Earth, so government officials used motorboats, travelling up the Indigirka River and its many tributaries to the coast of the East Siberian Sea.

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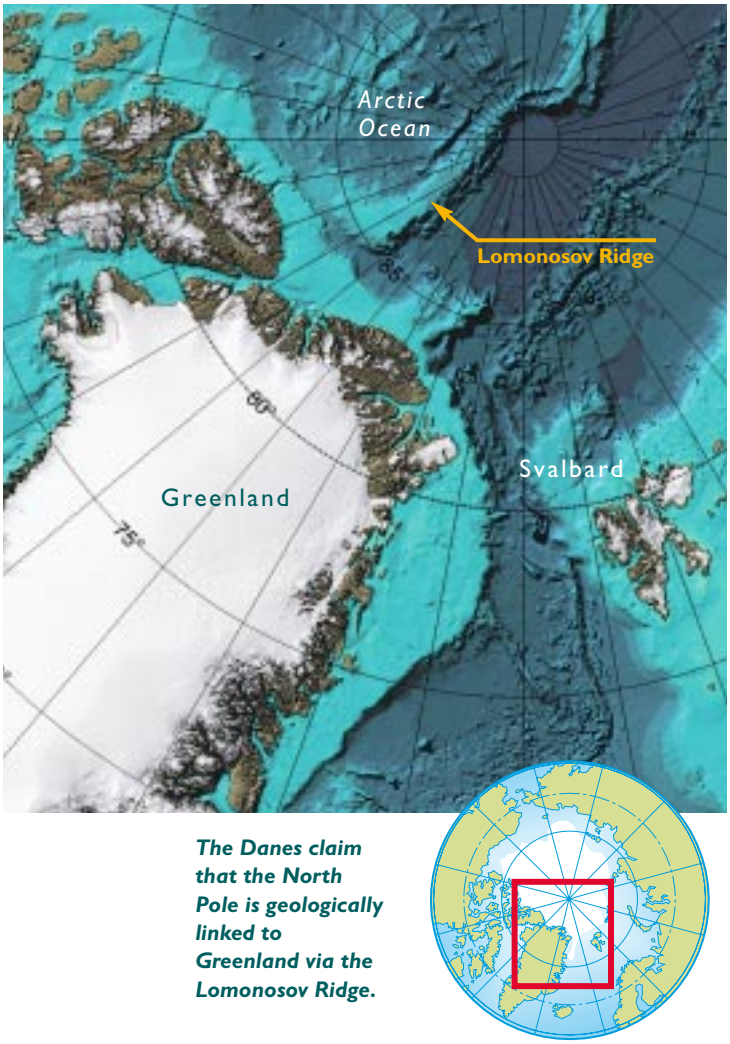
WWF supported a raid on poachers in the Russian province of Yakutia.

Denmark claims North Pole



NOAA/ National Geophysical Data Center

The Danes claim that the North Pole is geologically linked to Greenland via the Lomonosov Ridge.

Denmark has declared its intention to claim the North Pole in an attempt to access valuable oil and gas rights.

The claim is based on the idea that the North Pole is geologically linked to Greenland via the Lomonosov Ridge. The Danish Science Ministry has announced a $25-million survey to support their claim.

Most arctic claims to territory fall under the United Nations Convention on the Law of the Sea (UNCLOS), as most of the region is ocean, albeit frozen. The sudden rush to claim territory in the Arctic is due to the finalising of the UNCLOS rules for continental shelf claims in 1999 and the realisation that the Arctic is melting, thereby improving access.

There is a ten-year time limit on territorial claims. Countries have from the date they ratified UNCLOS or the date that the rules came into affect, whichever comes later. Denmark ratified on November 16, 2004.

In 2001 the Russian Government attempted to claim the Lomonosov Ridge as an extension of Siberia. Denmark, Norway, Canada, and the US, all of whom are potential claimants to various arctic regions, contested this claim, which was rejected by the UN Commission.

An arctic treaty, similar to the treaty established in the Antarctic, would help to ensure that the arctic region is adequately protected and not subject to ongoing land grabs in an attempt to access resources.

Samantha Smith, director of the WWF International Arctic Programme, says, "We're seeing a growing focus on and fight for the resources in the Arctic, especially as global warming makes the region more accessible."

Global warming is set to make northern sea routes and access to northern resources a viable option in the future.

Nigel Allan, nallan@wwf.no

Photo: Bryan and Cherry Alexander, www.arcticphoto.co.uk

World Heritage site is melt

The fastest moving glacier in the Arctic is melting, according to Danish and Greenlandic scientists.

The Sermeq Kujalleq glacier lies on the west coast of Greenland and runs into the Illulisat Icefjord. The Icefjord became a UNESCO World Heritage site recently.

In 2002 inhabitants of Ilulissat noticed an unusual amount of detached ice at the mouth of the Icefjord. Then in 2003, the Geological Survey of Denmark and Greenland (GEUS) confirmed that icebergs had broken away from the front of the glacier which floats on the Icefjord.

In the last two years, locals have noticed a build up of detached ice in Illulisat Icefjord due to the increased melting of the Sermeq Kujalleq glacier.

Studies of satellite images from 2001 to 2003 confirmed that the glacier is retreating. Since March 2002 the Icefjord has been breaking up and by May 2003 the glacier front was 11 kilometres east of its normal winter position.

According to the recently released Arctic Climate Impact Assessment (ACIA), the area of the Greenland Ice Sheet that is melting has increased about 16 percent from

Contaminated food

Chemical contamination levels in some Russian arctic indigenous communities are above average, according to a new report.

People in this communities become contaminated from chemicals in the traditional food they eat and also from exposure to old pesticides and paints.

Chemicals used and produced in distant regions of the world reach the Arctic by ocean and air currents.

Blood and breast-milk samples in four Russian indigenous communities were tested for polychlorinated biphenyls (PCBs), pesticides including dichlorodiphenyltrichloroethane (DDT), hexachlorocyclohexane (HCH), hexachlorobenzene (HCB), and the heavy metals lead and mercury.

The study's major sponsors were the Arctic Monitoring and Assessment Programme (AMAP), the Russian Association of Indigenous Peoples of the North (RAIPON), and the Global Environmental Facility (GEF). WWF also supported the study.

The study sponsors and the indigenous communities are now exploring ways of reducing chemical exposure. Workshops will be held in the four communities.

The Stockholm Convention – an international agreement developed in response to increasing concern about the global spread of hazardous chemicals – severely restricts or bans PCBs, HCB, and DDT. HCH is also banned in many countries.

However, past contamination of the environment, and some continued exposure to old pesticides and paints, means arctic peoples continue to be threatened by these chemicals.

Brettania Walker, toxics officer with the WWF International Arctic Programme, said: "The study results serve as a painful reminder that exposure sources don't immediately end when a hazardous chemical is finally banned.

"Passing a protective version of the European Union's REACH chemical legislation is one step we can take to prevent a similar tragedy related to chemicals in current use, ensuring that the most hazardous chemicals are removed from the market or never make it to the market in the first place."

The full report, *Persistent Toxic Substances, Food Security and Indigenous Peoples of the Russian North*, is available on AMAP's website at www.amap.no.

Brettania Walker bwalker@wwf.no

Photo: Bryan and Cherry Alexander, www.arcticphoto.co.uk

Alexei, a Nenets boy, coils his lasso as he stands by a reindeer corral, Yamal, Siberia, Russia. A new study has found above-average levels of toxic chemicals in individuals of some Russian arctic indigenous comunities.

ing

1979 to 2002, an area roughly the size of Sweden. The area of melting in 2002 broke all previous records.

A significant melting of the ice sheet will have major implications for the water levels of the world's oceans.

The Sermeq Kujalleq Glacier moves at a rate of 30 metres per day and is the fastest moving glacier outside of Antarctica. It is also one of the few glaciers through which the Greenland Ice Sheet reaches the sea.

The GEUS have recently launched a book about the Illulisat Icefjord, which is available through their website at www.geus.dk.

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Cod wars

A decline in sea ice could mean arctic cod will be replaced by the larger Atlantic cod, according to new research.

Scientists aboard the Canadian ship *Amundsen*, who recently returned from a one-year research mission to the Arctic, carried out the research.

According to Professor Louis Fortier of Université Laval, director of the Amundsen mission, the migration of the larger Atlantic cod northward could have dire consequences for seals, whales and polar bears which rely on arctic cod as a major food source.

"We found a zillion new discoveries, but this may be among the most important," said Fortier. Algae, which form on the underside of the sea ice, are the major food source for crustaceans that are eaten by arctic cod.

A decline in sea ice will mean less algae and therefore less arctic cod. Atlantic cod are too large for most seals and birds to eat.

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Arctic University going strong

The University of the Arctic has grown significantly since its launch seven years ago. But it now needs strong financial backing to continue to develop and deliver programmes.

At the recent Arctic Council meeting in Reyjavik, Iceland, University director Lars Kullerud delivered a report highlighting the achievements of the university to date.

These include the north2north programme which allows higher education students to live and study in other arctic countries, and the Bachelor of Circumpolar Studies, which has been running for two years and has 196 students enrolled.

The University is also in the process of developing new curricula based on the Arctic Human Development Report (AHDR) and the Arctic Climate Impact Assessment (ACIA).

Both the outgoing Icelandic chair and the incoming Russian chair recognised the contributions made by the University. In his statement, Russia's Minister of Foreign Affairs mentioned the University as a priority area, particularly for indigenous peoples of the Arctic.

Outi Snellman, deputy director of the University, said: "The University looks forward to working closely with the Arctic Council and the Russian chairmanship on enhancing educational opportunities in the North.

"Already, we have concrete plans for increased cooperation with the Russian higher education authorities as well as our members, the Russian Association of Indigenous Peoples of the North (RAIPON) in particular."

The university is a cooperative network of universities, colleges, and other organisations. It has 72 member institutions around the Arctic.

Nigel Allan, nallan@wwf.no

WWF Murmansk office

WWF's conservation work in the Barents Sea was boosted in November by the official opening of a new WWF office in Murmansk, North-West Russia.

The office will be a base for a variety of projects focused on biodiversity in the region and on awareness-raising about the natural values and threats to them.

The Barents Sea is one of the most productive marine ecosystems in the world and among the most biologically diverse in the Arctic. It is Europe's last large, clean and relatively undisturbed marine ecosystem.

Its cold but shallow waters teem with life. It is home to some of the world's largest fish stocks, seabird colonies and spectacular coral reefs. There are also important populations of whales, polar bears, walrus and seal.

However, the Barents is also at risk from oil and gas development, over-fishing, nuclear waste, climate change, toxic chemical contamination, introduced species, increasing shipping and aquaculture.

To address these threats, WWF believes that it is essential to work locally with people who live in the Barents region, in addition to working internationally.

At the opening ceremony in Murmansk, Samantha Smith, director of the WWF International Arctic Programme, said: "The Barents region has incredible natural values, including the world's largest populations of cod, herring and wild Atlantic salmon.

"WWF looks forward to working with people in the region to conserve these values for future generations."

Rune Aasheim, Norway's General Consul in Murmansk, added: "The nature of the Barents Sea is important, not only for Russia and Norway, but also for the whole world."

The Murmansk office is financed by the Norwegian Barents Secretariat, the Norwegian Government as well as WWF-Russia, WWF-Norway and WWF International.

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New Barents team

WWF's Barents Ecoregion team is now complete.

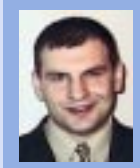
WWF's new office in Murmansk has a two-man conservation team. Mikhail Kalentchenko is project leader and Oleg Sutkaitis project co-ordinator.

Before joining WWF, Mikhail was head of the International Section of the Murmansk Marine Biology Institute (MMBI), then, after completing a law degree with the Murmansk Technical University, he became an in-house lawyer with MMBI. He joined WWF in June 2004.

Oleg joined WWF in April 2004. He has a degree in forestry and park economics from the Archangelsk State Wood Technology Institute and worked for the Svanhovd Environmental Center in Norway and the Ministry of Natural Resources of Russia in the Murmansk region before joining WWF.

The overall leader of the Barents Sea Ecoregion Programme is Dag Nagoda, based with the WWF International Arctic Programme in Oslo, Norway. Dag has headed the Programme for the last two years. Before joining WWF, he worked for the Norwegian NGO, The Future in Our Hands.

Dag Nagoda, leader of the Barents Sea Ecoregion Programme



Mikhail Kalentchenko, project leader

Oleg Sutkaitis, project co-ordinator

White Sea hope

A community-based pilot project on the White Sea coast in north-west Russia has set out to manage local resources sustainably. Vassily Spiridonov **and** Alexander Tzetlin **report.**

For decades, Russia's centrally-planned economy alienated local communities from the management of their own resources. Coastal resources were no different. Coastal biodiversity and landscapes became vulnerable to poaching, forest fires, the destructive impacts of unmanaged tourism, pollution and dirty industries.

Today, little has changed. Federal authorities in the Russian Federation remain focused on macroeconomic matters, and overlook local problems. Meanwhile local administrators and communities face poverty, lack of proper funding and no expertise to make a bad situation better. New administrative reforms and legislation, introduced since President Putin's re-election in spring 2004, raise further questions.

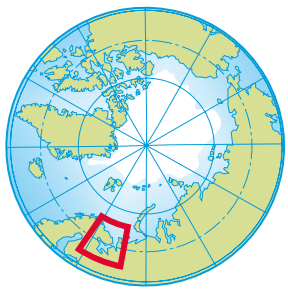
In the Russian North – the coastal areas of the Barents and White Sea, Lake Onega, the Onega and Dvina rivers, and the Pechora basin – this centralistic approach goes against the traditions of coastal resource management. Traditionally usage has been based either on self-governance or on a comprehensive policy by regional stakeholders, such as monasteries, running economic activity across an entire area.

Now, however, there's an opportunity to put local communities back in charge of their own local coastal resources, motivating them to prevent destructive practices and to promote sustainable coastal development. A possible route forward is to develop pilot projects, which will, in time, allow further dissemination of experiences and lessons learned.

One such pilot project has been established in the Barents Sea Ecoregion, in the Chupa Inlet area on the Karelian Coast of the White Sea. It's proving a good site for development of a new community-based approach to coastal management.

The project was initiated by an alliance of the Biodiversity Conservation Centre (Moscow), WWF-Russia and the Coastal Union (EUCC). The Lighthouse Foundation (Hamburg) provided support for the preliminary phase of the pilot project.

Source: Online Map Creation, Martin Weinelt



Several initiatives have so far been discussed with local stakeholders, and a Coastal Council has been established, which is intended to be a tool for integrated coastal development at the community level. Inside this new Council, people can look for solutions to the problems of how to improve coastal management, including fisheries, tourism, spatial planning, and harbour development. And they can promote the complementary use of coastal resources, such as sustainable aquaculture

In May 2004, an Information Centre for the Council was opened in Chupa, to establish a 'feedback mechanism' between visiting users of the coastal zone, such as tourists and anglers, and other kinds of visitors, including potential investors.

Information brochures on water birds, marine animals, fish, coastal plants, forest regulation and small boat safety were published with maps of the local area. And each brochure contains simple rules, which visitors to the coast must follow to help minimise threats to coastal nature.

In separate projects local children have linked up with staff from marine biological stations belonging to St Petersburg University and the Zoological Institute of the Russian Academy of Sciences in ecological summer schools. Children learned about White Sea ecology and took part in a project to assess the impact of tourism on the coast.

Despite a positive start, much work remains. Key priorities are how to protect the coast from the impact of visitors, including threats such as the degradation of the coastal landscape where tourists camp, and the risk of forest fires. Another challenge is how to involve more local people in providing services and obtaining benefits from tourists.

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The big melt

The Arctic Climate Impact Assessment (ACIA), produced by more than 250 scientists and indigenous people for the Arctic Council, provides incontrovertible proof that climate change is happening in the Arctic. Tonje Folkestad**, the WWF International Arctic Programme climate officer, investigates.**

People with a stake in the Arctic expected the publication of the Arctic Climate Impact Assessment (ACIA) in November to be big, but perhaps even they didn't predict just how big. The dramatic findings of the report were covered by media across the world in November, from *The New York Times* to *The Australian*, causing anxiety amongst arctic governments and the Arctic Council itself, as officials, scientists and non-governmental organisations sought to either play down or play up the importance of the findings, and the role of any policy document that resulted.

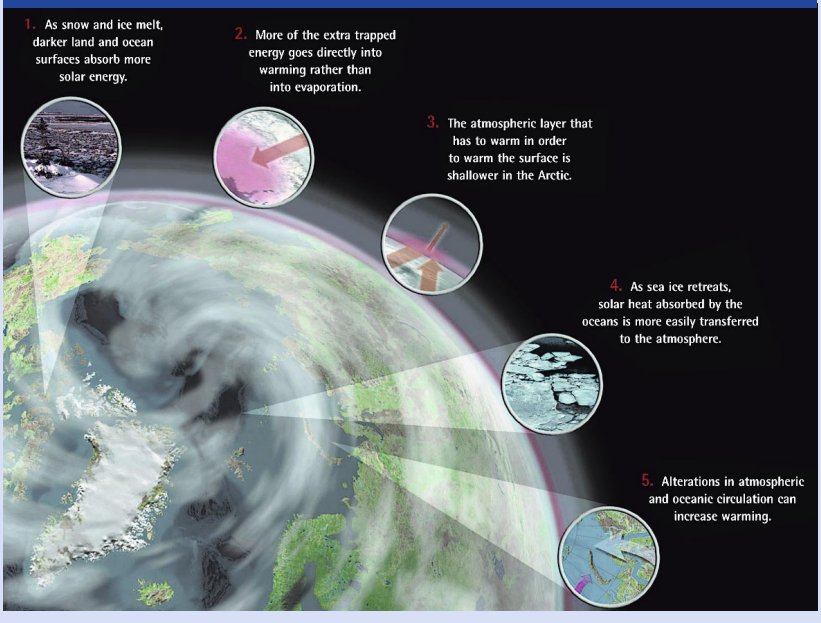
WWF welcomed the report but highlighted the hypocrisy of those governments that sponsored it because they failed to produce a policy document which supported stronger mandatory measures to reduce carbon dioxide (CO_2) emissions, essential to avoid many of the impacts outlined in the report (see story page 5).

In the battle of words that followed in the world's media, some commenta-

Key findings

The Arctic is extremely vulnerable to existing and projected climate change and its impacts. The Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes, many of which have already begun. Changes in arctic climate will also affect the rest of the world through increased global warming and rising sea levels.

Why does the Arctic warm faster than lower latitudes?



Graphic: ACIA/Map/Clifford Grabhorn

Arctic climate is now warming rapidly and much larger changes are projected.

- The annual average arctic temperature has increased at almost twice the lower latitude rate over the past several decades, with some variations across the region.
- Additional evidence of arctic warming comes from widespread melting of glaciers and sea ice, and a shortening of the snow season.
- Increasing global concentrations of carbon dioxide and other greenhouse gases due to human activities, primarily fossil fuel burning, are projected to contribute to additional arctic warming of about four to seven degrees Centigrade, about twice the global average rise, over the next 100 years.
- Increasing precipitation, shorter and warmer winters, and substantial decreases in snow and ice cover are among the projected changes that are very likely to persist for centuries.
- Unexpected and even larger shifts and fluctuations in climate are also possible.

Arctic warming and its consequences have worldwide implications.

- Melting of highly reflective arctic snow and ice reveals darker land and ocean surfaces, increasing absorption of the sun's heat and further warming the planet.
- Increases in glacial melt and river runoff add more freshwater to the ocean, raising global sea level and possibly slowing the ocean circulation that brings heat from the tropics to the poles, affecting global and regional climate.
- Warming is very likely to alter both the release and uptake of greenhouse gases from soils, vegetation, and coastal oceans.
- Impacts of arctic climate change will have implications for biodiversity around the world because migratory species depend on breeding and feeding grounds in the Arctic.

September sea-ice extent, already declining markedly, is projected to decline even more rapidly in the future. The three images above show the average of the projections from five climate models for three future time periods. Graphic: ACIA/Map/Clifford Grabhorn

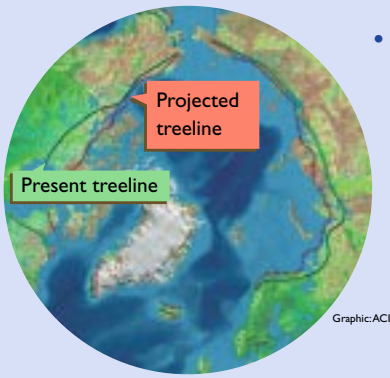
tors tried to undermine the report. Their efforts were largely unsuccessful: the majority of journalists grasped that this is the most significant report on climate change impacts so far produced.

WWF has reproduced the key findings here should anyone forget just how dramatic they are (see box.).

So what now? The arctic countries seem to be avoiding any further action to cut carbon dioxide emissions. As the ➤ p. 14

Arctic vegetation zones are projected to shift, bringing wide-ranging impacts.

- The tree line is expected to move northward and to higher elevations, with forests replacing a significant fraction of existing tundra, and tundra vegetation moving into polar deserts.
- More-productive vegetation is likely to increase carbon uptake, although reduced reflectivity of the land surface is likely to outweigh this, causing further warming.
- Disturbances such as insect infestations and forest fires are very likely to increase in frequency, severity, and duration, facilitating invasions by non-native species.
- Where suitable soils are present, agriculture will have the potential to expand northward due to a longer and warmer growing season and increased precipitation.



Graphic: ACIA/Map/Clifford Grabhorn

Animal species' diversity, ranges, and distribution will change.

- Reductions in sea ice will drastically shrink marine habitat for polar bears, ice-inhabiting seals, and some seabirds, pushing some species toward extinction.
- Caribou/reindeer and other animals on land are likely to be increasingly stressed as climate warming alters their access to food sources, breeding grounds, and historic migration routes.
- Species ranges are projected to shift northward on both land and sea, bringing new species into the Arctic while severely limiting some species currently present.
- As new species move in, animal diseases that can be transmitted to humans, such as West Nile Virus, are likely to pose increasing health risks.
- Some arctic marine fisheries, which provide food for the world and major contributions to the region's economy, are likely to become more productive, while northern freshwater fisheries that are mainstays of local diets are likely to suffer.

Many coastal communities and facilities face increasing exposure to storms.

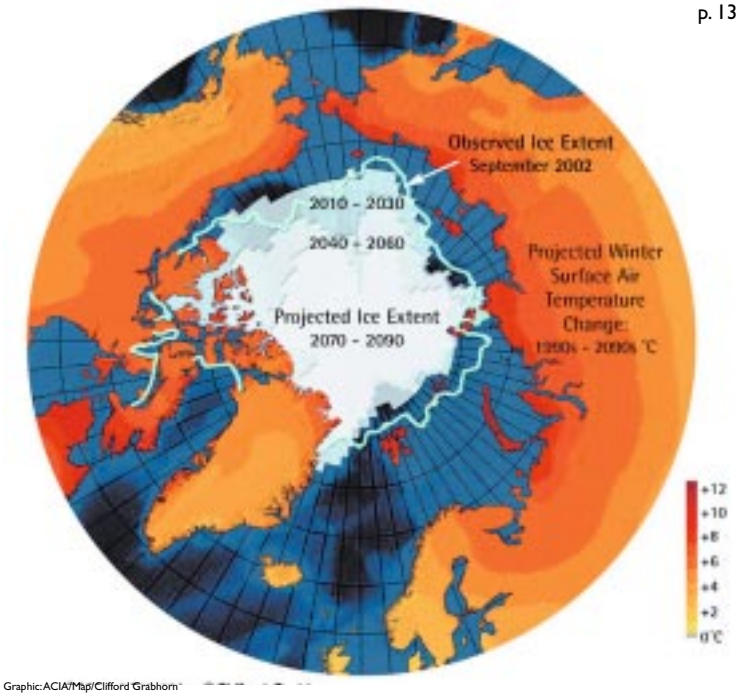
- Severe coastal erosion will be a growing problem as rising sea level and a reduction in sea ice allow higher waves and storm surges to reach shore.
- Along some arctic coastlines, thawing permafrost weakens coastal lands, adding to their vulnerability.
- The risk of flooding in coastal wetlands is projected to increase, with impacts on society and natural ecosystems.
- In some cases, communities and industrial facilities in coastal zones are already threatened or being forced to relocate, while others face increasing risks and costs.

Reduced sea ice is very likely to increase marine transport and access to resources.

- The continuing reduction of sea ice is very likely to lengthen the navigation season and increase marine access to the Arctic's natural resources.
- Seasonal opening of the Northern Sea Route is likely to make trans-arctic shipping during summer feasible within several decades. Increasing ice movement in some channels of the Northwest Passage could initially make shipping more difficult.
- Reduced sea ice is likely to allow increased offshore extraction of oil and gas, although increasing ice movement could hinder some operations.
- Sovereignty, security, and safety issues, as well as social, cultural, and environmental concerns are likely to arise as marine access increases.

➤ p. 14

Projected changes in sea ice and winter surface air temprature.



Graphic: ACIA/Map/Clifford Grabhorn

p. 13 ➤ *Arctic Bulletin* was going to press, WWF and indigenous people's organisations from the arctic were taking part in The Tenth Conference of the Parties of the UN Framework Convention on Climate Change (UNFCCC – COP10) in Buenos Aires from December 6th to 17th where they will continue to put the case for urgent cuts in carbon dioxide emissions, investment in renewable energy and energy conservation measures.

Arctic people are also aiming to team up with tropical islanders in the campaign against global warming. The proposed alliance between some of the hottest and coldest parts of the globe will lobby against industrial nations like the US, which has refused to sign the Kyoto Protocol on global warming, to cut emissions of heat-trapping gases.

p. 13 ➤

Thawing ground will disrupt transportation, buildings, and other infrastructure.

- Transportation and industry on land, including oil and gas extraction and forestry, will increasingly be disrupted by the shortening of the periods during which ice roads and tundra are frozen sufficiently to permit travel.
- As frozen ground thaws, many existing buildings, roads, pipelines, airports, and industrial facilities are likely to be destabilized, requiring substantial rebuilding, maintenance, and investment.
- Future development will require new design elements to account for ongoing warming that will add to construction and maintenance costs.
- Permafrost degradation will also impact natural ecosystems through collapsing of the ground surface, draining of lakes, wetland development, and toppling of trees in susceptible areas.

Indigenous communities are facing major economic and cultural impacts.

- Many Indigenous Peoples depend on hunting polar bear, walrus, seals, and caribou, herding reindeer, fishing, and gathering, not only for food and to support the local economy, but also as the basis for cultural and social identity.
- Changes in species' ranges and availability, access to these species, a perceived reduction in weather predictability, and travel safety in changing ice and weather conditions present serious challenges to human health and food security, and possibly even the survival of many cultures.
- Indigenous knowledge and observations provide an important source of information about climate change. This knowledge, consistent with complementary information from scientific research, indicates that substantial changes have already occurred.

Elevated ultraviolet radiation levels will affect people, plants, and animals.

- The stratospheric ozone layer over the Arctic is not expected to improve significantly for at least a few decades, largely due to the effect of greenhouse gases on stratospheric temperatures. Ultraviolet radiation (UV) in the Arctic is thus projected to remain elevated in the coming decades.
- As a result, the current generation of arctic young people is likely to receive a lifetime dose of UV that is about 30% higher than any prior generation. Increased UV is known to cause skin cancer, cataracts, and immune system disorders in humans.
- Elevated UV can disrupt photosynthesis in plants and have detrimental effects on the early life stages of fish and amphibians.
- Risks to some arctic ecosystems are likely as the largest increases in UV occur in spring, when sensitive species are most vulnerable, and warming-related declines in snow and ice cover increase exposure for living things normally protected by that cover.

Multiple influences interact to cause impacts to people and ecosystems.

- Changes in climate are occurring in the context of many other stresses including chemical pollution, over-fishing, land use changes, habitat fragmentation, human population increases, and cultural and economic changes.
- These multiple stresses can combine to amplify impacts on human and ecosystem health and well-being. In many cases, the total impact is greater than the sum of its parts, such as the combined impacts of chemical contaminants, excess ultraviolet radiation, and climatic warming.
- Unique circumstances in arctic sub-regions determine which are the most important stresses and how they interact.

"We are two of the world's most vulnerable areas," Sheila Watt-Cloutier, chair of the Inuit Circumpolar Conference (ICC), said of the low-lying islands, at risk from rising sea levels, and the Arctic, where the ice is melting.

"Linking up makes a lot of sense," Watt-Cloutier, whose organisation represents 155,000 people in Canada, Greenland, Alaska and Russia, said.

And, of course, despite the US refusal to endorse the Kyoto Protocol, it enters into force in February 2005, committing signatories to cutting emissions to five percent below 1990 levels by 2010.

Will this be enough to stave off the worst impacts of climate change in the Arctic? Unfortunately not. Deeper cuts in carbon dioxide emissions are needed urgently, and arctic countries continue to have a moral responsibility to ensure these are implemented.

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Photo: Peter Prokosch

Seasonal opening of the Northern Sea Route is likely to make trans-Arctic shipping during summer feasible within a few decades.

Who said what...

Jennifer Morgan, director of WWF's global climate change campaign, said:

"The big melt has begun. Industrialised countries are carrying out an uncontrolled experiment to study the effects of climate change and the Arctic is their first guinea pig. This is unethical and wrong. They must cut emissions of CO_2 now."

Bob Corell, ACIA chair:

"The arctic climate is warming very dramatically now, we have documented it scientifically. But what is fascinating for us is that it's doing so so much more rapidly than we had anticipated in the years ahead, it's already here."

US State Department official speaking to *the Washington Post*:

"We're bound by the Administration's position. We're not going to make global policy at the Arctic Council."

Pål Prestrud, vice-chair of ACIA:

"We are taking a risk with the global climate."

Samantha Smith, director of the WWF International Arctic Programme:

"Polar bears are walking on thin ice. If we can secure their future by cutting carbon dioxide emissions, we can secure the future of thousands of other species around the world."

Sheila Watt-Cloutier, chair of the Indigenous Circumpolar Conference:

"We find ourselves at the very cusp of a defining event in the history of the planet. The Earth is literally melting. Protect the Arctic and you will save the planet."

The Arctic Council and ACIA

■ The Arctic Council is an intergovernmental forum for addressing many of the common concerns and challenges faced by the arctic states: Canada, Denmark (including Greenland and the Faeroe Islands), Finland, Iceland, Norway, the Russian Federation, Sweden and the US.

The Arctic Council formally adopted the mandate of the Arctic Climate Impact Assessment (ACIA) in 2000. Two of the Arctic Council's working groups, the Arctic Monitoring and Assessment Programme (AMAP) and Conservation of Arctic Flora and Fauna (CAFF), in association with the International Arctic Science Committee (IASC), were given the task by the ministers to conduct the ACIA.

The goal of the ACIA was to evaluate and synthesise knowledge on climate variability and change and increased ultraviolet radiation, and support policy-making processes and the work of the Intergovernmental Panel on Climate Change. The assessment was to address environmental, human health, social, cultural and economic impacts and consequences, including policy recommendations.

■ For more on ACIA, including the full report, visit www.amap.no/acia/index.html

Importance of the Arctic to the global environment

A key finding of the Arctic Climate Impact Assessment (ACIA) is the connection between arctic climate change and the global climate. Arctic-influenced changes to global climate will have major implications for millions of people living in low-lying settlements and the migratory patterns of many species of birds.

According to Dr Robert Corell, chair of the ACIA: "The Arctic is experiencing some of the most rapid and severe climate change on earth. The impacts of climate change on the region and the globe are projected to increase substantially in the years to come."

The ACIA outlines three major mechanisms by which arctic processes can cause additional climate change to the planet. These involve changes in the reflectivity of the surface as snow and ice melt and vegetation cover changes, changes to ocean circulation as arctic ice melts, adding freshwater to the oceans, and changes in the amounts of greenhouse gases emitted to the atmosphere from the land as warming progresses.

According to ACIA: "Projections from global climate models suggest that the contribution of arctic glaciers to global sea-level rise will accelerate over the next 100 years, amounting to roughly four to six centimetres by 2100. Recent research suggests that this estimate should be higher due to the increase in arctic glacial melt during the past two decades.

Connected to the Arctic

"Over the longer term, the arctic contribution to global sea-level rise is projected to be much greater as ice sheets continue to respond to climate change and to contribute to sea-level rise for thousands of years.

"Sea-level rise has the potential for significant impacts on societies and ecosystems around the world. Climate change causes sea level rise by affecting both the density and the amount of water in the oceans."

As the water warms it will expand and less dense water takes up more space. According to ACIA, this phenomenon will persist for many centuries. The warming also increases melting of glaciers and ice caps, adding to the amount of water flowing into the oceans.

The average rise of almost three millimetres per year in global sea level during the1990s is ten to 20 times faster than the estimated rate of rise over the past few thousand years.

"Sea-level rise is projected to have serious implications for coastal communities and industries, islands, river deltas, harbours, and the large fraction of humanity living in coastal areas worldwide. Sea-level rise will increase the salinity of bays and estuaries. It will increase coastal erosion, especially where coastal lands are soft rather than rocky.

"Extensive coastal lowlands and delta areas contain important ecosystems that will be affected by the rising sea levels. Wetlands will be forced farther inland, and the incidence of coastal floods will increase." The low-lying islands in the Pacific Ocean, Atlantic Ocean, and Indian Ocean, are very likely to be severely affected.

"In Bangladesh, about 17 million people live less than one metre above sea level and are already vulnerable to flooding. In Southeast Asia, a number of very large cities including Bangkok, Bombay, Calcutta, Dhaka, and Manila (each with populations greater than five million), are located on coastal lowlands or on river deltas. In the United States, Florida and Louisiana are particularly susceptible to impacts of future sea-level rise."

Climate-related changes in arctic ecosystems will also have consequences for many species from around the world that depend on summer breeding and feeding grounds in the Arctic. Climate change will alter some of these habitats significantly.

Important breeding and nesting areas for migratory birds are projected to decrease sharply as the treeline advances northward, encroaching on tundra, and because the timing of bird arrival in the Arctic might no longer coincide with the availability of their food sources. A number of bird species, including several globally endangered seabird species, are projected to lose more than 50 percent of their breeding area during this century.

While the strongest effects of climate change will be felt in the far north, this is clearly a global problem. It is now the responsibility of all governments to develop policies that recognise the international implications of ACIAt.

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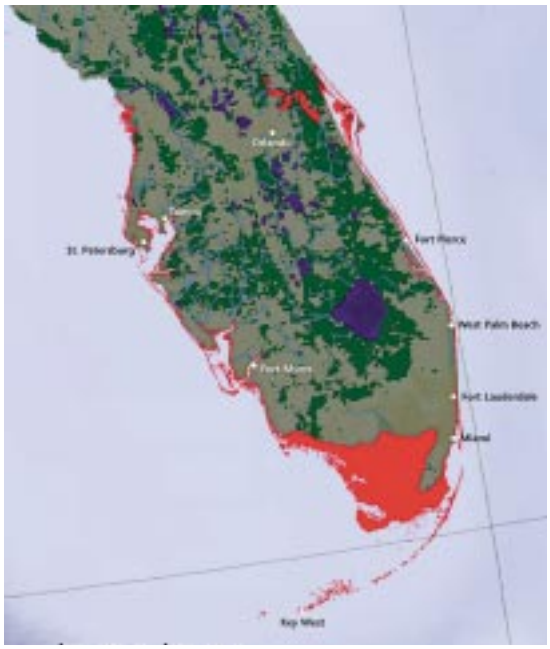

Low-lying areas in Florida.

Graphic:ACIA/Map/Clifford Grabhorn

Guillemot clue to climate change impact

The Brünnich's guillemot provides evidence that the marine ecosystem of northern Hudson Bay has changed over the past three decades. Tony Gaston **reports.**

Photo: Bryan and Cherry Alexander, www.arcticphoto.co.uk

Brunnich's Guillemot (Uria lomvia) raft on the water in foggy weather, Alkehornet bird cliffs, Svalbard, Norway.

The enormous expanse of arctic Canada, along with its very low human population density, combine to make it one of the least-studied areas on earth. The marine environment especially, locked in by ice for much of the year, is inaccessible to many forms of marine sampling. So information on changes in Canada's arctic marine ecosystems is very limited and fragmentary.

However, where biologists have a hard time going, marine birds encounter little difficulty. In summer, several millions of the Brünnich's guillemot, northern fulmars and black-legged kittiwakes pour into the seas around Nunavut to take advantage of marine resources exposed by retreating sea ice. Because these birds come to land at a small number of huge breeding colonies scattered throughout the Arctic, we can make use of them as convenient tools for assessing many aspects of the marine environment.

Studies of the Brünnich's guillemot, the most numerous marine bird in Canada's Arctic, have demonstrated several trends over the past three decades that illustrate very well what we may expect to see as climate warming continues. These birds are champion underwater swimmers, diving to depths of as much as 200 metres and remaining submerged for up to four minutes. They typically breed in places where the sea is ice-covered for several months of the year, and throughout most of their Atlantic range they feed principally on ice-associated fish and crustacea. While breeding, they may forage up to 200 kilometres from their colonies and hence sample broad areas of ocean otherwise almost inaccessible to biologists except by deploying hugely expensive research vessels.

At Coats and Digges islands, in northern Hudson Bay, near the southern edge of the species range in the Canadian Arctic, the Brünnich's guillemot has been studied since 1980. Since the start of the studies, we have found that the diet fed to nestlings has changed dramatically.

In the 1980s, nestlings were fed mainly arctic cod, along with a mixture of benthic species including snake-blennies and sculpins. However, in the 1990s and especially after 1994, we have seen an abrupt switch from arctic cod to capelin and Sandlance

At Digges Island the 300,000 breeding pairs of Brünnich's guillemot now deliver more than 90 percent capelin to their chicks. These changes have been simultaneous with a sharp reduction in the July ice cover in Hudson Bay and Hudson Strait. The fact that the arctic cod is an ice-adapted fish strongly suggests that ice cover ➤ p. 18

p. 19 ➤ changes have triggered the food web changes for which we find evidence in the Brünnich's guillemot diet.

Changes in diet have been simultaneous with a reduction in the growth rates of nestling Brünnich's guillemot and a decline in adult body condition during chick-rearing. Both of these trends suggest that the ecosystem changes that brought about the eclipse of arctic cod have had generally negative consequences for the Brünnich's guillemot. In this area, retreating ice seems to be bad for the birds.

At the other end of the Brünnich's guillemot range in Canada, at Prince Leopold Island, we have seen very different effects. Here, reproduction over the past 30 years has been poor, or even non-existent, in years of very heavy ice cover, but has been good in years of early ice break-up. Although there has been no trend towards earlier ice break-up in that area to date, we can confidently predict that amelioration of ice conditions around Prince Leopold Island, when it comes, should bring at least short-term benefits to breeding birds. To date, the diet at that colony continues to be more than 90 percent arctic cod.

The Brünnich's guillemot has provided us with a strong signal that the marine ecosystem of northern Hudson Bay has changed over the past decade. It seems very unlikely that the only thing affected has been the fish. Sea-ice carries with it a diverse flora of under-ice algae and diatoms and an associated fauna of under-ice zooplankton. This is the food web that supports the arctic cod and its main predators, marine birds, seals and toothed whales, such as beluga and narwhal.

As the marine environment moves towards a longer open-water season, the preponderance of ice-associated species will be reduced as we have seen, and replaced by species characteristic of more temperate waters. All parts of the food web must adjust to these changes: what we have observed is surely just the proverbial tip of the iceberg.

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Photo: Bryan and Cherry Alexander, www.arcticphoto.co.uk

Fur clad Inuk, Qaaviganguaq, builds an igloo that will be used as a hunting shelter. northwest Greenland.

Building for the Arctic

Arctic species have adapted to live in the North. Humans cope less well, but there are solutions. Professor Tang Lee**, an architect and building expert, looks at the challenges confronting an arctic architect.**

Compared to animals, humans are fragile and hairless creatures, who can only survive in a narrow range of environmental conditions. Clothing provides a modest degree of protection but winter clothing is bulky, uncomfortable and limits our flexibility. Humans, therefore, need a thicker, stronger and more durable enclosure. As environmental conditions become more inhospitable, the function of a building in which to live becomes more critical and must be designed, built, and maintained accordingly.

Environmental conditions typical of winter city locations, such as the Canadian Arctic, include extended periods of harsh weather, fluctuating temperatures, and shortened daylight hours. Climatic conditions affecting the performance of building materials include air temperature fluctuations, prolonged cold periods, wind effects, snowdrifts and water.

Fluctuations in air temperatures and the sun and air effects on a building cause thermal expansion and contraction. Since each building material has its own coefficient of thermal expansion, stresses are created between them. The building enclosure must accommodate such stresses by providing expansion joints and slip planes.

Wind chill is caused by cooling of the skin through evaporation. Air leakage through clothing, also cools the human body. Buildings do not lose much heat through evaporation, but air leakage through joints, cracks and holes play a significant role in total building heat loss; consequently, an air-tight enclosure is necessary, especially in the Arctic.

When water freezes it expands by about nine percent of its volume,

exerting high stresses within and between materials. It is important therefore to ensure the building enclosures situated in cold climates are designed and built to avoid any form of water entry. The presence of water in the building enclosure caused by water intrusion, rising dampness or condensation, is a prime ingredient for premature failure and deterioration. Furthermore, water is also an ingredient for mould propagation, resulting in serious health symptoms.

The scouring effects of wind can sweep the sidewalks and streets clean of snow. Snowdrifts pile up to collapse roofs because of excess weight. The effects of wind on snow movement and accumulation must be carefully analysed and accommodated by architects for the Arctic.

Snow avalanche from metal roofs can be hazardous. Horizontal ribs or rough textured materials can reduce the sudden release of snow or at least break up the mass of snow. Sometimes a covered walkway is the only protection from such avalanches.

Cold weather construction costs are higher than summer construction. Uncomfortable conditions, lower visibility, and bulky clothing reduce labour efficiency. More mechanical failures are expected in cold conditions. Building materials must be properly cured in costly heated temporary enclosures. Excavation is impossible unless the frozen soil is thawed. The special environmental conditions and short construction season in the Arctic requires better construction management.

Heat conduction can only be slowed down using insulation but will never stop. That is why it is critical not to place any heated building in direct contact with permafrost soil. The heat will eventually melt through the permafrost compromising the soil stability. So thick gravel beds or raised piles are used in permafrost conditions.

Although the arctic climate imposes certain limitations on building design features and construction activities, it is not impossible to accommodate. Techniques to mitigate the severe environmental conditions on the building enclosure have been developed.

The dome-shaped igloo has minimal exterior surface area for the volume contained so reduces heat loss and uses a minimal amount of building material. A tunnel shaped entrance blocks out wind and functions as an air lock. Inside the igloo are benches for sitting and sleeping, carved out of snow. The benches are raised above the floor to take advantage of stratified heat in the upper portion of the dwelling.

Buildings should copy the air lock entry of igloos as it prevents drafts and limits the amount of air leakage when doors are opened. Rotating doors typically seen in commercial buildings are a form of air lock. A connecting garage is an air lock.

There is no one building material that serves the many functions of the building enclosure. The building enclosure must be assembled with several materials, each with its own purpose and carefully positioned within the enclosure.

The trapped pockets of air in any materials such as layering strands of straw, paper, seaweeds, glass fibres, offer resistance to heat flow.

The short winter sun is known to cause seasonal affective disorder (SAD). Thus strategically placed windows to capture the low winter sun is important as is the use of full spectrum lighting.

Windows block rain and snow but not light and heat. A single pane of glass has the same thermal insulation value as one piece of paper and double glazing represents the insulation of only two pieces of paper. Higher efficient windows such as low-E and argon-filled and frames with thermal break are necessary. Windows should be located where it is most useful for daylighting purposes, solar heating and for views.

Solar heating is ideal for the Canadian Arctic due to its abundance of sunshine and the need for heating. Despite the reduced hours of the winter sun, there is substantial amount for solar water and space heating during autumn and spring. In the Arctic, solar collectors placed on the wall instead of the roof will capture the low winter sun and take advantage of reflected snow that can increase the amount of solar radiation by over 30 percent.

Winter exerts its effects on an individual's psychological or physical well-being. Many methods, such as design for daylighting, have been advanced to counter these effects. Architectural responses to improving the thermal comfort, lighting and air quality of arctic buildings are necessary to enhance occupant health, minimize energy consumption and extend the service life of building components.

■ Professor Tang Lee teaches in the Faculty of Environmental Design at The University of Calgary. He is also a registered architect, designing buildings that use solar energy, recycle waste heat and provide healthy indoor environments. Contact: lee@ucalgary.ca.

Lemming link to goose puzzle

The dark-bellied brent goose on the Taimyr Peninsula in northern Russia is in decline. A three-year study has set out to find out why. Bart Ebbinge **reports on the first year's field season.**

The Taimyr Peninsula in northern Siberia is a pristine, coastal area and contains the most important breeding grounds for the dark-bellied brent goose in the Arctic. Yet in the last ten years, the population of the goose has fallen from 300,000 to 200,000 individuals. To understand this decline better, Alterra, a Dutch research institute, and partners in Russia, have launched a three-year project to study the goose. Age-ratio assessments on the wintering grounds of the goose in western Europe seem to indicate that the decline in numbers is a result of breeding failure and not ➤ p. 20

Brent goose nest with a full clutch of six eggs. Note the abundant down.

Photo: Doortje Ebbinge-Dallmeijer

Siberian lemmings

Photo: Doortje Ebbinge-Dallmeijer

p. 19 ➤

increased mortality. Characteristic boom years, which occurred once every three years (and which followed peak breeding years for lemming), and in which winter flocks consisted of 30 to 50 percent of young birds, no longer occur. Now the annual reproduction is only about ten percent, whereas the annual mortality rate is 15 percent.

Our main focus for this year's field season was the Bird Islands in the Pyasina Delta. But we were only able to reach them 33 days after our departure from Amsterdam. A late spring, and lack of a stand-by helicopter in Dikson, forced us to wait. While we waited for transport, we worked 25 kilometres south of Dikson – from June 4 to July 1 – in the Willem Barents Station. In this area brent geese primarily nest in association with snowy owls.

The complicated relationships between brent geese, lemmings and lemming predators like arctic foxes, snowy owls and Taimyr gulls are widely known, but not yet fully understood. Brent geese can play one predator against the other, for example, by nesting within a territory of a pair of snowy owls, because the owls keep foxes at bay. However, snowy owls only nest when lemmings are sufficiently abundant, and the area around the Willem Barents Station (near Medusa Bay) has harbored nesting brent geese in lemming peak years such as 1994, 1996, 1999 and 2002.

Snowy owls, pomarine and long-tailed skuas, and rough-legged buzzards – all of which rely on lemmings as a food source and to breed successfully – were present this summer and defending territories. However, none of the snowy owls laid eggs until June 15. They normally do so by late May. When the snow finally melted some lemmings were seen, but 2004 was clearly not a lemming peak year. Presumably snowy owls can hear lemmings under the snow cover and assess their abundance. This probably made the owls wait and continue to defend their territories. In turn this meant that the brent geese decided to start to nest within several of the owls' territories. In mid-June most snowy owls had given up and left their territories. It was dramatic to observe how quickly the only arctic fox we'd seen scavenged the brent goose nests as soon as the owls disappeared.

Finally on July 1st two helicopters arrived from Norilsk and we arrived at our final destination: the field camp in the Pyasina Delta on July 3. Here we found there were more nesting brent geese than ten years ago, despite an overall decline in numbers. There were around 700 nests in between the 3000 pairs of gulls on the small Bird Islands whereas in 1990 to 1995 there were on average 300 brent goose nests. Moreover we regularly observed small flocks of non-breeding brent flying along the coast, apparently unable to find suitable nesting sites. Apparently these islands are the best option for the brent when predation pressure on the mainland tundra is too high. This is despite the presence of gulls that prey on goose eggs and newly hatched goslings.

Lemmings build up their peak numbers under a safe cover of snow, and it is possible that global warming has affected snow cover to such an extent, that lemmings have difficulty in reaching peak numbers. In the past, lemming peak years alleviated predation pressure on brent geese at least once every three years.

Taimyr is one of the few areas in the world where lemming cycles still regularly occur. Now that lemming cycles seem to be affected here as well, it is extremely important to monitor the phenomenon closely in order to understand the impact of global warming on these vulnerable arctic ecosystems.

Field work in the first year of the three-year study was organised by Yuri Mazurov of the Russian Heritage Institute from Moscow, Valery Chuprov, director of the Great Arctic Reserve from Dudinka, and Yakov Kokorev of the Extreme North Agricultural Research Institute from Norilsk and Alterra from Wageningen. Scientists from the French CEBC/CNRS from Chizé also took part.

A total of 16 people took part and two more arranged all the required permits, and complicated logistics.

The expedition was sponsored primarily by WWF, the Netherlands Arctic Programme (NAP-NWO), the agricultural counselor of the Dutch Embassy in Moscow, and a grant by the French Polar Research Institute to CEBC/CNRS.

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Pollution and polar bears: toxicology research in the Arctic

Polar bears and many other arctic species are contaminated with industrial and agricultural chemicals, the majority of which are produced and used in distant regions of the world, but which reach the Arctic via ocean and air currents. For the last 20 years, Andrew Derocher**, a professor at the University of Alberta in Canada, has studied polar bears.** Brettania Walker**, the WWF International Arctic Programme toxics expert, talked to him about what it's like to study toxic contamination of arctic wildlife.**

Brettania Walker: *What are your current research interests?*

Andy Derocher: The ecology of polar bears has been the main focus of my research for more than 20 years now and I am continuing my studies on both the natural and 'unnatural' life history of the bears. Within this context, I hope to continue studies on the effects of pollutants on polar bears but funding for such work is fairly limited recently. I have expanded my research on the effects of climate change on polar bears and have studies ongoing in the Beaufort Sea and in western Hudson Bay.

The Arctic is coming under increasing pressure from humans and my research tries to understand how humans are affecting arctic wildlife. I am interested in applying new forms of technology to studying the bears and in this context, I have students working on a variety of new means of understanding arctic ecosystems and how the bears play a role. I believe it is vitally important now to assist with training the next generation of scientists to work in the Arctic and my lab now has six students studying a variety of issues. This was a major part of my decision to enter academia after working as a research scientist until recently.

BW: *Why is it so difficult to determine how chemicals are affecting the health of wild animals? How do you handle multiple chemical exposures and other confounding factors?*

AD: The Arctic is a wildly dynamic part of the world and polar bears reflect this variation through large variation in aspects like condition, reproductive output, and cub survival rates. The areas where the bears live are remote and hugely expensive to study. We rarely have sufficient insight about populations and know even less about individuals, so trying to sort out natural climate variation from human-induced climate change or a cub dying from natural causes to one dying from pollution-linked causes is virtually impossible. Teasing apart natural variation from human-induced factors is extremely difficult. In practice, we can collect various insights on the bears and try to make a reasonable conclusion about the data we have.

Exposure to multiple chemicals is a very difficult issue to address. In the past, we have focused on the main organochlorines, such as PCBs and the pesticides, but we know that the polar bears are very good at breaking down many of the pollutants and that the bears can have very high levels of the breakdown products circulating through them at any given time.

We cannot be sure that we are looking at the right compound but if you can find a significant relationship between a pollutant and a parameter in the population or in individuals, then you are reasonably certain that the result is not spurious. However, with the toxic cocktail that polar bears carry with them, we can only guess at the possible synergetic effects.

➤ p.22

Photo: WWF-Canon/Tanya Petersen

Andy Derocher, with tranquillized polar bear, which will be blood and fat tested, and radio-collared, Svalbard, Norway.

p. 21 ➤ **BW:** *What sorts of biomarkers are needed to study health effects in wildlife? How do you develop these? What are the difficulties?*

AD: We are still trying to develop biomarkers for polar bears. This is an area of research that has fallen behind the documentation of levels and the discovery of new compounds. Much of the research on the immune system or hormones that has been done could yield biomarkers, but monitoring the effects of pollution on polar bear populations is limited and we usually only consider levels. The assumption is that if levels are increasing, we have a problem and that if they are decreasing, then things are getting better. Unfortunately, we do not know the pollution levels at which polar bears are unaffected so monitoring levels provides limited insight. On the plus side, decreasing levels is likely to be good news but given that all wild polar bears are polluted, we do not know the natural state so the baseline is missing.

Studying the health of any wildlife population is difficult but is exacerbated by the difficult conditions in the Arctic. For example, we know that polar bears with more pollution have weakened immune systems and we know that polar bears are exposed to a variety of diseases. When we catch a bear and takes samples, however, we are only looking at the survivors. We have no way of knowing if we are only looking at those animals that are still in good enough condition, or have low enough pollution levels, to deal with the disease and perhaps many others have died. These sorts of biases are expensive to remove. Working with a number of individuals followed over time using satellite technology is one means of dealing with this but even then, if a radio stops transmitting, we cannot separate a failure in technology from a mortality unless we can travel out to the location which is impossible for much of the polar winter.

BW: *What is special about the polar bear's ability to break down chemicals when compared to other arctic species?*

AD: Polar bears appear able to break down many of the pollutants in their diet. The downside to this is that the metabolites are also active in the body and may affect the bears. Some research suggests that these metabolites are more active than the parent compounds and if so, this could be a problem for the bears, particularly when they are fasting. A pregnant female polar bear begins fasting for four to six months when she enters a den in the autumn. During this time, she relies on stored fat for energy. Polar bear cubs are born extremely altricial (poorly developed) and only weigh about 600 grams at birth. The cubs have to grow up to about 10 kg before the mother can leave the den and take them out onto the sea ice again. From the moment of conception, these cubs are exposed to a variety of pollutants and many of these are transferred to the cub during development. Milk from their mothers is highly polluted and while it is an opportunity for the mother to offload some of her pollution, it is inadvertently dumped into their offspring. The long-term effects of pollution exposure on polar bears is unknown but it is hard to imagine that cubs with highly polluted mothers are unaffected.

We know that polar bears with more pollution have weakened immune systems and we know that polar bears are exposed to a variety of diseases.

BW: *Which arctic species might serve as the best models to study the effects of contaminants?*

AD: The marine system is far more impacted than terrestrial habitats so from the outset, marine species, or species partially reliant on the marine system, are the logical choice. Whales and seals are difficult to catch and follow. Arctic fox and birds such as the glaucous gull are a good choice given that they are abundant and can be reared or held in captivity. Simple correlative studies provide limited insight. Polar bears are a logical choice for some studies given that they can be reliably caught and followed over time and have very high levels of many pollutants. On the down side, all polar bears are polluted so it is difficult to obtain a control (non-polluted) sample to compare to.

Further, because polar bears are able to metabolize many pollutants, some like the polybrominated flame retardants are found at lower levels in polar bears than other species such as the white whale. In summary, there is no single species that can be used but polar bears do draw a lot of public attention and can be used to raise awareness of the issues.

BW: *How do you think the recent entry into force of the Stockholm Convention will affect the Arctic and its wildlife?*

AD: International conventions are a bright light on the horizon. The vast majority of pollutants in the Arctic come from the developed and developing countries at lower latitudes and unless people in these areas deal with the issues, it is impossible to be optimistic. At the heart of it, I am optimistic that we can create a sustainable lifestyle: it would be too painful to think otherwise. It will take a renewed vision that is often obscured by short-term objectives but there is a will.

BW: *What are your views on the European Union's proposed REACH chemical legislation? What other solutions or actions to deal with the problem of long-range pollution of the Arctic do you think are needed?*

AD: The REACH legislation will have wide ranging impacts on how human beeings interact with the planet. Long-range pollution is a concern for all human beeings and the leadership shown in this legislation is the sort needed to improve living conditions for all. Existing legislation is inadequate and bold initiatives are needed. This is an ongoing process and this is just part of the process. People will have to accept that the costs for the assessments will become part of the price they have to pay but in the long term, a healthier planet with less polluted ecosystems and healthier citizens will far outweigh the costs of implementation and testing.

Forthcoming arctic meetings & events

Arctic Council events

CAFF Management Board Meeting
WHERE: Helsinki, Finland • WHEN: February 1–3 • CONTACT: caff@caff.is

ACIA Presentation, and Arctic Climate Workshop
WHERE: St. Petersburg, Russia • WHEN: February 14–16 • CONTACT: caff@caff.is, amap@amap.no

AMAP Oil and Gas Assessment Expert Group Meeting
WHERE: Helsinki, Finland • WHEN: February 16–18 • CONTACT: amap@amap.no

AMAP Extended Board Meeting, (provisional)
WHERE: Helsinki, Finland • WHEN: February 17–18 • CONTACT: amap@amap.no

Senior Arctic Officials meeting
WHERE: Yakutia, Russia (provisional) • WHEN: April/May (provisional) • CONTACT: ac-chair@mid.ru

Conferences and workshops

Science and Education Objectives for a Seafloor Cabled Observatory on the Beaufort Shelf, Alaska NSF-Supported Community Meeting
WHERE: Barrow, Alaska • WHEN: February 7 – 8 • CONTACT: Bernard.Coakley@gi.alaska.edu

Alaska Forum on the Environment 2005, and Arctic Observation Network meeting,
WHERE: Anchorage, Alaska • WHEN: February 7–11

ASLO 2005 Aquatic Sciences Meeting
WHERE: Salt Lake City, UT • WHEN: February 20 – 25 • CONTACT: http://www.aslo.org/meetings/slc2005/index.html

Remote Sensing of Snow and Glaciers – Important Water Resources of the Future
WHERE: University of Bern, Switzerland • WHEN: February 21 – 23
CONTACT: swun@giub.unibe.ch or thomas.nagler@enveo.at

Western Regional Science Association 44th Annual Meeting
WHERE: San Diego, California • WHEN: February 23 – 26
CONTACT: http://www.u.arizona.edu/~plane/wrsa.html#SanDiego

5th Gordon Research Conference on Polar Marine Science
WHERE: Ventura, California • WHEN: March 13 – 18 • CONTACT: http://www.grc.org/programs/2005/polar.htm

CliC First Science Conference: Cryosphere – The "Frozen" Frontier of Climate Science: Theory, Observations, and Practical Applications
WHERE: Beijing, China • WHEN: April 11 – 15 • CONTACT: http://clic.npolar.no/meetings/first/index.html

GLOBEC Symposium – "Climate Variability and Sub-Arctic Marine Ecosystems"
WHERE: Victoria, B.C., Canada • WHEN: May 16 – 20 • CONTACT: http://www.globec.org

2005 ARCUS Annual Meeting and Arctic Forum
WHERE: Washington D.C. • WHEN: May 18–20 • CONTACT: http://www.arcus.org/annual_meetings/index.html

Yukon Conference - Rapid Landscape Change and Human Response in the Arctic
WHERE: Whitehorse, Yukon, Canada • WHEN: June 15–17 • CONTACT: bergeran@telus.net

For more on these events and other meetings, please visit:
http://www.arcus.org/Calendar/upcomingEvents.shtml • http://www.iasc.no/SAM/samtext.htm

■ *Tooga: The story of a polar bear*
By Shirley Woods.
Illustrated by Muriel Woods
Markham, ON: Fitzhenry & Whiteside, 2004
96 pp
ISBN 1-55041-900-5
Grades 3–7/ages 8–12

Tooga: The story of a polar bear, is a well written and detailed story of a young male polar bear living in northern Labrador, Canada.

Shirley Woods has made the story both entertaining for young readers and accurate in its re-creation of the arctic environment.

The reader quickly gets a sense of the reality of the world in which the polar bear lives. Attention is paid to small details, such as how a polar bear pulls itself out of the water and onto the ice, or creates a hole for ventilation in its den.

Throughout the story, we briefly meet other arctic inhabitants, such as an arctic fox that scavenges on the bear's kills, and the gyrfalcon that pounces on ptarmigan startled by bears.

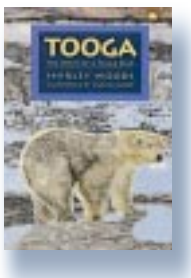
The story never over-sentimentalises and gives a very accurate portrayal of a polar bear's life. Ursa, the mother bear, must teach and protect her cubs – Apook and Tooga – how to survive.

Tooga is separated from his mother and sister when he becomes caught on an ice drift and eventually comes into contact with human beeings in a small northern community.

Woods acknowledges the assistance of several polar bear researchers, including Ian Stirling, a world authority on polar bears and senior research scientist at the Canadian Wildlife Service. Her close collaboration with them is evident.

There are also a number of nice black-and-white drawings by Muriel Wood that complement the story well.

Tooga: The story of a polar bear is a great way to introduce young people to the polar bear and the arctic environment.



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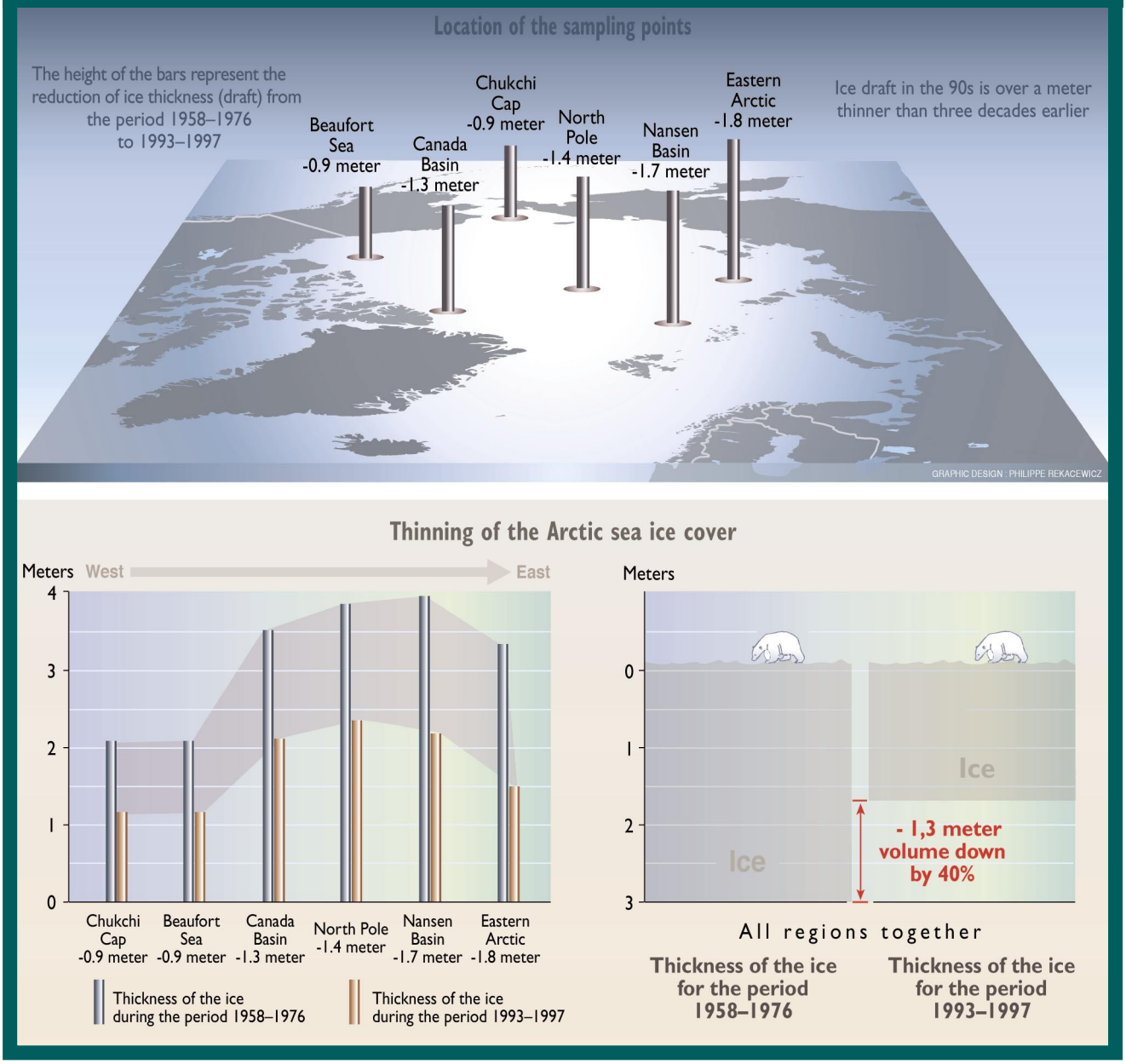
Thinning of the arctic sea ice cover



Graphic: UNEP/GRID-Arendal, Philippe Rekacewicz

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WWF is the world's largest and most experienced independent conservation organisation, with almost five million supporters and a global network active in 90 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature. WWF continues to be known as World Wildlife Fund in Canada and the United States of America.

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