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THE CIRCLE

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✦ Rising sea levels ✦ Industrial development ✦ Plastic pollution
✦ Alternative energy sources
✦ Human/wildlife conflict

THE ARCTIC CHECK-UP

The Circle 2.2019

THE ARCTIC CHECK-UP

Contents

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ABOVE: Meltwater in southern Greenland crevasse.

Photo: NASA/John Sonntag

EDITORIAL

Working together toward a sustainable Arctic

WHAT HAPPENS in the Arctic does not stay in the Arctic.

This fact has become more apparent in recent years as glaciers retreat and sea levels rise all over the world. At the same time, the Arctic is becoming increasingly accessible, a situation that brings both challenges and opportunities. International interest in the region is growing; multilateral, political and academic attention is increasingly focused on the Arctic; business interest is on the rise.

It is against this backdrop that Iceland is taking over from Finland as chair of the Arctic Council. The guiding principle of Iceland's chairmanship will be sustainability, with equal focus on each of its three pillars: social, environmental and economic.

Temperatures in the Arctic are now rising at more than twice the average global rate. Moreover, Arctic warming trends are expected to continue toward mid-century, while trends after 2050 are likely to depend on the mitigating actions we take today. Dealing with the repercussions of climate change is a global challenge, and the only way forward is to limit greenhouse gas emissions worldwide. Ocean acidification and melting sea ice put the entire marine ecosystem at risk. Adaptation will be challenging for most communities in the North in the decades to come.

The future of the Arctic must include environmental protection as well as economic prosperity and the social well-being of the four million people who live and work there. This is especially important to the region's Indigenous Peoples. Striking the right balance between environmental protection, economic growth and social development is essential. To that end, Iceland will strive to lead continued cooperation on economic development, gender equality, connectivity, green energy solutions and resilience.

Healthy oceans are vital to global sustainable development. Among other goals, Iceland will work toward strengthening Arctic Council cooperation on mitigating plastic pollution in the oceans. We have also proposed a project focusing on the Blue Bioeconomy and Arctic region. Our hope is that by applying innovation and the sustainable methodology of the Blue Bioeconomy, we can dramatically increase the use and market value of fish catches while significantly reducing biowaste from fish-processing operations.

Iceland will strive to lead continued cooperation on economic development, gender equality, connectivity, green energy solutions and resilience.

Working closely with all partners inside and outside the Arctic region is of utmost importance for the area's prosperity and security. The conflictive dynamics that may result from opening up the Arctic—such as how to address climate change, how to manage access to renewable and non-renewable natural resources, and how to respond to increased marine traffic—make the Arctic Council's contribution to sustainable development increasingly relevant. ○

Photo: Icelandic MFA, Golli.

GUDLAUGUR THÓR THÓRDARSON is Iceland's Minister for Foreign Affairs and incoming chairman of the Arctic Council.

CANADA

Thawing permafrost causing thousands of landslides

NEW RESEARCH published in *Nature Communications* warns that the Arctic is experiencing a substantial increase in the number of landslides.

Focusing on Banks Island, a land mass of about 70,000 square kilometres in the Canadian Arctic Archipelago, researchers studied "retrogressive thaw slumps," which are landslides that can take place on gradual inclines when permafrost thaws. These landslides move slowly, but are worrisome because they tend to grow and stopping them is very difficult.

Based on archive imagery over a 20-year period, researchers identified a 60-fold increase in the number of these landslides—from 63 in 1984 to 4,077 in 2015. The four warmest summers on record were associated with the highest numbers.

The implications are sobering, since the Banks Island area is likely representative of many other parts of the Arctic. Landslides cause substantial erosion and changes in lakes and rivers. Their increasing incidence has the potential to alter ecosystems and landscapes.

UNDERWATER NOISE

Calling on Artic nations to turn down the volume in our oceans

ARCTIC WARMING is making the region more accessible to shipping, oil and gas exploration, and military activities. As these activities advance steadily into Arctic waters, seals, whales, walruses and other forms of marine life are exposed to increasing levels of underwater noise.

In February 2019, WWF asked people around the world to add their voices to a campaign to put a stop to these rising noise levels. And people listened: more than 81,000 concerned people from 100 countries have already signed a petition asking Arctic states to recognise the threat of underwater noise pollution and commit to keeping noise at safe levels for ocean wildlife. On May 5, WWF presented the petition to the Arctic Council at its biennial Ministerial meeting in Rovaniemi, Finland.

WWF hopes to collect 150,000 signatures before the end of the summer. Please add your voice by going to https://arcticwwf.org/action/noise/. Over the next two years, we will also be advocating for Iceland—the incoming chair of the Arctic Council—to put ocean pollution, including underwater noise, at the top of its agenda.

Photo: Arto Rajanen

Peter Winsor and Liisa Rohweder of the WWF Arctic Programme present WWF's underwater noise petition to Kristina Bär from the Arctic Council Secretariat.

GREENLAND

The melting ice sheet

A NEW STUDY published in *Proceedings of the National Academy of Science* has found that the Greenland Ice Sheet has lost trillions of tons of ice to melting—a transformation that scientists characterise as a profound geological shift.

The Greenland Ice Sheet is about 1.7 million square kilometres in size, covering about 80 per cent of Greenland's surface. The study—the first to measure as far back as 1972—found that the ice sheet has lost 4,976 gigatons of water since then. (One gigaton is about 1 billion metric tons.) About half that loss has occurred in just the last decade, which indicates that the melting is accelerating.

Particularly alarming is the possibility that warmer ocean waters are shrinking the ice sheet from underneath at a faster rate than warmer air is melting it from above. Scientists think bottom-melting glaciers may be predisposed to rapid collapse.

The Greenland Ice Sheet is massive enough to raise sea levels by 7.4 metres worldwide if it melted entirely.

INSPIRING YOUNG PEOPLE

WWF's *Our Planet*

AT WWF, we love to hear that our work is making a difference—and sometimes, it inspires even the very young to want to do their part. In April, we heard from an American parent, Tracy McElroy, whose three-year-old son, Mack Petterson, was so moved by an episode of *Our Planet* that she decided to get in touch to learn more and ask about donating.

Our Planet is a Netflix original documentary series and a ground-breaking, four-year collaboration between Netflix, Silverback Films and WWF. Supported by the latest science, it explores the rich natural wonders, iconic species and wildlife spectacles that still remain on Earth, and reveals the key issues that threaten their existence.

"Frozen," the episode that touched young Mack, included a difficult scene where walrus in northern Russia's Chukchi Sea perish by falling from cliffs. In 2017, more than 100,000 walrus gathered along a stretch of coast in the area. They normally gather on ice platforms, but these have vanished as the climate has warmed. Crowded on land, a number of walrus climbed up rocks and cliffs to find more room. But many had trouble getting down safely, and plunged to their deaths.

In an email to WWF, McElroy said the scene brought on many questions and concerns from her son. "He actually cried, he was so sad for them, and he kept saying, 'Mommy, they are dying, we need to help them!' Mack recommended that we send Band-Aids. I told him that we would do what we could for the walrus."

Climate change is forcing Pacific walrus in Russia onto land in large numbers to rest because there is no sea ice near their feeding grounds. Some climb high cliffs to escape the crushing crowds and can become stranded, falling to their deaths.

PHOTO: Sophie Lanfear/Silverback/Netflix

Arctic state check-up

The 2019 Arctic Council

Thawing permafrost, loss of sea ice, shrinking caribou herds, ocean acidification: the impacts of climate change in the Arctic are accelerating, and will continue to do so unless the eight Arctic states take bold steps to limit the pressures and stressors on the region through good governance.

To that end, the Arctic Council has made recommendations—and the 2019 Arctic Council Conservation Scorecard, an initiative of the WWF International Arctic Programme, has evaluated how the Arctic nations are faring when it comes to implementing them. WWF engaged Ecologic Institute to conduct the research and analysis for the Scorecard. We spoke with ARNE RIEDEL, project coordinator and Arctic coordinator at Ecologic Institute in Berlin, for some insights into what the Scorecard reveals.

What is the Scorecard's main purpose?

The Scorecard looks at how countries are doing when it comes to protecting biodiversity and ecosystems and preventing their harm from negative impacts generated by black carbon and methane emissions, oil spills and shipping. At its core, it examines the concrete actions Arctic states are taking in these areas to fulfill their responsibilities as the primary stewards of the region.

The Scorecard measures the states against recommendations they developed themselves within the Arctic Council's working groups. Although the Scorecard can be critical, and aims to keep the Arctic states accountable, it is also meant to help states see where they may have information gaps and how they can fill them. I would sum it up as an exercise in cooperation that assesses how seriously the various countries are taking their commitments to protect the Arctic environment.

Arne Riedel

Which countries earned the best scores this year?

Overall, Sweden and Finland received the highest scores, but some indicators didn't apply to them, since they are not linked to the Arctic Ocean. The maximum number of points they could score was lower than for Norway or Russia, for example. Still, they scored reasonably well on the other areas.

Which area still needs the most work across the Arctic?

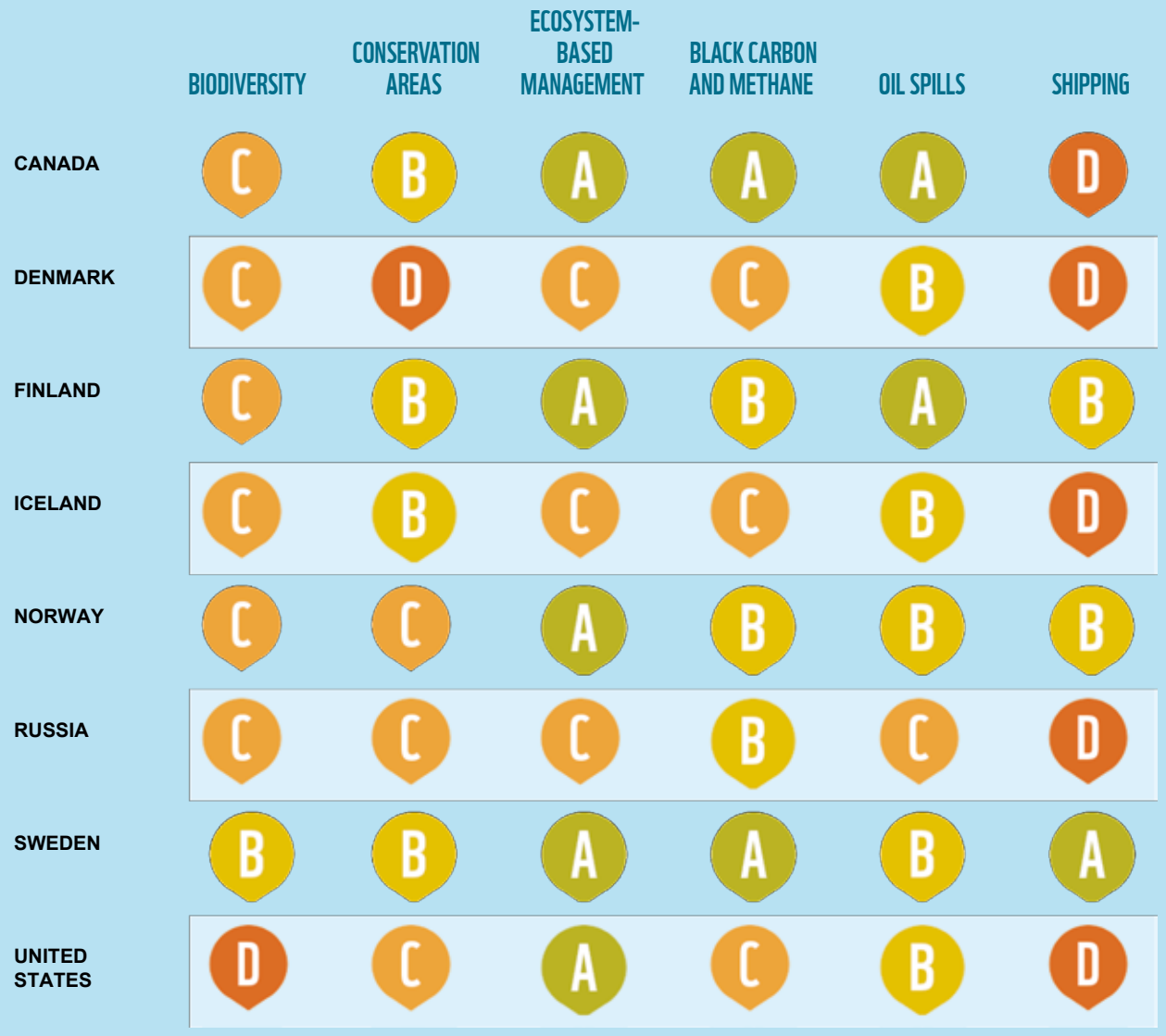
I would say shipping. That area is about crafting national policies, reducing carbon emissions, looking at national measures and implementing technological standards, and we saw very little of that. I was surprised that so many Arctic states received their worst scores on shipping, because that's where they have the opportunity to be quite active, exert national influence and take national actions. But the shipping industry is big, and it can take time for measures to be implemented.

A positive surprise was that many states received high ratings on ecosystem-based management. But the recommendations (and thus the indicators) in this area focused on passing legislation, not [yet] implementation. We will need to watch future developments in this area closely. ➤

Conservation Scorecard

2019 Overall Ratings

The 2019 Scorecard examines Arctic Council recommendations of crucial importance to the Arctic environment by focusing on the progress that has been made by each individual government and highlighting where states need to work harder to fulfil their commitments.



Graphic: WWF

Photo: U.S. Coast Guard, Petty Officer 2nd Class Charly Hengen

The Russian tanker Renda *transits toward the port of Nome, Alaska, 13 January 2012.*

What challenges did you encounter in developing the Scorecard?
One key challenge was communications—the quantity and quality of the information we received from states varied massively, and it's difficult to have a Scorecard without complete information. Another challenge was that some of the states' commitments are not very ambitious. We are measuring countries against recommendations they negotiated themselves, and some set the bar higher than others.

What is Ecologic's take on the results? What do they tell us about the future of the Arctic?
Research shows us that there will be massive shifts in the coming decades when it comes to climate change impacts and biodiversity, and based on the results, the Arctic may not be able to adapt as quickly as it needs to. To take on these challenges, cooperation is key: cooperation among Arctic Council states and with Permanent Participants and observers supports informed and implementable decisions. The Scorecards show, however, that national implementation is still lagging.

On the international level, recent developments have sent mixed signals. For example, the Arctic states recently agreed to refrain from commercial fisheries in the high Arctic for the next 15 years. On the other hand, it's been difficult to see the US making bold, uncomfortable policy statements [such as at the ministerial meeting of the Arctic Council in Rovaniemi, Finland in May]. The Arctic has been a place of scientific cooperation and environmental protection for many years, and this should not be jeopardised.

What major take-aways does the Scorecard offer?
On balance, it shows that Arctic states still face many challenges. One is fighting for the implementation of international commitments at home,

I was surprised that so many Arctic states received their worst scores on shipping, because that's where they have the opportunity to be quite active, exert national influence and take national actions.

It examines the concrete actions Arctic states are taking in these areas to fulfill their responsibilities as the primary stewards of the region.

where governments also have to confront other important issues and work within budgets. Another is about the need to streamline the flow of information. When we reached out to the Arctic states for information, they sometimes referred us to six or more different people, which shows you how many departments are involved and, in some cases, how stretched their efforts are. To reach their goals, they will need to become more effective at collecting and sharing data.

What is the solution to these information-sharing problems?
Having an Arctic focal point is a proven strategy. There are even some non-Arctic states that have an Arctic ambassador, or at least dialogues between involved ministries. But even then, coordination and communication among departments can still be problematic, especially with regards to setting ambitious environmental protection policies. I think part of the solution for environmental departments is enabling civil society to engage in that discussion and increase the ambition level. Not all Arctic states are inclined this way, of course. I would also say the communications angle is important for transparency and should be tackled by Arctic states, so everyone knows what is actually happening on the ground. This may help develop creative ideas about how implementation can be expanded and improved. ○

You can go to arcticwwf.org to read more about the 2019 Arctic Conservation Scorecard.

Arctic Indigenous governance

Why we must speak the words "climate change": A Saami perspective

In early May, the foreign ministers of the eight Arctic nations convened in Rovaniemi, Finland for their biennial meeting. For the first time since the Arctic Council was established in 1996, the meeting ended without a joint declaration to guide the Council's work for the next two years.

The meeting was supposed to result in the Council's first-ever longer-term strategy for balancing the challenges of climate change with demands for sustainable development. But the U.S. reportedly refused to sign the declaration because it included the words "climate change."

ÅSA LARSSON BLIND was one of the representatives who spoke at the meeting in Rovaniemi. She is the President of the Saami Council. Here is an excerpt from her speech.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services released its global assessment with a clear message of an alarming rate of species extinction and nature's dangerous decline. The findings are horrific. The report states that:

"Three-quarters of the land-based environment and about 66 per cent of the marine environment have been significantly altered by human actions." It's worth noting that on average, these trends have been less severe or avoided in areas held or managed by Indigenous Peoples.

Cooperation and co-management between Indigenous Peoples and states as equal partners is indeed the best chance we have for an Arctic with high bio- and cultural diversity—a prosperous Arctic for all.

Yet one of the findings presented in the WWF Scorecard suggests that Arctic states continue to show an unwillingness to recognize Indigenous Peoples as equal partners in the management of the Arctic region. This shows there are challenges with implementation at a national level. But unlike other regions in the world, we have the Arctic Council as a forum for cooperation.

Photo: Arctic Council Secretariat/Linnea Nordström

In the popular youth book series about Harry Potter, there is a dark wizard, Lord Voldemort, who is also referred to as "he who must not be named." If he is named, he might appear. By naming the enemy, the other wizards would put their lives at risk. We would like to underscore the fact that climate change and its impacts are nothing like Lord Voldemort. They won't only appear if mentioned. For those of us living in the Arctic, we can tell you climate change is already taking place and has a great impact on our lives. But by calling it by its real name, we can fight it and reduce its impacts. We do not even need magic. This room has the power and potential to agree on ambitious levels of emissions reductions and set a standard for the rest of the world.

Today, we express our deepest concern about the development of the commitment for this ministerial. In a time of great urgency, we, the Arctic states and Arctic Indigenous Peoples gathered around this table, are in the best position to make commitments to act in the best interests of the environment and global humanity. ○

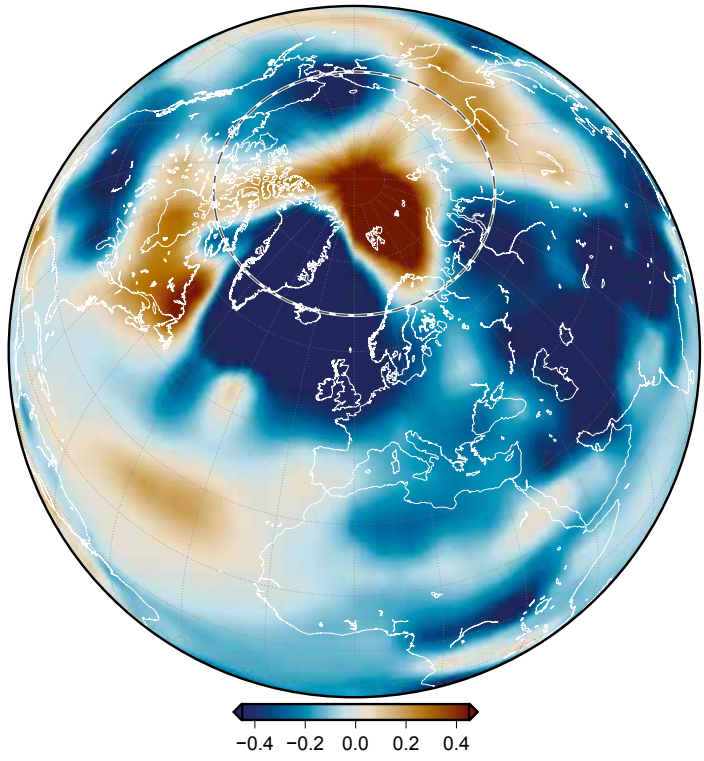
Fast-forward to the past: What can ice core records of a warmer Earth tell us about the Arctic's future?

We often hear about how our rapidly changing climate is already accelerating the melting of glaciers and ice sheets across the globe. But what about the reverse: could the melting polar ice sheets themselves disrupt climate, creating a feedback loop that leads to runaway environmental change? To explore that idea, NICK GOLLEDGE brought together an international team of climate scientists—and the results were alarming.

INSIDE A FROZEN TENT at the end of July 2010, Dorthe Dahl-Jensen, a Danish paleoclimatologist, announced the completion of the North Greenland Eemian Ice Drilling (NEEM) project. The team had finally hit bedrock, 2,537 metres below the surface of the Greenland Ice Sheet. Dahl-Jensen and her team had spent three summers camped high on the summit plateau, painstakingly drilling to recover cores that would tell them how the ice sheet had changed during the Eemian period 125,000 years ago.

This interval—the last time Earth was warmer than it is today—is important because it poses a worrying question. Average air temperatures then were only a degree or so above current temperatures, yet the global sea level was more than six metres higher than it is now. How could this be possible? As we head toward an artificially warmer world, can the NEEM ice core records give us a window into our future?

One way to address this question is to use computer models to simulate these periods of the past, and then use the same models to project into the future. For this we need three things: evidence of how the world (particularly the polar ice sheets) looked during warmer periods; predictions of how the climate may change in the future; and a numerical ice-sheet model that incorporates the necessary physical equations to accurately simulate the flow of an entire ice sheet.



In our recent work, we used a model developed by a team at the University of Alaska, Fairbanks. Over the last 10 years, we have used this model to

Photo: Nick Golledge

Galciers calving into Lazarev Bay, Antarctic Peninsula.

predict how both the Greenland and Antarctic ice sheets have evolved in the past, as well as how they might change in the future. By checking our past simulations against geological records as well as ice core records from sites such as NEEM, we have developed confidence that the model can be used reliably.

DYNAMIC THINNING

Climate models suggest that our current governmental commitments to mitigating greenhouse gas emissions will lead to average global warming of 3°C to 4°C by the end of the century. When we used our model to simulate how the ice sheets would respond to this warming, we found they lost ice, not just through melting at their surface, but also through dynamic thinning, a process through which ice-sheet outlet glaciers are melted by heat from seawater, thinning their lowest regions. Because this thinning happens most swiftly at the terminus, or end of the glacier, the overall gradient of the ice surface gets steeper, which in turn encourages the ice to flow more quickly and discharge even more of its mass into the ocean.

We found that meltwater from the Greenland Ice Sheet can accelerate its own retreat by up to 40 per cent.

In Greenland, our model suggested that this would happen to the greatest extent in the northwest sector of the ice sheet. Using a climate model, we then calculated that this meltwater would ultimately find its way into the North Atlantic. And this is where the problems begin: even though the amount of meltwater released is tiny compared with the volume of the ocean, it is buoyant because it contains no salt, so it floats on the sea surface. Normal ocean circulation relies on a process known as convective overturning, in which relatively warm water rises from depth at high latitudes, releases heat to the atmosphere and, once cooler, begins to sink.

But this sinking relies on the water being salty, and therefore dense. Adding freshwater, even if it is cold, prevents this sinking ➤

NICK GOLLEDGE is an associate professor in the Antarctic Research Centre at Victoria University of Wellington in New Zealand. He uses computer simulations of the Greenland and Antarctic ice sheets to understand how they behave under different climates and what this might mean for global sea levels.

process. As the meltwater from Greenland flows south, it meets warm water from the Gulf of Mexico being carried north. When the Gulf Stream moves east, it releases so much heat into the atmosphere that northwest Europe is kept far warmer than areas at comparable latitudes in eastern Canada. As this current slows down, however, this heat transport reduces, and northwest Europe cools. But the heat in the ocean remains—and it has to go somewhere.

A DANGEROUS POSITIVE FEEDBACK LOOP

With the rate of sinking suppressed, there is less vertical mixing in the water column, so the warmer, deeper layers retain their heat. This heat is especially dangerous for ice sheets, because many outlet glaciers flow through deep troughs that can be hundreds of metres below sea level and beneath the cold sea surface. Instead, these glaciers are flowing into the deeper, warmer parts of the water column, where the extra heat—trapped by the reduced overturning—accelerates the melting of the submarine ice fronts. The glaciers once again get steeper, flow more quickly and discharge even more ice.

The last time Earth was warmer than it is today, average air temperatures were only a degree or so above current temperatures, yet the global sea level was more than six metres higher than it is now. How could this be possible?

These processes form a self-reinforcing loop, also known as positive feedback. Yet the complexity of combining ice sheet models with global climate models has meant that this feedback was ignored in previous predictions. By including this loop, we found that meltwater from the Greenland Ice Sheet can accelerate its own retreat by up to 40 per cent.

Furthermore, the disruption to ocean circulation caused by ice sheet meltwater extends across the Arctic, reducing air temperatures in parts of Siberia and the Aleutian Islands, but producing considerably warmer temperatures across Svalbard and as far north as the North Pole. Worse still, the discharge of ice sheet meltwater into the oceans seems to upset circulation patterns in a way that can amplify year-to-year climate variations, producing unreliable weather that can be far warmer or colder than average from one year to the next.

Recent research has shown that the levels of warming expected over the coming centuries have no analogue in the recent past. In fact, conditions by the end of this century will be similar to those last seen three million years ago, when the sea level was around 20 metres higher than it is now. More alarmingly, some studies have suggested that positive feedbacks could trigger an unstoppable chain of events that would lead to a "hothouse" world entirely different from the one we inhabit today.

Whether we choose to fast-forward into that kind of future is down to us. But evidence from the past suggests that unless we rapidly reduce our emissions, the changes we are setting in motion now may play out for hundreds—or more likely, thousands—of years. ○

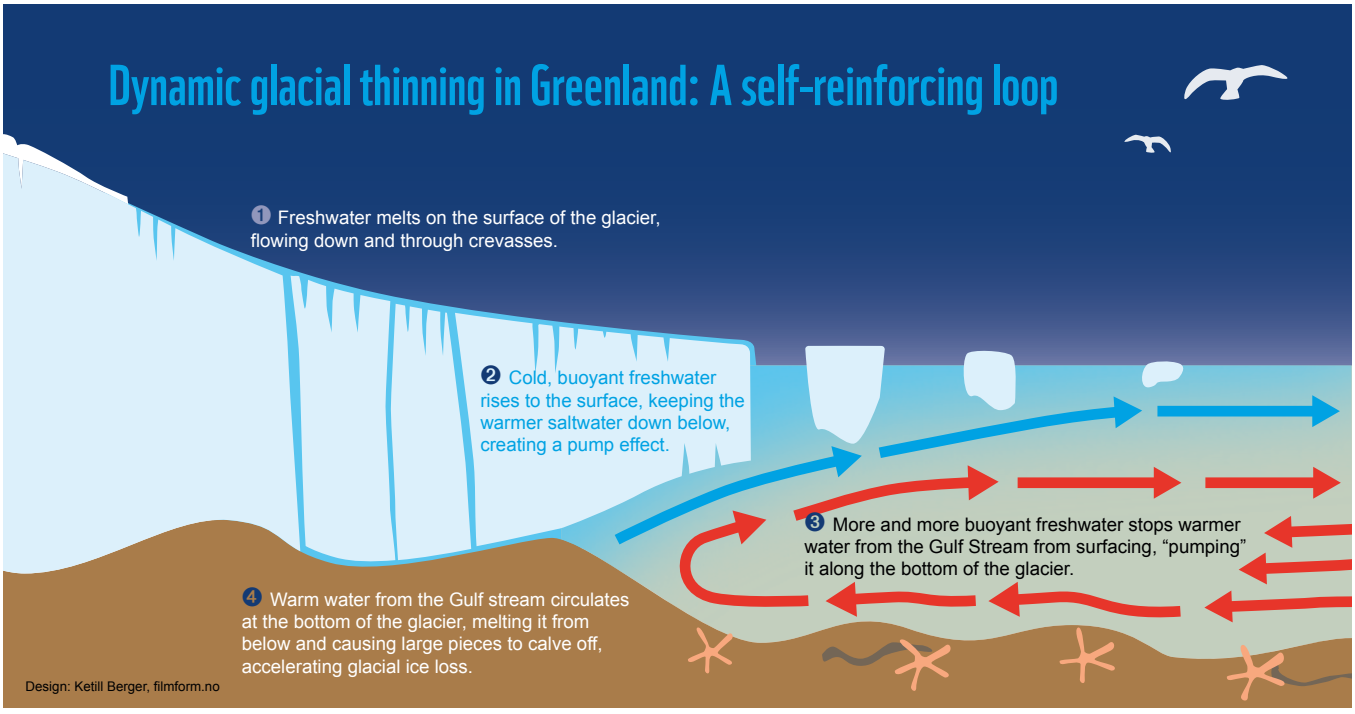


Photo: alvaroprieto, Creatrive Commons, Flickr.com

Human/wildlife conflict

Polar bear in the backyard!

People around the world have always lived with potentially dangerous animals—but as the human population increases and wildlife habitats shrink, this is becoming more challenging. FEMKE HILDERINK and GERT POLET explain why we all have a role to play in facilitating coexistence.

This warning sign in Svalbard, Norway tells people that polar bears may be anywhere in Svalbard.

Polar bear, Churchill, Manitoba, Canada.

IMAGINE YOU'RE ON YOUR way to the supermarket. Kids are running around in the playground while dogs doze in the sun. Shopping bag in hand, you turn the corner of a building and suddenly find yourself face to face with a polar bear scavenging for scraps in a waste bin.

The moment the bear sees you, it lifts its head and sniffs the air. Your heart starts racing and your knees begin to shake. While you panic and try to consider the best response, the animal turns away and slowly lumbers out of view.

Fortunately, this hypothetical episode ends well, with no one hurt. But it could have gone another way. Dangerous encounters like this happen not only with polar bears, but also with elephants, tigers, apes and many other wildlife species around the world.

FEMKE HILDERINK is a nature conservation advisor with WWF-Netherlands and **GERT POLET** is head of its wildlife unit. Together they facilitate a WWF initiative that seeks a coordinated approach to managing human/wildlife conflicts around the world.

People and wild animals have always shared the planet. But encounters between them are now occurring more often, and increasingly result in damaged property, injuries or even the death of people, their domesticated animals and the wildlife itself. As a result, local people can begin to argue against conserving potentially dangerous species, many of which now depend on people for their long-term survival.

People and wild animals have always shared the planet. But encounters between them are now occurring more often, and increasingly result in damaged property, injuries or even the death of people, their domesticated animals and the wildlife itself.

Such conflicts will only grow as expanding human infrastructure and agriculture continue to diminish and fragment wildlife habitats. The impacts of climate change, such as droughts and reduced sea-ice cover, are further affecting or limiting available wildlife habitats. Effective conservation measures can also serve to increase wildlife populations, leading to more, not fewer, interactions with people. On top of that, many species are opportunistic and curious. For example, the polar bear in our hypothetical village discovered there was an easy meal in the waste bin and was not afraid to go and get it.

Photo: Polar Bear Town, Flickr.com, www.facebook.com/polarbeartown/

To allow for coexistence, we all have a role to play. For example, food and waste can be stored properly in communities. Response teams, such as those that already operate in several Arctic towns, can be formed to help people on a day-to-day basis. Land-use planners need to think about wildlife migration routes. And while a lost life is irreplaceable, insurance companies and governments can cover some of the costs and economic losses suffered by people.

Harmonious coexistence between people and wildlife depends on our efforts to share space safely. And there are good reasons to do so: wild animals play an important role in keeping our ecosystems healthy, not to mention their significant roles in many people's cultures and livelihoods. Funding agencies should invest in people who live alongside wildlife and, with government support, create environments that are more conducive to ensuring that local communities continue to safely benefit from the presence of wildlife.

As the custodians of wildlife, local people are needed to safeguard these animals. After all, they are the ones bearing the risks of living with wildlife. We should be looking to minimise the attendant risks and explore opportunities that can benefit local communities that have wildlife in their vicinities. ○

Other hot spots for human/wildlife conflict

There are numerous locations around the world where conflict between people and wildlife is leading to killings of one or the other.

For example, in Asia, elephants and tigers are increasingly coming into contact with people. This is due to the loss and fragmentation of their habitats from expanding roads and railways, human settlements, agricultural fields and other development. In India, 100 people are killed by elephants every year, and in the Indian Sundarbans, 22 people are killed by tigers in an average year. Many animals are also killed in retaliation. WWF supports local people to secure their crop fields and livestock, and works with authorities to improve land use planning that protects wildlife migration routes.

Meanwhile, in the mountains of central Asia, snow leopards are preying on local herders' goats and sheep, leading to conflicts with herders that often result in the leopards' deaths. One study estimated that between 220 and 450 snow leopards have been killed over the past 11 years, mostly due to conflicts with herders. Snow leopards can kill animals that are three times their weight, so their ability to hunt domestic sheep and cattle makes them targets for herders. WWF supports herders to improve livestock housing to prevent predation by snow leopards, and is also helping them find additional sources of income to reduce the pressures on snow leopards caused by ever-growing livestock numbers.

Migrating plastics: Even the Arctic is not immune

The research vessel Tara *completed a five-month expedition around the North Pole. The researchers sampled floating debris and measured the concentration of the particles caught.*

Anna Deniaud/Tara Expeditions Foundation

We were surprised to find that plastic debris was plentiful in the Greenland and Barents seas to the east of Greenland and north of Scandinavia. Our study concluded that most of the plastic found in this part of the Arctic was coming from faraway sources, including the coasts of northwest Europe, the UK and the east coast of the United States.

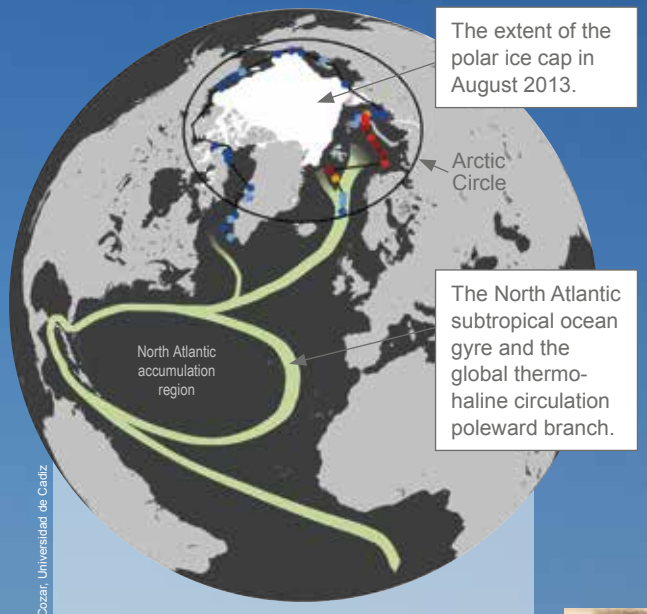
It's common knowledge that climate change has been causing a series of profound transformations in the Arctic Ocean. But until recently, it was believed that marine litter was primarily a concern in temperate and tropical regions. Not anymore. ANDRÉS CÓZAR CABAÑAS explains the changes that are making the Arctic more susceptible to plastic pollution.

THE ARCTIC'S REMOTE LOCATION and hostile environment have helped preserve it as one of the most pristine places on Earth. But in recent years, human voracity has led governments and businesses to turn a speculative eye toward this untapped piece of our planet. The polar regions are warming much more quickly than the rest of the Earth, and a shrinking ice cap is opening the door to unprecedented development.

THE SCIENCE BEHIND "GARBAGE PATCHES"

There are virtually no human settlements north of the Arctic Polar Circle, located above Iceland at 66.34 degrees latitude. The biggest sources of marine litter are far from there, and a powerful system of ocean currents works to retain the floating litter at mid-latitudes: the Earth's wind patterns mean that marine litter accumulates at around 30 degrees' latitude.

In each hemisphere, from the equator to 60 degrees, two steady wind belts blow in opposite directions south and north of the 30th parallel. When these crosswinds ➤



Map: Andres Cozar, Universidad de Cadiz

Locations and plastic concentrations of the sites sampled.

ANDRÉS CÓZAR CABAÑAS is an ecology professor at the University of Cádiz, Spain.

interact with the ocean surfaces, they generate convergence zones in the middle of each ocean basin. The results are the great subtropical gyres, more commonly known today as the "great plastic garbage patches."

In 2013, the research vessel *Tara* completed a five-month expedition around the North Pole. I was responsible for leading the team that assessed plastic pollution in the waters around the Arctic ice cap. The researchers sampled floating debris by towing nets with meshes as fine as one-third of a millimetre wide and measured the concentration of the particles caught.

This expedition changed our understanding of the isolation of the Arctic Ocean. As expected, most of the ice-free surface waters in the Arctic Polar Circle were only slightly polluted with plastic debris—a situation that seemed consistent with the low population settled there. However, we were surprised to find that plastic debris was plentiful in the Greenland and Barents seas to the east of Greenland and north of Scandinavia. Our study concluded that most of the plastic found in this part of the Arctic was coming from faraway sources, including the coasts of northwest Europe, the UK and the east coast of the United States.

Anna Deniaud/Tara Expeditions Foundation

Microplastics intermingle with plankton from an Arctic Ocean sample.

THE ARCTIC: A "DEAD END" FOR FLOATING DEBRIS

In addition to the wind-induced system of subtropical gyres, there is a second large-scale ocean circulation at work. This one is driven by differences in the densities of polar and tropical waters. The surface water in the Greenland and Barents seas becomes progressively more dense by cooling, ultimately moving downward. This sink of ocean waters pulls surface water from the North Atlantic, collecting buoyant plastic from highly populated latitudes and delivering it to the Arctic, where the landmasses, together with the ice cap, constitute a dead end for all floating debris.

This poleward migration of plastic involves the so-called thermohaline circulation, a global conveyor belt currently known for redistributing heat across the global ocean and now connecting remote sources of marine litter with the Arctic.

Most of the hundreds of tons of plastic found in Arctic waters appears in the form of aged fragments about the size of a grain of rice. A total of 300 billion plastic pieces are estimated to be present in surface waters alone, and it's likely there is even more plastic on the sea floor. These tiny fragments are nearly impossible to remove.

There is no way out for the plastic entering the Arctic. It will stay there for a long time, interacting with one of the Earth's wildest ecosystems. While we still don't fully understand the consequences of so much plastic for the Arctic, it is troubling that plastic pollution has made its way into the marine food chain.

The migration of floating debris to the Arctic is a non-stop process. A massive accumulation of plastic is just beginning: years' worth of plastic already disposed into the oceans is now in transit to the Arctic, and more and more plastic litter enters the oceans every year.

The Arctic is more vulnerable to remote sources of pollution than ever before. Plastic particles also have the potential to act as vectors for contaminants added during plastic manufacturing or acquired from seawater. As well, invasive species are hitching rides across the oceans on these long-ranging plastic vehicles. Our study confirms that the Arctic is indeed connected to the rest of the world.

More than ever before, preserving the Arctic requires preserving the planet. ○

Microplastics in the Arctic

Microplastics are tiny plastic fragments measuring less than 5 mm. We are surrounded by them—and they are clogging our oceans.

A considerable quantity of microplastics find their way into the ocean when larger pieces of plastic, such as bags or bottles, are gradually broken down over a period of time by the sun or the ocean's waves. Microplastics can also enter the sea from health and beauty products that get into water supplies (such as tiny plastic exfoliants in face washes or toothpastes) or from activities like washing synthetic clothing. These tiny plastic particles are then consumed by animals like plankton, sending the problem back up the food chain—and eventually to us.

But this isn't only a southern problem. Record levels of microplastics have been found trapped inside Artic sea ice: one study found up to 234 particles concentrated into just one litre of melted Arctic sea ice. That's much higher than in the open ocean. Researchers say that's because sea ice forms from the top. Plastic particles also float at the surface and become bonded to the ice as it freezes. As sea ice melts with climate change, these plastics will be released back into the water, with unknown effects on wildlife.

Protesting the Pebble Mine in southwest Alaska.

Photo: Scott Dickerson/WWF-US

Photo: Brandon Hill

Industrial development

The Pebble prospect: the wrong place and the wrong mine

There's trouble in paradise. Bristol Bay in southwest Alaska is facing an unprecedented threat from a proposed open-pit gold and copper mine. DAVE APLIN warns that if permitted, the Pebble Mine would permanently compromise Bristol Bay's intact ecosystem, abundant wildlife, fish-fuelled economy and bustling local communities.

BRISTOL BAY is a place that inspires superlatives. It is one of the world's remaining salmon strongholds—more than 60 million sockeye returned to its rivers and streams to complete their epic life-cycle last year alone. Their annual return supports more than 1,400 jobs, a sustainable commercial fishing economy worth $1.5 billion a year, and centuries-old Indigenous cultures. The salmon also feed beluga whales, bald eagles and the largest concentration of brown bears on the planet. They provide the nutrients that fertilize the willows and grasses upon which moose and caribou depend. ➤

DAVE APLIN is the director of education and community outreach for the WWF-US Arctic Program. He lives in Homer, Alaska.

Brown bears hunt for salmon at Brooks Falls, Katmai National Park and Preserve, Alaska.

It is safe to say that Bristol Bay is like nowhere else on Earth. The problem is: its sustainable natural riches lie atop mineral riches—vast low-grade copper and gold ore deposits.

It's been 30 years since the Pebble deposit was first discovered by a Canadian mining company and nearly 20 since another Canadian firm, Northern Dynasty Minerals, acquired the claim. Since the discovery, the spectre of the Pebble Mine has remained a contentious issue, especially for the commercial fishermen, sportfishing lodge owners and Alaska Natives who depend on clean water and healthy salmon for their livelihoods and subsistence har-

Photo: Christoph Strässler, Creative Commons, Flickr.com

Fisherman with salmon. Bristol Bay, Alaska.

Photo: Chris Ford, Creative Commons, Flickr.com

Bristol Bay fishing boats at Dillingham.

Photo: Paul Colangelo/WWF-US

vests. Today, nearly 80 per cent of area residents and the majority of Alaskans oppose the mine.

A PROJECT RIFE WITH RISKS

Over the past two decades, four major mining companies joined Northern Dynasty to become what is called the Pebble Limited Partnership. All four have since retreated from a project that promises major challenges that include its remote location, low-grade ore quality and a laundry list of risks to Bristol Bay's intact environment—including the destruction of salmon habitat and the potential for the release of acid mine waste into the region's rivers and streams.

In spite of these risks, Northern Dynasty, the sole remaining Pebble partner, has persisted.

In 2011, local tribes joined commercial fishermen in petitioning the US Environmental Protection Agency (EPA) to step in. In response, the EPA initiated a three-year scientific review to assess the potential impacts of the mine on the region's environment, economy and cultures. The study's peer-reviewed findings led the EPA to conclude that the mine would substantially affect Bristol Bay's freshwater and fisheries resources, and it moved to protect the region.

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However, a legal challenge to the EPA's process stalled the implementation of those protections until 2017. That year, a new federal administration set aside the EPA findings and greenlighted Pebble's permit application.

Since then, the US Army Corps of Engineers has pursued a highly accelerated permitting process and aims to complete the process by summer of 2020.

THE FIGHT TO PROTECT BRISTOL BAY

If not stopped, Pebble Mine would be allowed to develop the first 1.5 billion tons of its nearly 11 billion ton deposit. If permitted, the mine would run continuously for 24 years. And, like the proverbial camel's nose under the tent flap, permitting Pebble would set the stage for future expansion into nearby areas and could jump-start the development of a mining district in Bristol Bay.

In response, a coalition of Indigenous groups, commercial and sportfishing interests, tourism providers and non-governmental organizations, including WWF, have banded together to protect Bristol Bay. WWF and others have retained scientists and economists to review the rushed and incomplete Draft Environmental Impact statement released by the Corps of Engineer. Grassroots and grass-top activists are working to harness the support of Alaskans to influence elected officials and agency professionals to throw out the flawed process and start over. At times, it appears to be an uphill struggle as political leaders at the state and federal levels embrace extractive industries over sustainable development. But it's a battle that thousands of Alaskans and many more people around the world are willing to fight.

Many locations around the Arctic face similar challenges in changing the methods we use to calculate value and wealth. The controversy that swirls around the Pebble project illustrates the global need to mainstream the understanding and acceptance of factoring ecosystem services into decision-making and financial systems. The future of Bristol Bay and many other irreplaceable Arctic jewels depends on successfully navigating that change. ○

Alternative energy

Making the move to green energy in Nunavut

For people living in the Canadian territory of Nunavut, diesel fuel is essential to their daily lives. Residents rely on it for heating, electricity and transportation. But diesel has a lot of drawbacks: it is expensive, pollutes the air, produces greenhouse gas emissions, and destroys habitats and ecosystems when it spills.

For almost four years, MARTHA LENIO and others at WWF-Canada in Iqaluit have focused on bringing green energy to the region as part of the Arctic Renewable Energy project. Lenio spoke to *The Circle* about the work WWF is doing with communities to help reduce their dependence on diesel and make the shift to renewables.

Why is it important to work at the community level to make this transition?

One of the big things is that we want these projects to be habitat-friendly and renewable—so they don't have an impact on caribou, birds or other animals that people rely on. But the projects should also have social benefits for the community and result in jobs. For that to happen, people should be involved. The projects won't be successful unless communities want them, understand them and see real benefits in the community from renewable energy.

Part of that is information: getting community members access to training programmes. There are also a lot of concerns like, "Do solar panels work in the North? Do wind turbines work in

Photo: Tomasz Adamski

Martha Lenio.

Projects won't be successful unless communities want them, understand them and see real benefits in the community from renewable energy.

Photo: Martha Lenio

WWF-Canada's Martha Lenio says Nunavut residents are eager to learn about renewable energy options.

the North? Is it just going to break?" So, we need to give people some hands-on training and the chance to see some of these projects in action. I think completing one or two pilot projects will make a big difference. Then people will be able to say, "Yeah, this is working. This can work in Nunavut."

We want to have really thoughtful, renewable energy projects in communities that work to bring down costs and make a difference in people's lives.

How receptive are people to making this kind of change?

In general, they're very receptive. Energy is expensive up here and the impacts of climate change are very real, so people realise that we need to make changes. People are very eager to learn and to hear about what the options are.

Can you tell us a little more about what you are doing in Gjoa Haven?

We asked people in Gjoa Haven what kinds of energy projects they wanted to see in their community. We started with a list of 12 initiatives that the community wanted, then decided to focus on three of them: energy efficiency, wasted heat and solar energy. Our approach has been to start with some pilot projects, see how they work, and then expand them once we have a good grasp of how the finances will work.

People in Gjoa Haven are also interested in starting an energy co-op.

Photo: Martha Lenio

Waste oil drums in Gjoa Haven.

I'm really excited about that one in particular.

What is the energy co-op project?

The Gjoa Haven Energy Co-op aims to use commercially available technology designed to reduce diesel dependency. The idea is to have really thoughtful, renewable energy projects that work to bring down costs and make a difference in people's lives.

Over two years, the co-operative will be formed by implementing three existing technologies: home energy monitoring, solar net metering and waste-to-heat energy. Personally, I think the home energy monitoring project is quite neat. It would focus on installing home energy monitors in people's homes, and then people would have real-time information about how much energy they're using and they could adjust their behaviour to try and lower their bills.

One of the challenges in Nunavut is that a lot of people live in social housing, so the housing corporation is actually paying the large majority of the energy costs in many of the communities. So with this project, we're looking at creative ways to encourage people in social housing to decrease their energy use. This is one of the things we've come up with. We're estimating that it will help bring electricity use down by 10 per cent.

What could other communities learn from the project in Gjoa Haven?

This project will have a lasting impact in both Gjoa Haven and Nunavut as a whole. The energy co-op will not only reduce people's dependence on diesel, but it will empower energy literacy and create a better understanding of how energy projects that are operated through a co-op can be financially viable. Gjoa Haven's experience in creating an energy co-op will provide a roadmap for other remote Arctic communities interested in doing the same thing. ○

Energy is expensive up here and the impacts of climate change are very real, so people realise that we need to make changes.

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THE PICTURE

Walrus belong on ice

Photo: Wild Wonders of Europe/Ole Joergen Liodden/WWF

The walrus pictured here is on an ice floe in Svalbard, Norway. Walrus spend their time on sea ice, migrating with moving ice floes and resting on ice between dives for food. But climate change is dramatically shrinking available sea ice for walrus, especially between Alaska and Russia. As a result, thousands are swimming much further to seek refuge on shore, where they congregate in large groups known as “haulouts.” Unless we dramatically cut the emissions of greenhouse gases, pictures of walrus resting on sea ice could become a thing of the past.

WWF

Why we are here
To stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature.

www.panda.org/arctic