

Environmental Audit Committee

Sub-Committee on Polar Research

Oral evidence: The UK and the Arctic Environment, HC 1141

Monday 12 June 2023

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[Watch the meeting](#)

Members present: James Gray (Chair); Philip Dunne; Barry Gardiner; Clive Lewis; Anna McMorrin; Cat Smith; Claudia Webbe.

Questions 99 -180

Witnesses

I: Dr Jenny Turton, Senior Adviser, Arctic Frontiers; Professor Andrew Shepherd, Head of Geography and Environmental Sciences, Northumbria University, and Director, Centre for Polar Observation and Modelling; Dr James Lea, Reader, Geography and Planning, University of Liverpool; and Professor Geraint Tarling, Principal Investigator, BIOPOLE.

II: Dr Anna Jones, Director of Science, British Antarctic Survey; Dr Iain Williams, Director of Strategic Partnerships, Natural Environment Research Council; and Henry Burgess, Head of the Natural Environment Research Council Arctic Office, NERC Arctic Office at the British Antarctic Survey.

Written evidence from witnesses:

[Dr Jenny Turton](#)

[Centre for Polar Observation and Modelling](#)

[Dr James Lea et al.](#)

[BIOPOLE](#)

[British Antarctic Survey](#)

[NERC Arctic Office](#)



Examination of witnesses

Witnesses: Dr Jenny Turton, Professor Andrew Shepherd, Dr James Lea and Professor Geraint Tarling.

Q99 **Chair:** Good morning everyone and welcome to our four learned witnesses. I won't introduce you. It is perhaps better if you introduce yourselves in a moment. The purpose of this afternoon's session is to focus on Arctic science, which is quite different from other sessions we have had in the inquiry so far. A brief warning before we start: it is rumoured that there will be a vote or probably two votes in the House at 4.30 and when the bells go, I will suspend the Committee for 20 minutes or so. I apologise for that because it will interrupt us. We have quite a lot of business to get through and I am a very old fashioned and tough chairman. Therefore can I appeal to both my colleagues who are asking questions and indeed to all of you to be relatively succinct—precise and short, in fact—in your answers?

Can we start with witnesses introducing themselves for the record?

Professor Tarling: I work at the British Antarctic Survey. I am the principal investigator for the BIOPOLE project. I am also the head of the ecosystems team at BAS.

Professor Shepherd: I am the head of the department of geography at Northumbria University. I also direct the UK Centre for Polar Observation and Modelling. I am the principal scientist for the European Space Agency's CryoSat mission.

Dr Lea: I am a reader in glaciology at the University of Liverpool and am a UKRI future leader fellow.

Dr Turton: I am a senior adviser at Arctic Frontiers, a non-profit organisation based in Norway. I have previous experience with polar regions research in the UK and Europe.

Q100 **Chair:** Thank you all for taking the time and trouble to be here. I hope that you will agree, when you see our report when we bring it out around the time of the Arctic Circle conference in Iceland in October, that it has been worth doing. Our aim is to produce a weighty document that the Arctic community will value and will think has been worthwhile. That is our aim. We might not achieve that but we will do our best.

Can I kick off with a general question? I was particularly concerned this week to hear about the report that the water in the north Atlantic and Arctic Ocean is warming at an extremely alarming rate; plus 1° was the figure I heard. To what degree are these very dramatic changes correct? A New York report came out this week said the sea could be ice-free by 2030, I think. Are these very dramatic reports of warming realistic or are they scare-mongering?

You do not all have to answer all the questions, so whoever feels most comfortable.



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Professor Shepherd: I am happy to answer that question. The observations are correct. It is a figure that you can rely on. It is a lot hotter this year because of the combined effects of long-term climate change—warming of the oceans and the atmosphere—and the El Niño. It is a pattern that we have seen in the Arctic for many decades now. Warming is higher in the Arctic than it is elsewhere on the planet and that is something that we notice in the UK, even though we are remote from the Arctic. We still notice it. It affects our weather patterns because they are coupled with what happens in the Arctic. It is a snapshot. It is a window into the future. This is what the world will look like in most years and decades to come.

There has also been a story about reduced sea ice. We should be seeing sea ice-free summers in the Arctic in the next 10 years. That should have happened around about now but we have the Montreal protocol to thank for the fact it hasn't yet happened—the CFC reductions because of the ozone hole. That has prolonged the life of the Arctic sea ice by about 10 to 15 years so we are lucky, thanks to that action that was taken many decades ago, that the Arctic sea ice is still here this summer. If it were not for that, the sea ice would already have gone.

Q101 **Chair:** Can I ask you one more detailed question that comes from my own ignorance really? El Niño happens in the Pacific and is a sort of ocean current. El Niño and La Niña are alternate years—is that right, broadly speaking, or not quite?

Professor Shepherd: They are not alternate years but they are alternate sides of the same cycle. Sometimes we have one and it moves to the other but over a period that is more than years—maybe five to 10 years.

Q102 **Chair:** If this year's very alarming 1° increase may be partly attributable to El Niño, does that not mean that on occasions where El Niño does not exist, any increase will be less alarming?

Professor Shepherd: On average, it would be less than that; that is right but of course we see the background warming that has happened to our planet over the past decades. It is fortunate that we see these things because people get to experience the climate that we will live through in most years in the future. We see this in Greenland, for instance. We have had two or three record melting years in Greenland in the past decade or so, when most of the ice sheet has melted out. That has not happened before but it will be the case most years in the future. We get the window on what is to come, so we can take decisions to try to avoid them.

Q103 **Chair:** Bearing in mind that the purpose of our inquiry is to consider what contribution Britain is making to analysing, realising and correcting the situation, how important is British science—both from BAS and the 50-odd universities that have an Arctic interest—in understanding and perhaps reversing some of these trends?

Professor Shepherd: British science is punching well above its weight in Arctic science. We are responsible for about 15% of polar science on the



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planet—mostly Antarctic science—whereas we are only 1% of the world's population, so we are punching well above our weight. Our expertise in Antarctica—Geraint can tell you more about that, as can the next panel—is world-renowned, and that is because we have an Antarctic survey. We do not have an Arctic survey; we do not have the equivalent activity for the Arctic—for the north pole—but we still produce 10% of the world's science on Arctic research, and that is done mostly in our universities. Half the UK science on Antarctica is done by the British Antarctic Survey; the rest of it is in universities. Of Arctic science, 90% or more is done by universities.

Q104 **Chair:** The British Antarctic Survey does have a survey in the Arctic so the name in that sense is misleading, isn't it?

Professor Shepherd: It does but it does not co-ordinate science in the Arctic in a strategic way to address big science challenges for the UK.

Q105 **Chair:** We will come back to that in a moment. I want to know about what contribution we make and also what effect it has.

Dr Lea: We make a huge contribution across a range of topics. I am a glaciologist but I am also aware that we are making contributions towards understanding biology and ecology, not only in terrestrial areas but in the oceans. We make contributions towards understanding past change, present change and future change through a combination of fieldwork and observations through both short and long-term monitoring and also numerical modelling, which allows us to understand what might happen in the future under different scenarios.

Dr Turton: We also have a number of research institutes that are well known and doing a lot of good science, for example the National Centre for Atmospheric Science, and there is a lot of collaboration with other institutes, such as the UK Meteorological Office, where a lot of models are developed and then used as part of Arctic science. There is also the National Oceanography Centre in Southampton. Although we do not have a British Arctic survey or a British polar survey, a lot of research institutes also contribute heavily.

Professor Tarling: Also, we do have a strength in autonomous instruments. The UK has the second largest fleet of autonomous instruments, which are instruments that we can set off into the oceans and that can make measurements for us. There are big fleets out there, particularly from the US, which measure physical variables, but where the UK is leading is in biogeochemical and biological instruments and we have made a lot of progress. We even put instruments now on ice floes, which can send tethers down below the ice to measure things that could not be measured before. We have strength there that we should build on.

Q106 **Chair:** Let me pick you up on one thing you said there. You said that our strength in Antarctica is that it is 90% co-ordinated by BAS and 10% by the universities whereas maybe the opposite, or some such figure, applies in the Arctic. In other words, British scientific energy is dissipated or is unco-ordinated in a way in the Arctic. Does that mean that there is a



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role here for some organisation that would better pull together the 58 universities and BAS? Is there a role for some sort of polar institute or organisation to try to better co-ordinate that science? If there was, would the academics not resent it?

Dr Turton: Maybe not necessarily an institute but there need to be mechanisms or places where these meetings can take place. There are alternating years of UK Arctic and UK Antarctic conferences that are often tied to the IGS—the International Glaciological Society—and other institutes, but informal networking spaces are important for collaboration across different universities and sectors, including businesses, policymakers and non-academic research institutes.

Professor Shepherd: In the 1990s and before, the vast majority of polar science was concentrated on Antarctica and you can see that there has been a shift because of the recognition that what happens in the Arctic has more of an impact on the northern hemisphere, where most people live. As well as long-term climate change, changes in the Arctic affect people's weather and that affects many things we do, so the vast majority of work on polar science is now on the Arctic. Times have changed and I would say that there is a need in the UK for strategic co-ordination of Arctic research. I think it is important to the UK—we feel the effects of the changes in the Arctic—and we will miss the opportunities that changes in the Arctic present if we do not do this. It is also a quick win, right?

Q107 **Chair:** Presumably what this means is that sometimes scientific research will not be co-ordinated and two academics may well be doing the same thing, doing the same thing differently or doing different things, when they should be getting together. Is that a layman's interpretation of what you are saying?

Dr Lea: Pretty much, yes. We have had examples of bumping into people in airports in Greenland and having no idea those people were going to be there. In addition to what Andy said, it would be valuable to have something along the lines of what I know Danish colleagues do, which is that at the start of each year—normally about January or February, before the season starts—people who are interested in going to Greenland or have fieldwork plans in any area get together, give presentations on what they are planning and then work out how to share resources to optimise the amount of work they can do.

Chair: Who would organise that?

Dr Lea: It is organised informally among different universities.

Chair: That is in Denmark. But what about in the UK—is it INTERACT?

Dr Lea: INTERACT is about field stations so I do not think it would be a suitable body to co-ordinate something like that. But if there would be anything to be done in the UK, currently it would have to be organised informally.



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Professor Tarling: There is a body—the UK Arctic and Antarctic Partnership—that a lot of academics are involved in. I don't think it has as much outreach as it could have. It does have an all-party parliamentary representative on it, but it needs to be augmented to have better co-ordination. I don't think it is used in that way as much as it could be but that is one vehicle—a body that already exists and has the potential to be far more functional. That is not to the detriment of the people who work on that panel, but it should be given far more emphasis and maybe even a way to steer money as well. It does exist.

Q108 **Chair:** If we were going to review, register and consider all our very diverse scientific enterprise in the Arctic, it would take quite a lot of organisation and funding; you cannot do it on the back of an envelope. Are you saying that there is a role here somewhere for an organisation like BAS or NERC—maybe a new organisation for all I know—that would systematically bring all of this information together?

Professor Tarling: There is the UK Arctic Office, which is based at the British Antarctic Survey. I think you will hear more about that from the second panel. It does a good job of trying to bring people together, make people aware of what is out there and co-ordinate as best as it can, but it is a very small office and now, as we are growing the amount of science that is happening in the Arctic, it does need quite a lot of co-ordination and I think some augmentation would be worthwhile.

Professor Shepherd: The organisation that funds the vast majority of the UK's Arctic research is NERC, the research council. There are also contributions to external organisations such as the European Space Agency and other activities in Europe—modelling and things like that—and the World Climate Research Programme. The Met Office has involvement with those. But for boots on the ground, that is Natural Environment Research Council.

Q109 **Chair:** Let me change the topic slightly, if I may, in that case. One of the things that we are looking into quite carefully is the way in which British interests make use of Arctic resources in a sustainable way. One thinks of minerals in Greenland, fisheries everywhere, tourism, big ships and all that. To what degree does British science contribute to enabling people to do their perfectly legitimate business interests while preserving the Arctic environment? Clive Lewis does not agree, I don't think.

Clive Lewis: I did not say that but it is a fair point.

Chair: We will come back to you. But my question is this: there will presumably be some scientists who work for, let's say, the mineral or oil extractors. To what degree does British science contribute to the ability to make use of the resources of the Arctic?

Professor Shepherd: It is mostly inadvertent. British science does not take place to make sure that people can safely exploit the Arctic, but it is true that scientists are concerned about people's safety, so we want to make sure that anything that happens in the Arctic is done as safely as possible—not necessarily as efficiently as possible, but as safely as



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possible. We do not want people to be in danger, so we can tell people where sea ice conditions are favourable for moving around in the Arctic, where weather conditions are favourable—

Q110 **Chair:** Yes, that is quite different. Of course we must do that; that is true. But let's imagine somebody was going to be digging for rare earths in Greenland. It is very important that they should do so properly. They have to know where those rare earths are. They have to know what to do with them. What contribution can British scientists make to safe exploitation?

Dr Lea: To my knowledge, there is not that much in the way of current contribution. That does not include anything that is done internally by the mining or shipping companies, which I would not be aware of. However, as far as assuring the safety and environmental responsibility of any such activity, the UK has great potential to ensure that if any activity goes on—within the stated intention of the Greenlandic Government to pursue those goals—it is done as safely and responsibly as possible.

Chair: A monitoring role, is it?

Dr Lea: Monitoring and understanding process and risk.

Q111 **Clive Lewis:** My point relates to that. The reason I sort of laughed was because I remember asking the question when we were there. Some of the Norwegian scientists seemed to have a quite different approach when we were talking about seabed mining. I said, "Surely that is a bad idea". It is my understanding that the seabeds count for a quite significant amount of carbon absorption. But they said, "We would want to make sure that if there was going to be seabed mining, it did not happen in areas of very crucial scientific interest or in areas where there is a lot of deep carbon sequestration". Are you, however, saying that British science would be more averse to going down that path?

Dr Lea: I was speaking from the perspective of terrestrial, above-ground deposits in Greenland.

Professor Tarling: The Changing Arctic Ocean programme, which has just finished, was a £60-million NERC-funded programme. It did a lot of research on blue carbon deposits. That is the carbon sequestration that is happening through the interaction of the marine communities going down into the benthos. It is quite patchy. It does not happen everywhere. One area where it happens quite well is right at the ice edge. The ChAOS programme within the Changing Arctic Ocean programme mapped out some areas where there was a lot of carbon sequestration—a lot of this blue carbon. We should think about trying to preserve those areas to make sure that things such as mining do not go in and disturb the sediment, outgassing all the carbon that has been sequestered over many hundreds of years. British science is informing. One might want to go one step further and think about trying to make those areas marine protected areas so that you do not have commercial activity where it would make a difference to the climate through disturbance.



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Clive Lewis: It is highly possible that that is what they meant when they were talking about that—not disturbing those areas that could release vast amounts of carbon.

Dr Turton: I think Norway does have a slightly different perspective from the UK's, probably because it is an Arctic nation. I live in the Arctic in Norway, and people there see the Arctic as the place where they live; it is their city and their home. It is not only a place that is pristine and needs protection. Activity needs to be sustainable and thoroughly researched. There are spaces where more scientific research could be done, not only in having a look at what is under the ocean but also at the ethics of it. It is not just the natural sciences that need to be involved but also the social sciences.

Q112 **Clive Lewis:** James Lea, in your enthusiasm to unlock the truth, you answered my first question so I will go on to the alternate. What are the key knowledge gaps in the Arctic? What contribution can the UK make to addressing them? You have talked up what we are doing well. Where are those gaps? That question is open to you all.

Professor Shepherd: From my perspective, the main knowledge gaps are in what is happening to the sea-ice pattern during the summer. That has always been a challenge because we rely on satellite measurements and they are most difficult during summer time. What is happening in summer? We cannot get people on the sea ice in the summer because it is not safe and we do not have any airborne assets to be able to survey it. That is a big unknown.

Another gap is the future contribution to sea levels due to the melting of the ice caps in Greenland. This also applies in the southern hemisphere, in Antarctica, but I am talking about the mountain glaciers and the ice caps in the Arctic, of which there are many. We still do not have a careful bound on that into the future. Related to that, there are several tipping elements in the climate system that we cannot accurately predict, because of a lack of knowledge about how they are behaving today.

These are big-picture items that we need to study scientifically in order to reduce uncertainty.

Dr Lea: Leading on from what Andy said, from a Greenland ice sheet perspective there are two big problems in my opinion: the lack of understanding of iceberg calving processes and the stability of the glaciers. The glaciers can jump back several kilometres within a couple of years, after being stable for 100 to 200 years. What is the top of the ice sheet doing? How is melt going to spread across the ice sheet? What is happening within the snowpack, because the density of the snow within snowpack can affect how much water gets to the ocean? Leading on from that, when that water gets into the Atlantic, what is it doing? How is it affecting the ocean? How is it affecting the biology and the ecology? Ultimately, it will impact the atmosphere, so what will the impact on the UK weather be? The UK has strengths in all those areas that can make significant contributions to solving those problems in the near future.



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Dr Turton: If I can follow up on that, one of the strengths of the UK in the Antarctic is the big, multinational projects that we are involved with, such as Pine Island glacier and Thwaites, that we do not see so much in the Arctic. Thinking about Greenland and building on the two previous statements, the Northeast Greenland Ice Stream, which is the largest ice stream in Greenland, has the potential to raise sea levels by 1 metre. That is probably unlikely in the near future but it is still an area where there are so many questions, because it is so difficult to get to and for a long time it was considered stable, so nobody looked into it too much. It has huge potential for an international research project because it is a marine-terminating glacier; it has ocean processes, atmospheric processes and of course ice processes. These projects are happening—there was a big project in Germany that kicked it off—but there is still so much that we do not know about this part of Greenland.

Professor Tarling: Could I also say something about ocean productivity? It is a massive thing. It is worth several million—

Chair: What sort of productivity?

Professor Tarling: Ocean productivity—the productivity that is coming through the phytoplankton at the base of the food webs going through into the plankton and the fisheries. The Arctic is a major exporter of the nutrients that fuel that productivity and things are changing rapidly now in the Arctic in terms of all those things that are delivering nutrients—the glaciers, the rivers, the sea ice—and also upwelling from deep oceans. What we don't know is how sensitive the system is in terms of maintaining that export of nutrients that the world's oceans rely on.

As for what the UK is doing, we do have a programme that is trying to look at that in both poles—because both poles are important in this process—called BIOPOLE. That is under way and there are a few sister projects alongside it, looking at the impact of climate change. It is a problem that is a major knowledge gap now. We have a lead in looking at this quite holistically, just as Jenny was saying. What the UK does really well is mobilise a lot of scientists and lots of different disciplines into these scientific problems, and it has done that quite well over the past decade.

Clive Lewis: I will hold my final question because I think we are about to vote.

Sitting suspended for a Division in the House.

On resuming—

Q113 **Chair:** I have a final question following on from Clive's group of questions, and this really goes to the heart of the matter. Which single problem in the Arctic do each of you believe science could cure in the next 10 years? Perhaps a more realistic way of putting it might be: which single problem would you like to see trying to be cured? Name one problem.



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Professor Tarling: I would like to see some advancement in the carbon pumps in both polar regions but particularly in the Arctic.

Chair: What is a carbon pump?

Professor Tarling: It is a way that natural systems take carbon out of the atmosphere. The carbon then goes into the marine ecosystems or physical systems and is taken into the deep ocean, where it is sequestered. The polar regions play a disproportionate role in pumping carbon into the deep ocean but because of the climate change that is happening there, we need to know how sensitive these pumps are to the changes that are happening in the Arctic and the Southern Ocean.

Professor Shepherd: Sea level contribution due to the ice caps is something that can be solved but we do not seem to have the structures to solve it because we do not have an international effort to improve ice sheet models and climate models in the same way that we have international efforts to put satellites into space, for instance. We have the European Space Agency, NASA and other space agencies that deal with that but we do not have any organisation responsible for improving predictions of sea level rise. It is a tractable problem; we just do not have the agency to implement a change.

Chair: Does the United Nations not do that?

Professor Shepherd: No. The United Nations collates information that is learnt about those things from the science and published but does not strategically address the problem, and nobody has a collective or individual responsibility for it.

Dr Lea: I agree with Andy. There is no formal, internationally co-ordinated body for ice sheet modelling to work out what is going to go on in the future. There is the ice-sheet modelling comparison project—an international group of researchers—which provides sea level change projections. It does a fantastic amount of work of great quality but that is still a relatively small number of people responsible for generating the estimates of how global sea level change is going to evolve.

What I would like to see addressed is what happens when the Greenland ice sheet melts and dumps a huge amount of meltwater and freshwater into the north Atlantic. What impact will that have on the climate system? Will that shut down thermohaline circulation? Will it produce extremely weird and wonderful weather for the UK? Will it get warmer, colder, hotter, drier?

Dr Turton: We need a greater understanding of the impact of Arctic change on the mid-latitudes—where we live now, in Europe—but also vice versa; how are those changing storm tracks going to affect the Arctic? Are they going to go further north? Are they going to veer off more towards Svalbard and Greenland? Our understanding at the moment is very dependent on whether we are looking at observations or models and on which type of model we are looking at. It would be great if we could



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narrow down that uncertainty so that we can say for sure what will happen in Europe.

Q114 **Chair:** Let me ask you an unanswerable question, if I may. My experience of all academics is that if they see something that needs to be looked into, they look into it and find solutions—particularly scientists, I suspect, more than anybody else. But you have just laid out all these great questions that you hope to see answered in the next 10 years. Why has it not happened by now? What has stopped it?

Dr Turton: Perhaps one thing is that when you apply for these big grants for these big proposals, it is a lot of money. The word “novel” or “new” is expected in every paragraph and on every line. If you say that something has been done before somewhere but that there is uncertainty or that someone else has looked at it in some way, it is not seen as novel.

Chair: It is not structural or institutional; it is about money.

Professor Shepherd: It is not just money. For instance, if you gave the research council £20 million right now, it would more than likely put it to free, open competition and wait to see who bids. They would not be able to spend it strategically to answer the question that you want them to answer. We need directed research, but we need an organisation that has a responsibility to solve these questions.

Dr Lea: A lot of it is to do with the lack of observations and long-term records. Going back to the way that science is funded, generally funding is for three-year projects—sometimes five-year projects if you are lucky—but in terms of being climatologically meaningful, we need decadal time-scaled observations and monitoring programmes and consistent funding to allow us to get these observations out into these inaccessible areas. We need to be doing things more intelligently, using the technology that we now have and could develop for automated systems, whereby you can deploy them and then do not have to go out every year to retrieve the data. To enable that, we need better telecommunications in the Arctic.

Chair: I am keen to explore the question of funding a lot further. Anna?

Q115 **Anna McMorris:** Thank you, Chair. I will take this on a little more and explore support and funding, particularly funding for Arctic research, which you have talked about in some of the previous questions. I will ask a little further. The UKRI combines the seven research councils and has a total combined budget of more than £25.1 billion. NERC receives around £400 million of annual funding from UKRI. We are told that the UK received over £56 million in Arctic science funding. Is this sufficient to allow the UK to make a full contribution to Arctic science and what is needed to explore Arctic science?

Dr Lea: We make sure that we get the most value for money out of the funding we have received and we eke the value out of every single pound we get for doing the science. The work we are doing in the Arctic is incredibly logistically complex and can be extremely expensive to do. When we are doing the work, a huge amount is spent on logistics.



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The other thing I would like to raise is that we need to make sure that we get the next generation of Arctic researchers coming through. The undergraduates we teach are engaged with climate change and want to study it more. However, they are not applying for PhD. There is extreme competition and the reward compared to going into the private sector, where they could apply their skills, be that updated science or knowledge of process—

Anna McMorris: To answer the question, though—is £56 million enough in your opinion?

Professor Shepherd: The £56 million is since 2012, right? That is £5 million a year, which is about a tenth of what we spent on Antarctic research. Yet 70% of polar science is on the Arctic, so it is out of step with the perceived importance of the issue.

Anna McMorris: It does not show the value of what UK research and science can do in the Arctic.

Professor Shepherd: I think it is fair to say that, but I would also say that scientists spend money if you give it to them. Before giving them money, I would encourage them to come up with a plan as to how they might want to spend that money so they can ensure that you get value for that money.

Professor Tarling: I would also add, though, that for that £56 million UK science has been leveraging that against a lot of other nations and using their infrastructure to try to get the biggest bang for their buck.

Q116 **Anna McMorris:** It goes back to what you were saying. What you are doing is trying to use the £56 million as efficiently as possible to get the most possible out of it. On whether it gets the value for what is needed, would you collectively say no?

Professor Shepherd: There are obstacles to spending money in the Arctic on science for the UK because we do not have the assets in the Arctic that we have in Antarctica. That is one of the obstacles. In addition to the funding for the science, you need to make sure that there are ships and aeroplanes and all the other resources that are needed to conduct polar research in the north.

Q117 **Anna McMorris:** We have, for example, the UK's only research station in Ny-Ålesund—which we have been to, by the way. We were fortunate to visit and it is an incredibly impressive place. We have had some written evidence from NERC as well. We saw there how collaboration between other countries can work. Scientific collaboration works very well there. What you are pointing out is that first you need a strategy. Who should be responsible for that UK Arctic strategy? If I am right, NERC is not responsible for that.

Professor Shepherd: NERC designs strategic programmes for science for the UK. It does that routinely in lots of different areas. If the Government is interested in a strategic programme on plastics, pollutants or covid-19, they will go to the UKRI and will ask them to put it on. If the



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Government wanted a strategic programme nationally on the Arctic, NERC would be the people to make that happen.

Anna McMorrin: Okay, so the Government should ask NERC to do that and perhaps equip NERC with more money to do that.

Professor Shepherd: More money and authority, I guess.

Q118 **Anna McMorrin:** The NERC Arctic Office have told us in their written evidence that their role does not include choosing, co-ordinating or making assessments on the Arctic research funded by UKRI or the Natural Environment Research Council or anything like that. You have this broad spectrum of work that is happening without co-ordination.

Professor Shepherd: The word "co-ordination" can mean different things to different people. Henry will talk to you later; he does an absolutely fantastic job of co-ordinating UK activities in the Arctic that fall within his remit.

Anna McMorrin: I know he does.

Professor Shepherd: You have met him. You have seen him. But it is not the same as a national policy on the Arctic and a national science strategy for the Arctic. He would be the first to admit that that is not what he is putting on for us.

Q119 **Anna McMorrin:** Yes. We are trying to get to the bottom of what is needed in the Arctic. Does what exists at the moment fit with what is needed? What is lacking? What can you give us in evidence today that will help us say what is needed in our report to the Government?

Professor Tarling: A lot of the people I work with say that the strategic planning and the long-term funding of long-term observations is desperately needed. There is no funding body that can fund long-term Arctic science that presently exists. We have no long-term assets beyond the base and possibly the visit of the ship every year. We have no other long-term assets in the Arctic. That is because of the lack of strategic long-term funding. A body that can produce that and have this commitment to long-term funding in the Arctic is desperately needed. We will not be a major player in the Arctic unless we get these long-term observations under way.

Dr Turton: I would also like to point out that while Ny-Ålesund is the place where the British flag flies for the UK Arctic, there are also many other Arctic research stations that we could collaborate with and that we could use in a much better way. There are ones all across Greenland, for instance, that are not so well known but that have all the capacity and infrastructure that is needed, across Canada and Sweden. We do not always have to go in through Ny-Ålesund, especially as it is hard to get to, it is expensive and it has limited capacity for the number of scientists.

Q120 **Anna McMorrin:** How can improvements be made to the way researchers access that funding?



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Dr Turton: I think the other forms of funding just need to be more visible, because of course UKRI is the one that many people go to first, but there are also lots of bilateral agreements—for instance, the one with Norway right now. There are lots of agreements with other research councils in the Arctic and in Europe that we could use.

Dr Lea: Quickly following on from that, the MOU with Norwegian Research Council is an absolutely fantastic and valuable thing. At the moment, NERC enables international collaboration, which is so valuable for UK Arctic scientists. Without international collaboration, UK Arctic science would not be in as strong a position—nowhere near. What would really strengthen UK Arctic science would be to enable us to cost in international partners routinely, either through MOUs or by a certain percentage of a grant being costed to international partners for meaningful collaboration. For example, we have indigenous peoples and local groups in Greenland, Canada or wherever. We want to make sure that they get value back themselves and get their time recognised, so that we are not just turning up and saying, “Please can we collaborate with you for free or in kind?” or anything like that. We are reliant to an extent on the good will of these partners and increasingly they are saying no to us, and rightly so. We would benefit from having these mutually beneficial collaborations.

Anna McMorris: They are saying no to you. Why are they saying no?

Dr Lea: Because, for example, their time is not costed. The time that they would spend working with us on the project is not recompensed. The structures are not there to allow us to provide funding to them that would allow them to do the work that we would like to work with them on.

Q121 **Anna McMorris:** What are all the UK research assets in the Arctic? You have Ny-Ålesund—

Professor Shepherd: Let us not focus just on the bases. What we have learned about polar science—

Anna McMorris: That is why I am asking the question. You have a base.

Professor Shepherd: What we have learned about polar science for the past 30 years, and indeed climate science, has come from satellite measurements and climate models. The vast majority of our understanding comes from those two things. They exist in people’s computers in Europe and America. They do not exist in the polar region. We spend lots of money on those and they are absolutely essential.

Anna McMorris: That would be a research asset. What I am saying is what are the UK’s Arctic research assets?

Professor Shepherd: We have CryoSat, which is the European Space Agency’s polar mission. The UK paid for, led and invented that. We have British Antarctic Survey’s assets, many of which spend the summer in the Arctic. All the aeroplanes go back to the Arctic to be serviced in Canada. They are at present within the Arctic during the northern hemisphere summer. They are potentially available as an asset to be used in the



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Arctic. The ship can sail into the Arctic as well and we have Ny-Ålesund as a base.

Professor Tarling: On a minor point, we do deploy certain things there as well, mostly using other people's infrastructure, but we leave it there. They are assets that we leave in the Arctic. These are instruments that we put on moorings in Svalbard and also in the Davis strait in Canada. They are not particularly our assets. They are things we are leaving there.

Q122 **Anna McMorris:** How important is the UK Arctic Research Station, Ny-Ålesund, to UK researchers? Andrew, you talked about the fact that there are a number of different types of assets. How important is the Research Station?

Professor Shepherd: It is our footprint in the Arctic. I think that it is absolutely vital for the UK to maintain that footprint in the Arctic; I really do. I have never used it as a station, but I know that it is important to have expertise in the Arctic to mirror that which we have in the Antarctic. It is something to grow on. The future for polar science will be more autonomy, using airborne or ocean-based drones. That would be an ideal platform to start a UK capability with autonomous sensors. British Antarctic Survey is starting that in Antarctica with Halley, trying to make sure that that base can be run operationally with autonomous sensors. That will be the future for polar science. Fewer people and fewer expensive one-off assets like ships and planes.

Q123 **Anna McMorris:** Ny-Ålesund is only open for half of the year, part-time. I have my own views on this, but what are yours? Would it merit being open 12 months of the year, through the Arctic winter? When we were there, we saw how little research is taking place on the impacts of climate during the Arctic winter. What are your comments on that, Geraint?

Professor Tarling: The polar winter is an understudied period, both physically and biologically. My bent is more biological. What we have found from the few observations we have made is that the biology is really active during the winter, which is contrary to what we thought was happening. I want to go back to things that I am working on, like carbon cycles. This activity in the wintertime is important. What we do not have are these observations. We have already talked about autonomy. Ny-Ålesund will be a perfect base to operate that autonomy from. It would not necessarily mean that we keep the base operational for 12 months of the year, but we can put broadcasting stations there and use that as a hub to transmit data, without necessarily keeping it open year-round. That is a logistical difficulty for us, leaving people there year-round.

Q124 **Anna McMorris:** Though if you do not have people there, you are not able to collaborate and get other scientists there if there is no one actually there looking after the base.

Professor Tarling: That is partly true, but we are managing to go to the Antarctic and operate Halley without people there in the winter. That is successful in keeping our tools and measurements going through the



wintertime. It is a whole other level of logistical funding to keep people there year-round. I appreciate your point that we should have people there doing things. Their capability to operate in the field during winter is also a difficult thing to do with complete darkness. I would say that there is a lot that we can achieve with autonomy without sending people in there year-round. We would have to ramp up the spending, the training and a lot of other facilities in order to make that operational. Nevertheless, it is important science—this year-round science. The seasonality is critical for a full understanding of what is going on, particularly from the biological perspective.

Q125 Anna McMorris: The important point here is what happens in the Arctic does not stay in the Arctic. It impacts the world. What needs to happen within our report? What do we need to say to Government within our report to make sure that the investment in Arctic science is such that that impact is realised across the rest of the world, so that there is an understanding and a priority being given to scientific research across the Arctic?

Dr Lea: There are a couple of things. One is the expertise and autonomy that has previously been mentioned, but the other thing is trying to get telecommunications and the ability for us to be able to get near real-time data back. For example, we have three time-lapse cameras and a weather station overlooking a glacier. It is far cheaper for us to physically go out there each year to recover the memory card, swap them over and then come back than it is to send the observations by satellite. If we had near real-time things, then we would not need to go out as often. We would save on the carbon costs of going out into the field. We would get data in real time and we would be more responsive to how things are changing because we would be able to get the data there and then. It could be applied potentially anywhere in the Arctic as well.

Dr Turton: I think that you partly answered the question when you opened with, “What happens in the Arctic does not stay in the Arctic” because there are also many applications of science that we might discover in the Arctic or focus on in the Arctic initially that can then be applied to other parts, including the UK—things like the wildfires happening right now in Canada. The UK also has wildfires. If we were to be in the Arctic researching the impact of wildfires, there is more than a high chance that we could then apply that knowledge to what is happening in the UK. That is just one example, there are also countless others. Especially over the next few years when the green transition is starting to take place, the possibilities for energy production or renewable energies in the Arctic is then applicable worldwide.

Professor Shepherd: I would encourage you to ask what the strategic importance of the Arctic is to the UK and to try to put that on a parallel with the strategic importance of Antarctica. In the historical past, Antarctica was really strategically important for the UK for obvious reasons, but we have a danger of missing out on what is happening in the Arctic. It is geopolitically changing rapidly, as you know. We also see clearly now that the events that take place in the Arctic affect us. The



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Beast from the East storm occurred because sea ice had retreated across the Barents sea and there was a high pressure sitting over the Barents sea at the time, which pushed Arctic air across north-western Europe and we froze as a consequence. These things happen and they happen to us. It is strategically important for the UK and it merits the same level of investment that we put in Antarctic science, and the same level of strategic thinking.

Q126 Chair: The question of the strategic importance of the Arctic and Antarctic will be a central part of this inquiry but also the Committee has to do a new inquiry into the Antarctic in the autumn and winter. We will be able to compare the two over the two reports. Can I ask two very quick supplementaries on assets? One, we were extremely impressed by Iain Rudkin, who runs Ny-Ålesund, but my understanding is that his contract is ad hoc. In other words, he goes there when someone has some piece of research that has to be done, but he is not there permanently. Is it your opinion that he ought to be there on a full-time permanent contract up there?

Professor Tarling: Yes, I would agree. There are a lot of things that we might miss out on. He mostly goes there to support the science that is happening. For instance, the project is at NPI and we send some scientists to Ny-Ålesund to do both land and marine-based measurements. Iain will go with them to support them, to give them access to the boats they need and to make sure that when they do those land surveys they are properly supervised and have the adequate training to do that, but he is not there when those things do not happen. Basically, the station goes into dormancy until a new science project then goes there.

Chair: If he were there full-time, you would be welcoming people to come because the station is there and open.

Professor Tarling: You would be, but you would also have to encourage the scientists to go so there is a steady stream of scientists going in, that there is adequate funding for them and support to make sure that that is a resource. There were funding streams that existed in the past that were called polar funding initiatives, which allowed people to go and use those facilities. They do exist, but they are not so well known and not so lucrative.

Q127 Chair: I have a second quick question—although it may not be that quick—on resources before I pass on to Barry. I hear anecdotally that the Sir David Attenborough is going to be almost exclusively in Antarctica over the next five or 10 years and the chances of going up to do anything in the Arctic are looking pretty unlikely. Is that true, and what would be the consequence for Arctic science?

Professor Tarling: There is a very ambitious programme—it will be a multidisciplinary programme—called KANG-GLAC that will go into the Arctic. It will measure the rates coming out of marine-terminating glaciers. Those are important because a lot of the ice that is being lost from the Greenland ice sheet is coming through these rapidly moving



glaciers. The ship will park itself in one of those fjords, look at the physical movements, fly people onto Greenland itself and do geological measurements so we can see how that glacier has moved in past geological periods, and also do a lot of the biological and physical monitoring of what happens when a glacier starts to increase in its flow. That will be happening in August next year. That was responsive funding. It is called a highlight topic. It is something that NERC said was a good idea to do. We won the competition to put the SDA in there. It is the first use of the SDA in the Arctic that we are aware of.

Chair: Yes, it will be visiting in 2023. After that, how often?

Professor Tarling: The plans beyond that are vaguer, I must admit. Planning the ship is not always easy and I am not aware of other Arctic projects after that one as yet.

Professor Shepherd: The way that assets are used in the south is through bartering and BAS has a long history and lots of experience of bartering assets with other polar agencies in the southern hemisphere. To some extent, they do the same in the Arctic, but of course it is not their main remit. There is not an organisation that is acting in the same way for Arctic research. That is a missed opportunity.

Q128 **Barry Gardiner:** I want to focus on international co-operation and collaboration. We heard from British Antarctic Survey that an international approach was mandatory. We heard in the written evidence we received that the departure from the European Union had some serious consequences—loss of €95.5 billion of funding available through the Horizon project and that we even lost the lead in some of the research programmes we had engaged in. Bringing that all together, could I get your comments on the importance of international co-operation, the impact it has had on research that each of your bodies has felt as a result of leaving the EU and specifically around Horizon initiative and the funding that we have already discussed?

Professor Shepherd: I will start by saying that I do not think you could conceive of a simpler and more effective way to damage UK science than leaving the European Union. We have done that, so we need to recognise that and deal with that situation. It has been a hard experience for UK scientists to cope with over the past five years. Polar science demands—

Chair: Five years?

Professor Shepherd: In the run-up to these activities—

Chair: We only left last year, so it cannot be five years, can it?

Professor Shepherd: We have been involved in programmes that have been developed over the past 20 years and we have been progressively wound out of those programmes. I can tell you, because I used to lead the Copernicus Climate Change Service for ice losses and we were eventually ejected from that service last year, but I am trying to be positive.



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Polar science demands international collaboration. We cannot do it without international collaboration, because it is not efficient to do it without international collaboration. A satellite costs €300 million, for example. A ship costs £300 million. We cannot pay for this on our own and we should not pay for it on our own. We need to collaborate with our partners. We have to recognise that that is an obstacle and we need to solve that, so we need to find some way around it. The second significant problem that we face in the UK science base is recruiting people. The most important asset any organisation has is its staff.

Q129 **Barry Gardiner:** Your website at the moment actually has a number of job vacancies being advertised in prominent positions.

Professor Shepherd: It is very difficult to fill senior academic positions in the UK. Geraint will tell you the same and I am sure anybody else will tell you the same. It is very difficult. The more senior and the more expert we try to hire, we cannot find them. People do not want to move to the UK. This is just the reality. It is not the answer to the question. The answer to the question is that we need to recognise that and do something about it. Putting together an authority to co-ordinate UK Arctic research providing an outward-facing entity for collaborators to approach would be one way to try to address that.

Q130 **Barry Gardiner:** The Government has put in £880 million to try to address some of the shortfall in funding that the Horizon programme has resulted in. But you have alluded to issues that are not simply funding here. Perhaps you could not only elaborate on those but say whether you feel that the level of funding the Government has now put in to try to make up that shortfall actually does so.

Professor Shepherd: The specific example that I am involved in is the Climate Change Service, which delivers climate indicators for a wide number of organisations. Our observations are used by the European Environment Agency, the US Environmental Protection Agency, the IPCC and other organisations. They were produced and created in partnership with Europe—the European Copernicus Climate Change Service. We are no longer part of that. The UK has done the right thing to find the cash to support a UK version of it, but we are living in the middle of a climate emergency. The second most important thing for all of us to deal with is communicating our messages—our science—to the widest possible audience. Now we are left as a single organisation and a single nation climate service of the UK trying to have its voice heard against the climate service that is representing 700 million people in Europe. It is difficult. We will face challenges and the diminishing importance of UK science is a consequence of this.

The second example is space. That is a challenging landscape now for the UK. We are still members of the European Space Agency, but we are not members of the European Union's space activity. That causes lots of complications for the UK. We do not have involvement in building the long-term monitoring satellites that are required to produce 20 or 30-year climate data sets. We were only involved in the technology



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development that the European Space Agency is responsible for. That is an obstacle that we need to solve because the UK needs high-skill jobs and we need to be involved in the space sector, and we are in danger of missing out. We saw the failed launch activity earlier this year. We will not be in the business of launches anytime soon, but we are world-leading scientists and we ought to be able to capitalise on that.

Dr Turton: I think that it does not only come down to funding. It is not just about bridging the gap in the UK; we are also missing those collaborations and therefore the experience from outside, from Europe. I moved to Europe after the Brexit decision but before it had gone through, in 2017, and also live in Norway now, post Brexit. It is very different on either side. It is logistically much more challenging. You can also see that the more time that goes past, the increasing number of people you speak to who say, "I am not going to submit that proposal with the UK because there is so much uncertainty." The uncertainty in this five-year period is also one of the biggest challenges that we have had. It has not just been, "Let's wait until 2021." It was, "Well, we are not sure. Is this going to happen or not?" All of these things have now become a cumulative thing and there is less collaboration going on between the EU and the UK. That will affect people in the future as well because we also need increased mobility for early-career scientists and students so that they can have those collaborations. It is much more difficult, not just financially, but also as a reputation. One of the first things that people ask me when I am in Europe is, "How did that happen? Why did that happen?" People do not understand it and I think that that also has a knock-on effect for science.

Dr Lea: I completely echo what Jenny Turton has just said. I have direct experience of talking to colleagues in Europe who say that the UK is no longer a partner of choice for having these Horizon grants, despite UKRI's underwriting any bids, because there is too much uncertainty.

Q131 **Barry Gardiner:** Is that uncertainty now reducing, or is it still dramatically affecting new research proposals?

Dr Lea: I am not sure if UKRI underwriting makes too much of a difference. Do not get me wrong; it is fantastic to have that underwriting there, but in terms of the perception of EU-based scientists it is that they are not following what UKRI is doing day to day. Because of that then they have something that they may have seen a few months ago, and they still think that is going on. It means that they are hesitant and that collaborations have been damaged. If and hopefully when we do reaffiliate with Horizon, there need to be investments in re-establishing those existing collaborations and creating new ones to get these things off the ground again, because as they are those collaborations have been damaged.

Professor Tarling: What has happened in BAS, I work very closely with somebody who wrote a successful Horizon 2020 programme funded to quite a few million pounds, and he had to step aside and let somebody else lead that programme, even though he wrote it himself. It was



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absolutely gutting for him given that the leadership allowed the direction of the quite complex programme to be from him as opposed to deferring to somebody else and giving that influence to somebody else as well. It is not just a matter of the funding.

The UKRI-associated country status, the underpinning of that, was there, but there was still a bit of misunderstanding and then they asked for him to step aside. That misunderstanding is going to stay there because scientists do not keep up with the politics of the situation. They just see if they are going to invite these into their consortium. They are quite difficult things to put together anyway and if they see somebody as a bit awkward, they are probably going to leave them out.

Q132 Barry Gardiner: You have certainly informed us about the problem. What you have not done is given us anything that we could perhaps put in our report that might look like a solution. Can you reprise your answers, and provide us with any glimmers of hope that you may be able to?

Chair: Perhaps, keeping an eye on the clock, as swiftly as we can because we have one more set of questions before our second panel arrives. If everyone can be as swift as possible that will be helpful.

Professor Shepherd: We should rejoin the Copernicus space programme. That is a fundamental thing that the UK can do and get a seat back at the table in terms of decision making in space. That is important. It is somewhere where a decision could easily be made.

We also should, in the context of this inquiry, think about creating a front-facing shop window for Arctic science within the UK. That would be a place for people to collaborate and that would be important. There is an opportunity, there is a demand for Arctic science, and so there is an opportunity to strengthen our science base.

Dr Lea: In addition to what Professor Shepherd just said, we should make collaboration with international partners easier, either through memoranda of understanding or through changes to rules and being able to cost in international partners. Leading on from that, in terms of trying to reinvigorate these international collaborations, NERC has an early-career funding grant stream—the NERC seedcorn international network funds—which then could provide a nice model to re-establish old collaborations and create new ones.

Dr Turton: We should remain in Horizon and then in the meantime make some more bilateral agreements, especially with Arctic nations. We also have a societal and ethical responsibility to include Arctic nations when we are doing Arctic research.

Professor Tarling: I was going to say exactly the same thing—bilateral agreements, particularly with countries such as Germany and France.

Q133 Barry Gardiner: I want to push on to my final question to you, and that relates to the impact that Russia's invasion of Ukraine has had on



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collaboration. I would like you to talk about the impact that has had on UK research, but I also would like your view on the Ottawa declaration, which states that "The Arctic Council" which we are not members of, "should not deal with matters related to military security." Yet I understand that the collaboration between Arctic Council members and Russia—the seven plus Russia—has effectively ceased. Is that a violation of the Ottawa declaration? What is the role for scientific and cultural co-operation to remain as a back channel in the more fraught international diplomacy?

Professor Shepherd: Professor Tarling has personal experience.

Professor Tarling: Yes. Maybe I can talk about the BIOPOLE project that I lead. We had a very enticing collaboration that we were going to set up with Professor Semiletov. He is in the Oceanological Institute in Vladivostok. He is an expert modeller in permafrost. He was going to give us berths on a lot of expeditions into the Arctic and also access to data that was going to give us ideas about the amount of nutrients coming out of the great Arctic rivers. We had to sever the link there and that was quite painful for us, because there was a lot of good science that we were going to do with Professor Semiletov. He has a worldwide reputation, and we have not had any contact with him since, which has been a great blow for us. We could not proceed with BIOPOLE until we made that severance with him. That was a condition that was put on us, and we did it with a very heavy heart. That was a direct impact.

I would also say, talking about the ECRs, that the UK polar network did have a memorandum of understanding with the Russian equivalent of the early career network there and there was a lot of exchange of particularly British early career scientists going over to train and do fieldwork in Russia. That was a great success. I had a PhD student go on that myself. She had a fantastic time. She learnt an incredible amount about working in the Arctic and again that has also been sanctioned; it is that exchange at the lower level. If there was going to be a back door diplomacy way through, I would advocate going through the early career researchers as a great way to do it, because there is a real benefit from that. That is a way that you are communicating at the lowest possible level that has benefits for both sides.

Professor Shepherd: There have been impacts on the space sector, for sure. We have had significant delays to both launches, which incidentally used to occur in Ukraine, and satellite builds, because of the scarcity of components that are required for high-tech instrumentation. These are all in scarce demand in general, but now because of the military activity, it is even harder to get hold of them. Europe has delays to its space programme, which is going to run on for the next five or 10 years because of this invasion. That does impact science.

Dr Lea: In terms of the ability to do science, we no longer have access to ground-based observations that we would otherwise have access to. In lieu of that, the ability to gain observations through satellite imagery becomes key. Nothing can ever replace field science or field observations,



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but if you do not have them then satellite imagery is the next best thing. This means that having the best possible access to organisations such as Copernicus also becomes key as well for UK science.

Q134 **Barry Gardiner:** I hear from you that there has been a significant impact on research programmes. Again, so that we can translate this into the Committee report, would your view collectively be that at the earliest possible diplomatic moment re-engagement in science and scientific co-operation would be a very good way to establish those lower level—as Professor Tarling called them—diplomatic channels and begin to re-engage, which ultimately of course we will have to do post Putin or whatever?

Professor Tarling: We need to look at the Arctic holistically and if one third of the Arctic is not being represented in our scientific discussions, it is a huge loss.

Barry Gardiner: It is 53% of the coastline.

Professor Tarling: Yes, exactly. It is a massive thing to not have Russia engage with us scientifically because we will not have the data sets to fully understand what is going on.

Professor Shepherd: Let us not get carried away. It has been difficult to work in the Arctic, and the Russian Arctic, for a long time. It has not been a bed of roses. The lesson that I think we have learned is very similar to the energy crisis. We are susceptible to things such as this, and Britain needs to have its own capabilities in certain areas to ensure that we are robust enough to carry on, if these things happen.

Q135 **Claudia Webbe:** It is great to have you all here. This is an open question for you all. I want to touch a bit more on research and policy. Is there anything more you want to say about how scientific research, in relation to the Arctic's climate and environment, impacts UK Arctic policy?

Dr Turton: This year we had the Global Ocean Alliance that was signed by 73 countries, which the UK led or co-led and was very active in. That is a pledge to protect 30% of the ocean by 2030—it is being called 30by30. That is a huge success story of how science translates into policy because it has taken a lot of scientific understanding of lots of different areas related to oceanography, not just the physical ocean but also the biodiversity and other areas where the ocean is being used for things such as shipping and fishing. This treaty was signed by so many countries partly because of the strength of the science that underpinned it, and it now means that it will have an impact going forward on other science and development. We now know which areas are going to be protected and how much of them, which means that we can then look at other areas of the ocean that are not covered by this, to see whether there is an opportunity for sustainable development or further protection.

This area is a key success story where UK science has gone into a treaty that was led by us.

Q136 **Claudia Webbe:** Could you give us a bit more information about how



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you think scientific research has impacted the UK's Arctic policy?

Dr Turton: One of the areas where it has impacted the UK Arctic policy, and what was included in the framework for this, was the part of the policy discussing more interaction with indigenous communities in Canada. From this now there are several years of research funding where this will at least be kicked off and hopefully continued. That was then included in this policy framework that these Committees have all been discussing. One understanding was that we knew from the past science that has not included the indigenous aspect and now that we have addressed that this is a problem, we are now putting it into the policy for the Arctic in the UK.

Dr Lea: At the fundamental level, the sea level change projections have key effects on UK policy in terms of what protections we put in place for coastal defences, port infrastructure, and other forms of infrastructure. It is also about research that goes on the Arctic, and the atmosphere and the oceans, and how that might impact the UK's climate, and planning for what the future might look like for the UK climate. It all goes into policy development.

Professor Shepherd: There have been important changes in the way that science and government interact over the past five years in the UK. The National Climate Science Partnership has been established. In the past the Government used to consult just with the Met Office and the Met Office is responsible for a lot of the climate projections that the UK makes, but not all. Now, the Natural Environment Research Council centres are all involved in this climate science partnership, so there is a link to the science that is being done, particularly to the Arctic.

Dr Lea is right that the UK sea level projections are now critical for government because every centimetre of sea level rise floods 2 million to 3 million people around the world. You might not think a centimetre of sea level rise is a lot, but it is somewhere around the world. People get displaced. In the UK 1 million people will be flooded by the end of this century. We need to adapt to this, and the Government is listening and that is something to be welcomed.

We have Tamsin—a scientist who is working to support your inquiry, right? This is a fantastic step in the right direction. We just need all of Government to be as enthusiastic as this Committee is about addressing the problems that the UK faces because of climate change. There are problems and opportunities and that means burning fewer fossil fuels.

Q137 **Claudia Webbe:** To explore the question a bit more, did scientific research properly inform the Government's current Arctic framework "Looking North"?

Professor Shepherd: Yes, it does, and scientific research informs all of Government policy now. We have serious policymakers engaged with the scientific community where we did not in the past, so the message is getting across.



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Q138 **Claudia Webbe:** Professor Shepherd, in terms of the impact of Arctic research, apart from academia, who else does it impact?

Professor Shepherd: It impacts everybody. The Chair asked earlier about the commercial opportunities in the Arctic. By far the main commercial advantage that UK citizens will have is avoiding the effects of climate change within the UK, not in exploiting resources in the Arctic. I understand that we need resources; I have a telephone and a computer here. We need these precious metals, but we need to avoid the devastation that is going to happen to our farming industries, our coastlines, our infrastructure around the country, and our flood defences. All these things add up to much more. The impacts of the Arctic add up to much more locally than the opportunities of opening up the Arctic. This is what we need to concentrate on in the future.

Q139 **Claudia Webbe:** Were the scientific assessments done at the IPCC part of that agenda?

Professor Shepherd: Absolutely, but the IPCC is not concerned about the UK alone. We need to have a UK focus, and not all countries will be affected in the same way by changes in the Arctic as the UK is. We are in a particularly unique location—a maritime location on the edge of the European continent—and we see the effects first that will happen in the Arctic before the rest of our neighbours in Europe.

Claudia Webbe: I was thinking about Arctic research more generally in that respect.

Professor Shepherd: Arctic research is absolutely part of the IPCC's assessment.

Q140 **Claudia Webbe:** For some, it seems that the research speaks to academia. How well does it inform the public?

Professor Shepherd: The Arctic affects tourism; it affects biodiversity. Most people on our planet are more concerned about the loss of natural habitats than they are about the loss of their own habitat. People care about animals and wildlife in a way that they do not necessarily care about themselves or their neighbours. That is just a matter of fact.

The environmental emergency—the biodiversity emergency—is just as important. It is driven by the climate emergency, but it is just as important to society as the changes. We can adapt. We can probably cope, but animals cannot, so people are just as concerned about what is happening to wildlife on our planet as they are about the environment.

Q141 **Claudia Webbe:** How can the links between science and UK Government policy be improved?

Dr Turton: First, there needs to be a bit more understanding for scientists on how their science can be impactful for policy. At the minute there is a lot of pressure on scientists to publish scientific articles that are read mostly by scientists and there is not so much of a drive for scientists to produce policy briefings or come to talk to people like you. I feel that



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there needs to be more appreciation for these types of science activities as well as publishing. Of course, publishing is still a thing but when the only merit of a university or a research institute is based on their scientific publications, then that does not have an impact. Scientists individually and research institutions as a whole need to have more opportunities to inform policy and be rewarded for that.

Professor Tarling: I think you need to start young. We have been pushing ECRs a lot in this panel, but I also mean internships within policymaking bodies and Government. There is an early career research submission to this inquiry. They call for that; they want to be more involved in policymaking, to understand what is relevant for policy and how they can tailor what their outputs are so that they can be integrated into future policy thinking. There are things you can do within Government to make sure that the scientists are engaging more. If you start young, they will always remain engaged and know the ways that they can be engaged.

Medium to senior scientists have almost gone past their careers now and can see what their goals are. If you get people young, you can interest them.

Professor Shepherd: Part of the submissions from my centre commented on the early career scientists and the entry-level scientists in our community, and on the diversity of our community. There are problems within our community. It is not diverse. About 40% of the polar science community in the UK is female, so that is pretty good; it is not as good as the rest of STEM but it is pretty good. We have very low representation from black and minority ethnic groups. We have very low representation from disabled groups and from LGBTQ+. I think there are problems and there is no funding available for people to do something about that. It would be very welcome if there was funding to change the diversity profile of polar science in the UK.

Q142 **Chair:** Thank you all very much indeed. You have been grilled pretty intensively for two hours. That is quite a session, and you have been extremely interesting and useful. I hope you find that our reports will reflect the weight of the evidence you have given us, both written and oral. Thank you all very much.

Examination of witnesses

Witnesses: Dr Anna Jones, Dr Iain Williams and Henry Burgess.

Q143 **Chair:** Welcome to both of you who are with us in the room, and to Dr Anna Jones, who is joining us remotely. All three of you are very well known to this Committee and are very good supporters and helpers of this Committee, so thank you very much for finding the time to come to give evidence to us this afternoon.

I will kick off with a general question for all three of you. First, what is



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the thing you are most concerned about regarding the Arctic and what is happening in the Arctic? The recent thing we have heard about is the disappearance of the Arctic sea ice. That is a big concern, but more important than that, what can British science do to counter that, analyse it, sustain it or recover it? Who wants to go first?

Dr Jones, thank you very much for escorting us on our recent trip to Ny-Ålesund. It was very kind of you.

Dr Jones: It was a great pleasure. I very much enjoyed it, and it was lovely to meet you all. Thank you also for the invitation to provide evidence and meet with you this afternoon.

I am going to kick off with this question and then I imagine the others will join in. You asked about the biggest concern and for me it is a question that could be answered in different ways, but I am going to play it very straight. The change in the sea ice is a thing that is concerning because it is happening so quickly. There are different things or concerns, and they will affect over different timescales, but the sea ice is changing so quickly and the effects of the loss of the sea ice in the Arctic—I know you will have heard input from other witnesses about this as well—are potentially huge. The sea ice is important for its role in reflecting solar radiation; it affects the way heat is exchanged between the atmosphere and the ocean and affects the exchange of gases. The formation of sea ice affects ocean properties because it affects salinity in the ocean. That affects the structure of the ocean and how ocean circulation works. It is important for ecology. It feeds across the whole of the Arctic system in almost every single discipline you can think of.

In terms of what we might do about it, and how we might predict changes, this must be a combination of modelling studies supported by observational data, which can include long-term observations, but also process studies, so studies that get down into the real detail of why that particular thing behaves in that particular way. That will give you information and a number, which can go back into a model. That improves the model, and gives you better confidence in your model and in your model predictions.

I also think given where we are, and you referred earlier to this recent paper that was suggesting that sea ice in September is likely to be gone by 2030 or so, we do need to think more about the consequences of the loss of sea ice, and what this is going to mean for the UK, for the ecosystems in the Arctic, the knock-on effects for our weather and all of the knock-on effects. I think that is very important also.

Chair: Before I ask Henry Burgess or Dr Williams, I agree with you, but why has that not been done before now?

Dr Jones: That is a very big question. There are lots of studies about sea ice. Some of the comments made earlier about long-term monitoring are very salient here. Long-term monitoring is difficult to set up and it is difficult to support.



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The sea ice has changed very quickly. That is another thing. Each time we get a new study it brings the date forward; it becomes closer and closer. There is an awful lot of work, but it is a very big question. In the answer that I just gave you, I touched on the atmosphere, the ocean, the biology. These are huge science questions. The implication is not just for the Arctic, but for lower latitudes also. A lot has been done, but there is a lot more to do.

Q144 **Chair:** I am not being difficult. We spent two weeks at Ny-Ålesund. I am not being provocative or difficult, but we know that the sea ice is disappearing; we know that is happening. Surely what science should focus on now is not whether it will be in 2030 or 2031. We know that is going to be the case. Surely there should be a focus on what we can do about it, and what the solutions are, rather than whether it is happening, which we understand.

Dr Jones: I completely agree. It is the sort of approach that I take. Yes, great, so we think it is five years earlier. Really? Does that matter? It is going—that is what matters. I do completely agree with you there.

We do need to think about the consequences. We know what we need to do about it. We need to reduce our emissions of greenhouse gases. We have known that for decades. The frustration of the scientists plays out here because we have been saying for many years that this is going to happen. The studies all show that it is going to happen, and now the observations show that it is going to happen. The absolute best that we can do is get our emissions of greenhouse gases down. That is the key thing that we should be doing. I think sometimes we think about what the consequences might be, but the bottom line is we just need to cut greenhouse gas emissions. We need to do both, though. With cutting greenhouse gases, things have gone too far already for the sea ice in the Arctic, so we need to do that so that we can try to hope for some sort of repair, but we do need to think about what the consequences are going to be. We have allowed it to get that far.

Q145 **Chair:** Henry, you will have your own answer to this question. Before you do answer, can I ask a supplementary to Dr Jones's answer, which is that Arctic scientists of course have no role to play in terms of carbon production globally. That is for others. Arctic scientists are responsible for saying it is happening and how awful it is, but of course there are a variety of people who are nothing to do with the people in this room whose responsibility it is to combat carbon. Is that a reasonable dichotomy? In other words, your expertise is on the consequences. It is other scientists in completely different places who have the expertise in trying to combat it.

Henry Burgess: Partly, but as we heard from the previous panel the UK-based researchers and others are very interested in not just atmospheric carbon but, for example, what is happening to carbon sequestration in the ocean. That is not being obsessed with the consequences of it. That is more of a focus on carbon processes in the Arctic, particularly in the Arctic ocean. It is more than just assessing what is happening in the



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Arctic and then responding to it. It is getting into the detail of what is happening to carbon in the Arctic.

It is one of the reasons why places such as the central Arctic ocean, which we have not heard much about so far in this session, are important. Climate change is literally and figuratively shining a light into the Arctic. At some point in the next couple of decades, we will have, in the summer at least, essentially a new ocean or a new sea that we have access to and that other countries have access to—and that has not happened anywhere in the world since the North sea opened up 10,000 or 20,000 years ago. That is perhaps an over-dramatic analogy, but we are about to enter that situation in the next couple of decades.

If you ask me where I think one of the areas of focus will be or could be for the UK in the future it could well be the central Arctic ocean. It is not to say that we have not been doing work there, particularly with remote sensing and elsewhere, but other countries are beginning to focus a lot on the central Arctic ocean—ecosystems, fisheries, blue carbon—and it is an area of great potential for the UK community.

Q146 Chair: In a sense that is the opposite side of the coin. Anna quite correctly highlighted the dangers and the worries of the fact that the sea ice will disappear by 2030. You are saying that in fact there are some advantages for scientists from the opening up of a new area of expertise that we might then find in a newly opened ocean.

Henry Burgess: I think “advantage” is the wrong word. I would say there is a requirement for scientists to study what is happening there so that those scientists can inform policymakers and decision makers, so that they can make wise choices about the exploitation of, governance of or access to that region in the future.

Chair: Do you have a different view or agree?

Dr Williams: I agree. I would certainly add the Greenland ice sheet to the discussions, as well as sea ice. We have just heard in the previous session how important that is—ensuring that as we monitor and understand the changes in the Arctic, they are plugged into the whole climate system and we understand the climate system. As we have said, what happens in the Arctic impacts much beyond the Arctic—our own climate, our own weather patterns—so ensuring that those things are linked up is important. I emphasise that point.

Q147 Chair: You could argue that the Greenland ice sheets and the Antarctic ice sheets are far more important than the disappearance of sea ice. Aren't they the really big things?

Dr Williams: They are certainly significant. I do not think I want to comment on the relative importance of them, partly also because of the feedback effects as well. It is understanding those feedback effects, so it is not just simply the different ice melting, but it is understanding the relative feedback effects, which might make it not necessarily as simple as just the ice melt.



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Q148 Chair: I want to move on quite swiftly, because we are keeping an eye on the time. Henry, I want to ask you about a particular thing that we heard when we were in Svalbard. There is this proposed new Norwegian law, which would restrict UK accessibility to work in the field. Will it happen? Is it going to go through the Norwegian Parliament, and if it does what effect does that have on our ability to carry out scientific research in Svalbard?

Henry Burgess: The UK has a long-term commitment to research in Svalbard. UK researchers have been there for at least 50 years. We have had the UK research station there for 30 years. The support we get from our Norwegian partners in Kings Bay at the Norwegian Polar Institute is exceptionally strong and welcome. At the same time, we are seeing significant changes to the way that science is co-ordinated and how Ny-Ålesund in particular is run. Some of those changes have the potential to have a chilling effect on the UK's and other countries' research in that location.

There is a risk that the baby will be chucked out with the bathwater when it comes to some of these requirements. There are requirements around field safety, environmental protection, and permitting. We think in some cases these are duplications or unnecessary additions to the stringent safeguards and practices that we have in place in Ny-Ålesund already, which have been created, generated and successful over 30 years. We have made representations through appropriate channels to consultation exercises over several years, but unfortunately there has not been a great track record of positive responses to those consultations. We worry that the direction of travel is such that it is making it more difficult in the future for UK researchers to access the station. That is bad because it means it is more likely they will go somewhere else and have more impact or more unregulated impact somewhere else.

We are fully in favour of protecting Svalbard. It is a pristine, natural environment and we do not want to undermine that in any way at all, but we are very keen to ensure that we do not duplicate or create unnecessary barriers to researchers.

Q149 Chair: What is your understanding of what state things are at in the Norwegian Parliament? Is it going to become law?

Henry Burgess: My understanding is that these provisions, which were consulted on over the course of the last year or so, are likely to be rolled up in the proposals of the Norwegian White Paper, which will be voted on through the Norwegian parliamentary process. We may have some time to go until they are implemented.

Q150 Chair: You were here for the first panel, so I know you have heard a brief discussion on this point. I do not want to just talk about Svalbard, but I was very struck by my impressions there. First, what an absolutely outstanding job Iain Rudkin does. The way that he handled everything that we did was first class. Secondly, as I understand it, his contract is ad hoc; he goes there when he is required to be there, rather than keeping



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the station open all summer or even all winter. Is there an argument in favour of increasing the British presence by having a more stable research base in Ny-Ålesund?

Henry Burgess: The UK research station is open when it needs to be, but it can be open at any point throughout the year. There is no restriction on when the station can be open. It tends to be open in the spring and summer because that is the time when scientists apply to use it, and it is when it is most straightforward and safest to use it but there is no restriction on when people can apply.

I am very pleased that this year we have had a second round of NERC's Arctic station access scheme, and that is going to be focused on using the station in the latter part of the autumn, the winter and early spring. That allows researchers to get some modest financial support to use the station then. As Geraint and others said, though, those biological processes that we thought were dormant or semi-dormant in the Arctic in the winter are absolutely not, so there is great potential for the station there in the winter. But we will still open the station when it needs to be open, because there is no point having someone sitting there doing nothing, but we are keen for people to use it all the year.

Q151 **Chair:** The counter argument to that would be that if it were open and you were there, that would attract scientists in. If scientists must go through a bureaucratic process to apply and persuade you, there is quite a lot of money involved in sending Iain and the team up there, so is there not an argument in favour of having a permanent presence there and then seeking to find the scientists to make use of it?

Henry Burgess: At the moment we have 10 or a dozen projects a year, and that does not take up the whole year. If we get to a stage where people want to use the station 100% of the time, then that is what we will face and we will respond to that. At the moment we are not in that position, and it does not look like the demand will be there to do it like that in the foreseeable future. If that is the demand, then the station will respond.

Q152 **Barry Gardiner:** I will ask Dr Jones to engage again. We have UK research capacity. We try to understand what is going on. We try to model what is going on, and we then need to use that for mitigation of some of the changes that the region is seeing. Give me a gap analysis. Tell me where in those three elements our research programmes are missing things. What are the key things we could do to improve the UK's research capacity in those three elements?

Dr Jones: For good research, you need several things. You need research funding to support projects, and that might be strategic funding, it might be funding for projects that are proposed directly by the community. You need collaboration and community—either national or international—so you can develop your ideas and thinking, and you can share your assets. You also need facilities, and they can be shared as well. Those are the three key ingredients.



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You need some way of working efficiently, recognising that the money and assets will never really be enough. People will always want to have more, so it is about how you work efficiently and strategically. It is about the good design of projects as well. If you were thinking about long-term monitoring of how the Arctic is changing, you would need to do some sort of analysis to understand what the key things are that are changing, what the models most need more confidence in, and where you would need to put your systems and instruments to make those measurements. You can do those sorts of things quite cleverly. There are new methods in AI, for example, which can work out efficient locations of systems. We talked about autonomy, which is important as well.

There are things that can be done in those ways. There have been several horizon scans by eminent groups internationally in the UK and broader. We talked earlier about the IPCC and whether they think about the Arctic. There is a special report called "The Ocean and Cryosphere in a Changing Climate", which has a section with recommendations about the data gaps and knowledge gaps for the Arctic. AMAP—we might come on to that—have their own thoughts. Some knowledge gaps have been identified.

Those are the ingredients that I think come together, but perhaps ensuring that the most strategically important research and the best-designed experiments are taken forward is something that I know there was a lot of discussion about in the earlier session. That might be a way of bringing those ingredients together. Iain might want to comment on that as well.

Dr Williams: I completely agree with everything that Anna has said. We have talked a little bit about autonomy and capabilities in the Arctic. We also need to make sure that they are backed up by capabilities back home to curate, manage, store, publish, make available the data, and make available the tools to analyse and manipulate those data; otherwise it is not very helpful. Of course, with the growth in autonomy and remote sensing the growth in data is more or less exponential, which is fantastic, but it needs to be supported by the right framework and the right policies and infrastructures behind it, as well as on the ground in the Arctic or wherever.

Q153 **Barry Gardiner:** I am not quite satisfied that you have given me a gap analysis of what I asked for, which was where are the gaps in our understanding, where are the gaps in our modelling, and where are the gaps in our research capacity on mitigation? Now, Henry, you look as if you want to come in here. The British Antarctic Survey gave us a list of things that you would like to see further funding for. You talked about cutting-edge infrastructure, scientific equipment, support for researchers and training, and enhanced engineering science. I do not want just a shopping list, though. I am trying to identify where the gaps are that our UK Arctic research ought to fill because that is where we can then say, "Here is a recommendation."



Henry Burgess: I think this fits into a wider process. There are a lot of people internationally thinking about what the gaps are in the Arctic. The UK is very much not on its own here. There is a whole process run by AMAP and supported by IASC on sustaining Arctic observing networks and thinking about what observations we need in the Arctic—what the black holes and the gaps are, the local purpose that people might need that information for, the regional purpose and then the global purpose. All that work is continuing now.

Some is delivered through the UK's participation in the Horizon-funded project Arctic PASSION. It sounds dry, but it is called a system of systems for observations in the Arctic. We do not have to wait forever to get that result, but when we do get that and as the process develops we will begin to know where countries need to invest their skills and their capacities and interests. It will be interesting at that point or quite soon to map the UK's Arctic community to see what we are good at, and what we know that system of systems—that observation network, that ideal network—needs and where the UK can then contribute. At the moment there is not an exact list saying, "These are the 10 gaps; these are the 10 things we need to do. Let's match it. That's it." It is more, as you say, a shopping list of things that we are interested in and are good at. This thinking is happening internationally.

Q154 **Barry Gardiner:** Dr Turton, in her written evidence to us, talked about how there was a need not just to accumulate data that are sitting on a shelf, but to get research programmes that are mining that and new research data. In our written evidence we were also told that there is a need for diversified research programmes looking at more cross-disciplinary research to provide a holistic view of what is going on in the Arctic ecosystem. Why doesn't that cross-disciplinary research take off from the ground? Why does it not get lift-off? Why is the funding not there for that? Do you think there is not a need for that? Explain to us what is going on here because they both seem eminently sensible suggestions, but if it is a gap in what we are doing, why?

Henry Burgess: There is a need for both. I think there is a need for hard science—single-science process studies—and deeply understanding what is happening in a particular field or in a particular area. The Arctic is still, in many cases, radically understudied and undersampled. There is also, not least because the Arctic is a lived space—4 million people, including 400,000 of the indigenous population—an absolute need to understand those changes and how they are impacting people, and how people in the Arctic and the near Arctic are impacting the Arctic in turn.

That thinking is beginning to happen and it is embodied by a new UKRI-funded programme, the Canada Inuit Nunangat United Kingdom Arctic research programme, which is now in its second or so year of fieldwork. This is a transdisciplinary programme because it is bringing together the consequences of environmental change and of social, cultural, artistic, engineering and physical sciences changes. All that is being looked at together. This is the beginning, but I do not think it is an either/or



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situation. It is the appropriate programme and the appropriate method in the right circumstances.

Dr Williams: There is a trend of increasing interdisciplinary and transdisciplinary research across the research community. With the advent of UKRI, which is now five years old, we are seeing more transdisciplinary research. I could cite the building a green future programme—a cross-UKRI programme with £75 million to build a green future, as it says. NERC has itself funded a £40 million programme called changing the environment, which has what I call a whole-institute approach in order to see if we can get a whole institute, whatever the discipline, to focus on environmental issues. We are not just funding environmental scientists in these programmes. They are not specific to the Arctic at this point but we are seeing trends in that area.

It will be easier as we change our processes across UKRI and harmonise more for researchers to apply across research councils in transdisciplinary ways as opposed to the danger of falling between two councils, which may have happened. There is good progress.

Q155 **Barry Gardiner:** Henry, you committed the cardinal sin of using the acronym. You talked about AMAP, the Arctic Monitoring and Assessment Programme—just so that anybody watching this knows what we are talking about.

You talked about a vehicle for observing systems with expanded monitoring and documentation of Arctic change to give that better database of what is going on. In practice, how are we contributing to that programme? What is the best input that we can make to fill in those gaps in data?

Henry Burgess: All those AMAP reports, including the report from 2021, are available to the scientific community and to funders. We would hope and expect that researchers would look at that report, see where the gaps and the opportunities are, and then be tailoring that to the proposals that they are putting forward for grants and other work. That would be an obvious thing for people to connect to. I think that the AMAP work is strong enough and powerful enough that that is the case. There were submissions from, I think, the Met Office and it was talking about its connections to AMAP, so hopefully that is beginning to happen.

Chair: Anna is keen to come in.

Dr Jones: I was going to come in on one of the previous points, which was about the use of existing data. I can say a few words if that is useful, but if you feel we have moved on then I don't mind.

Barry Gardiner: Please do, Anna.

Dr Jones: In the past traditionally for polar research, there has been a sense that you should be going somewhere and there should always be fieldwork—that boots on the ground or presence on a ship are very important. I think that is changing now. I get the sense that the



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possibility to propose a project based on existing data is much more palatable now than it used to be. I am not sure that that message has quite filtered out, but I think it is getting out into the community. The project always has to be driven by the science. It is not, "I know there is some data. I am going to analyse it". It is about, "This is the question and I know that there is a dataset there that can help me answer it".

There are a few reasons that there is a move in that direction. It is a much lower carbon cost. Scientists are taking into account the carbon impact of their projects. These are things that are taken into account in funding bodies. They are obviously not the primary consideration but it is part of that. It is also an EDI question. You might have people who are not able to travel, to get out into the field, but they can do a very good project using existing data. I think this is a conversation that is moving in the right direction at the moment. It used to be that you had to go out into the field to do things, but now the notion of having a project that utilises existing data, good analysis and potentially good modelling as well I think would also be fine for a proposal.

Chair: Before you move on, I will interrupt briefly to say we are expecting a vote now and we will, therefore, have to suspend for 15 minutes for this one vote. That takes us through to 6.45. Can I personally apologise to the Committee? I have to meet, believe it or not—this is a real name drop—the Chief of the Defence Staff, who is arriving here for dinner at 6.45, so I will have to vacate the Chair. Philip, are you going to be here?

Philip Dunne: I am.

Chair: I will ask my boss, the Chairman of the EAC, to take the Chair at that time, and I hope colleagues will be back in time to make sure we have a quorum. We will suspend until 6.45 pm.

Sitting suspended for a Division in the House.

On resuming—

[Philip Dunne took the Chair]

Q156 **Chair:** We are resuming with me in the Chair, as James Gray had other business to attend to. Barry Gardiner is just towards the end of his set of questions.

Barry Gardiner: Dr Williams, can I ask you about the recent memorandum of understanding with the Norwegian research council? What benefits is that going to bring? Are these bilateral agreements really productive? If we were making a recommendation to this Committee, should we be having more of them and, if so, with whom?

Dr Williams: First of all, it is early days to comment on whether it has been successful yet because it has still fairly recently been signed, but theoretically it should be. It is a very positive thing. It will enable co-investigators from either country to apply to the country's research



councils. You have a lead investigator and a co-investigator from both countries applying either to UKRI or to counterparts in Norway. That is very positive. It essentially avoids what you might call the double jeopardy of collaborating internationally, where if you did it separately the UK partner would have to get agreed funding from UKRI and then, separately, funding from the Norwegian research council, for example. It avoids that, so it should be a very positive agreement. We will wait to see what collaborations come out of it because it is too early to say at this point.

To answer your question about whether we should have more of them, they are a good thing. We are exploring all sorts of collaborations all the time with other countries. This is a high-level one. It is quite a broad one negotiated across UKRI. We have smaller MOUs, if you like, to enable us to collaborate in similar ways with other countries at a NERC level. They are certainly helpful. They are not absolutely necessary. We have already talked about a collaboration we have with Canada, which has an MOU associated with it but at a NERC level. There are collaborations, for example, with Germany as well. We have collaborated quite heavily on the Arctic Ocean programme. It is not a prerequisite but they are very helpful.

Barry Gardiner: Who would be your top targets for us?

Dr Williams: Perhaps I ought to defer to Henry to speak about who the most active Arctic nations are that we should work with. As my first stab, we already work a lot with Germany, Canada and probably the US. We have good collaborations with the National Science Foundation and agreements with the National Science Foundation in the US already.

Henry Burgess: One of the consequences of Russia's actions in Ukraine is that countries are looking for other places to do their Arctic science work than in Russia. People are looking to Canada. In particular, we have had this new programme with Canada. That is a good start and is a model for future work. The focus on Greenland and, therefore, with Greenland itself but also through the Kingdom of Denmark is going to be increasingly important. We have a new UK-Greenland bursaries programme funded by the Department for Science, Innovation and Technology this year, and that is small scale. I think that Greenland is only going to increase in importance, not just for those reasons but for its increasing importance in Arctic change more generally. I think that will be an interesting place to explore.

Q157 **Chair:** I am going to ask a few questions on the way in which we allocate support for the Arctic versus the Antarctic and some further questions on collaboration. I would like to start my questions by thanking Anna and Henry for facilitating our visit to Svalbard with you earlier in the year.

In the session earlier you touched on the pace of change and the warming in the Arctic. Anna, I think that this is probably for you to start with. Could you describe how you go about allocating research funding for research in the Arctic for UK researchers? Or perhaps it should be Iain



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who starts with that.

Dr Williams: If I may take a step back and talk about NERC funding, that will get us to how we allocate funding in the Arctic. The NERC research and skills funding budget this year is £311 million. That is split into two components: 40% is national capability; 60% is what you might call primarily response-led research.

I will cover the national capability element first. That is 40%—about £120 million a year. That funding is all through NERC's six centres—I will avoid the acronyms: British Antarctic Survey, National Oceanography Centre, National Centre for Atmospheric Science, National Centre for Earth Observation, UK Centre for Ecology and Hydrology, and the British Geological Survey. Many of them have research relevant to the Arctic, not just the British Antarctic Survey.

We fund those centres and 65% of the funding that goes to those centres is for research and scientific activity, which should be decadal in scale and of at least national or international standing. It is there for long-term scientific activity of large scale that you would not ordinarily fund through short-term grants.

Q158 **Chair:** Does that mean it does not have to be spent in-year but that it can fund multi-year programmes?

Dr Williams: We have an annual budget that has to be spent in year, in line with public sector funding, but it is enduring funding. Some we commission on five-year cycles. Some of the infrastructure funding we commission on 10-year cycles. We have guarantees to ensure that we do not drop that funding off at the end of, say, a five-year commissioning cycle. It evolves. We challenge it, of course, and peer review it, but it is there to be enduring funding. That is a key component of environmental science in this area. That is the national capability.

It is slightly more complicated with the British Antarctic Survey because in addition to the national capability funding it gets from NERC there is what we call the ALI partition—the Antarctic logistics and infrastructure partition—which is an agreement between DSIT, the Government Department responsible for science, and the Foreign, Commonwealth and Development Office, which provides additional funding above NERC's baseline to support primarily Antarctic research but, of course, there are benefits for the Arctic in the facilities and capabilities that that provides, in particular the Sir David Attenborough ship.

There is a whole range of national capability, and the national capability funding for NERC includes funding for the Arctic. That is at BAS but there is also a relevant programme led by the National Centre for Atmospheric Science looking at ocean and atmospheric circulations in the north Atlantic and the Arctic. There is quite a lot of activity on that side of NERC's funding.

Then you can move over to the response mode funding—the 60% or £190 million a year funding—which itself falls into two parts. One is what



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you might call strictly response mode, where research proposals are submitted by the research community, which obviously includes universities but our research centres can also apply. That is assessed, peer reviewed and awarded on the quality of science.

The second component of response mode funding is more strategic, where through head office, in consultation with our council and science committee, we choose specific areas that we choose to promote research in and then ask the research community to respond to calls in those areas. I should say that the Arctic has done quite well out of those areas. The Changing Arctic Ocean programme was a strategic call, a highlight topic, and partnerships collaborating with other countries, because of the timeframe we often have to work to in collaborating with other countries, things like the Canadian collaboration. The MOSAiC collaboration with Germany is another one that has been funded through that. There are quite a lot of options for building Arctic research programmes.

Q159 Chair: That is a very helpful overview. In relation to funding for Arctic-based as opposed to Antarctic-based projects, do NERC or BAS set out specific calls so that you want to promote a particular line of inquiry or is it, as you were saying, more bottom-up responses?

Dr Williams: It is a mix. We do promote specific calls through the strategic programmes, things like the Changing Arctic Ocean programme. That is an example of a call that we asked the community to respond to. There is then the other side, where it is completely investigator-led, as it were. There are both aspects. Of course, it is also through national capability.

Let me give an example. We have talked a little bit about long-term monitoring already today. Through our National Oceanography Centre rather than BAS, we fund long-term monitoring of the oceans, which includes the higher north Atlantic, to give an example. As part of the OSNAP programme—the Overturning in the Subpolar North Atlantic Programme—there is a line that goes from Scotland across to southern Greenland and across to Labrador in Canada. We have been monitoring that line since the 1970s through our national capability programmes through the National Oceanography Centre as an example of the directed activity as opposed to the response mode.

Q160 Chair: Within the British Antarctic Survey, is there a trend towards greater support going towards the Arctic than there used to be? What proportion of your funding goes into Antarctic projects, Anna?

Dr Jones: The majority of our core funding will support Antarctic research. The national capability funding that Iain just talked about for what is called the single centre—that is this five-year programme, if you like, just for BAS and CPOM as well now—funds some long-term observations in the Antarctic and what we call key capabilities. The problem is, of course, that you need the measurements in the Antarctic as well. We have some measurements in the ocean offshore of the west Antarctic ice sheet and it is looking at how the ocean temperatures are



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behaving and how the ocean is behaving. You need to know that to understand what is happening to the west Antarctic ice sheet, and that is a huge question and a hugely important one as well.

We do have our long-term observations focused in the Antarctic, but we have our key capabilities and they are mobile. They can be used in the Arctic and they are used in the Arctic. One example is that we have our fleet of Twin Otter aircraft and two of them are fit for doing scientific measurements. One of them does atmospheric measurements and it measures the way heat moves between, let's say, the ocean and the ice or the ocean and the atmosphere. That asset—that Twin Otter aircraft—can be bid for by UK university groups or by BAS scientists applying for external funding. You can apply for money to use that aircraft in the Arctic and that aircraft has supported quite a few projects in the Arctic already over the years. There was one looking at what is coming out of the ocean—the little droplets—and how that is affecting the formation of clouds, and what those clouds are doing in the atmosphere and into the heat budget. There was one recently looking at what you call cold air outbreaks. It is basically air from the Arctic that is coming down towards the UK. What is causing it and what are the impacts? That is just two. There have also been proposals looking at methane emissions that wanted to use the aircraft.

That is an example of where we have our assets. Our asset is mobile so it goes up to the Arctic. We have funding from the national capability that goes into our ice core extraction and analysis, and that has been used in Greenland. Those capabilities are mobile and they will go north and south. Our long-term measurements at the moment are focused in the Antarctic. I was thinking that when you do your inquiry into the Antarctic, we will have this question about where we should be doing our measurements and you will see just how important those are.

There are scientists at BAS that work in the Arctic, but they tend to do it by applying for external money. There is a very small number that use core funding to do work in the Arctic and they have done some fantastic work with long-term measurements. However, the Arctic work is mainly supported by external funding.

Q161 Chair: Do we keep any analysis? If we were to ask you to produce a 10-year table showing how much British scientific endeavour is being done and how much it is costing in each of the two polar regions, is that available?

Dr Williams: Yes. All our data on grant-funded research is publicly available. It is there. I can give you a very brief summary if you would like, but for competitive funding, we award on average just over 40 grants a year. That is very similar in the Arctic and the Antarctic. There is not a great deal of difference. They are averages. It is obviously lumpy year by year, but there is also no trend in either the Arctic or the Antarctic. As numbers of competitive grants awarded goes, it is pretty consistent, although it obviously varies year by year. I can provide you with details.



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Chair: If you were able to point our team to where we could look or if it exists already and you could send it to us in a simple way, that would be very helpful.

Dr Williams: Yes. I am happy to.

Q162 **Chair:** On this prioritisation, Henry, maybe you would like to come in on the extent to which British Antarctic Survey looks to direct inquiry into what is happening in the Arctic or whether you rely solely on researchers bidding for particular research projects. Given the overview that you demonstrated to us when we were on Svalbard, I wonder whether we should not be trying to encourage particular lines of inquiry.

Henry Burgess: As Iain and Anna have both said, it is genuinely a mix. There is this split between strategic investment by UKRI and the Natural Environment Research Council, and bottom-up suggestions of interesting questions and challenges from the researchers themselves, combined with the opportunities that we see for quick links and connections internationally.

For example, the MOSAiC programme, which was this big German drift expedition of several years ago, was an initiative that was going ahead without the UK. We were not a partner in that, but we saw collectively the opportunity to get involved in something that was very significant, studying the central Arctic Ocean in the middle of winter and all year round. Combining funding from Government but also over £1.5 million from NERC, we have provided the opportunity for UK researchers to join that programme. That is an example of something in between a little bit, strategic and then bottom up, and then something in the middle that is, "Here is an opportunity, we must not miss it". By working with partners in Government and the research councils, we can provide a competitive opportunity for researchers to participate.

Although that was directed funding, it was still competitive because we asked people to put their best ideas forward. That is the kind of thing that the Arctic Office is particularly involved in and wants to promote more. If what you are asking is whether we need a strategy for Arctic research and investment, that is more a question for Iain or Anna.

Q163 **Chair:** Does NERC look to direct endeavour in scientific research? You obviously prefer most things to come up from individual projects to be bid for because you see that as your main role in allocating money, but to some extent you must have your own preferences.

Dr Williams: Well, it is a mix. As I say, 60% is competitive; 40% is not competitive funding through our centres. It is a genuine mix.

Chair: Much of the 40%, if I understood it correctly, is looking at maintaining the infrastructure of the capability, the logistics.

Dr Williams: Not entirely. The BIPOLE project is a research programme that is funded through national capability, which Geraint talked about earlier. There is another one called CANARI, which is looking at ocean



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and atmospheric circulation in the north Atlantic and Arctic ocean. The best way to describe it is that about two thirds is scientific activity. That scientific activity, of course, maintains a capability, most which is people. That is the important capability it is maintaining. The other third is maintaining the physical capability of our national capability. That is how that fits together.

Q164 **Chair:** Anna, you were talking about some of the air assets that constitute some of the physical capability. The RRS Sir David Attenborough is a state-of-the-art vessel, which we were under the impression is largely going to be used in the Antarctic. Could you indicate how you expect that to be used in the Arctic, what time in the calendar there will be to be able to get it to be used in the Arctic, or whether that is rather fanciful, given the logistical challenge and the seasons?

Dr Jones: It is worth pointing out to begin with that it is not a BAS ship; it is a NERC ship that is operated by BAS on behalf of the UK. Iain could equally take this question and perhaps he might want to chip in. From memory, the ship would take about eight months of the year in the Antarctic, including the transit times. Obviously, it takes time to get south and it takes time to get north. That leaves about four months for the northern hemisphere. Within that four months, 50 days I think has to be in the refit. If the refit is in the northern hemisphere the 50 days has to come out of that.

We have this project coming up, the KANG-GLAC project you have heard about already. That will be delivered in August 2024. Of course, at the moment, the Sir David Attenborough is being used to help deliver the infrastructure modernisation programme in the Antarctic, so we do have a tension, if you like, between using the ship for various purposes and that it also should be delivering science in the Antarctic.

As far as I know, there is no Arctic science programme bid to use the Sir David Attenborough beyond the 2024 programme. These things always take time to feed through. You respond to the science community putting in a proposal saying, "We would like to use the ship". It is about balance, though, in the ship's availability. Iain, did you want to come in and say a little bit more?

Dr Williams: Yes—thanks, Anna. First of all, Anna alluded to the pressures on all our polar infrastructure at the moment, partly as a result of the modernisation and improvement programme that is happening in the Antarctic, which is putting pressure on us. Because of that, we have published how we prioritise our use of polar infrastructure. Again, I can show your colleagues where that is published if it helps explain some of the approaches we are taking, as there is high demand for the polar infrastructure generally.

On ships specifically, we have to be a little bit careful not to focus entirely on the Sir David Attenborough. As Anna mentioned, it is a NERC-owned ship and NERC manages the planning of the ships. We plan our ships—plural, as a fleet of three—including the NOC ships Discovery and James



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Cook. That is important because they also do a lot of work in the north Atlantic. The two NOC ships are not ice-strengthened so there are obviously limits, but they do a lot of work in the north Atlantic and have supported us in the Antarctic while we were waiting for the Sir David Attenborough to come online. They are incredibly capable research vessels.

We plan them like that. A researcher does not choose which ship their research goes on. We ensure that we match up the requirements with the capabilities, as each ship has its own separate capabilities, and to assist in planning. We want to reduce the transit time—the movement of ships between projects—as much as possible. If we can plan campaign after campaign in similar locations that is more efficient financially and more efficient for carbon use as well. We plan as a fleet of three across the capabilities.

Q165 **Chair:** Turning to some of the collaborative things that have been talked about, you mentioned MOSAiC just now. Henry, I think that you indicated that two thirds of UK research papers have international co-authors, where everybody is clearly encouraged to bid collaboratively where they can. You touched on the double jeopardy issue earlier, about the relationship with Norway and Canada. Are there other relationships that we need to be developing or that we could do more to develop to encourage international collaboration in the absence of collaborating with Russia? I do not want to cover the ground already touched on. I think that Barry was asking where else we should be looking. Are there some quick wins where we can step in, with Russia out of the scene at the moment?

Henry Burgess: It is a very exciting time for international Arctic science, there is no doubt of that. We are in the UN decade of ocean science. That is from 2021 to 2030, and there is all kinds of potential for the UK to be involved in projects and programmes there. We are within the International Conference on Arctic Research Planning process. That is looking at what the challenges will be for Arctic science over the next 10 years. That is a good opportunity for some blue skies thinking about where the opportunities, risks and gaps are in Arctic science, and for people to then step forward and fill those.

We are building up towards the fifth international polar year in 2032-33. This is a genuine once-in-a-generation opportunity to scale up polar science as a whole. The previous international polar years had a great track record in bringing together new initiatives, new countries and new partners, putting some new money behind big new programmes. In the Arctic community but in the broader polar community we are looking forward to what that will bring. It will only be successful if we get research councils, funders and decision makers behind that.

Q166 **Chair:** Is that something that we could draw attention to in our report to highlight the preparation necessary for that year, given that although 10 years sounds like a long way off, it is probably quite—



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Henry Burgess: That would be very helpful because to make an impact it does genuinely need that level of thinking. The community as a whole is not planning for just one or two years of effort around 2032 and 2033. It genuinely is ramping up effort from now, even more work in 2032 and 2033, and then beyond that as well. It is not a decade, but it is a ramp-up of activity. The potential to use the Sir David Attenborough in the mid to late 2020s to support, develop and push that international polar year as part of the UK's contribution, among other assets, will be welcome.

Q167 **Chair:** The previous panel touched on the importance of Horizon Europe to this endeavour. Given that we have been out of Horizon for a small number of years thus far, if the current negotiations fail to get associate status again, which we all hope that they will not, how significant would that be to future international collaboration?

Henry Burgess: It will be very significant. We did a bit of calculation. The UK has benefited by over €45 million from 2010 to 2023. That is not including some recent money. It is significant for the UK. The UK is a partner in the Arctic PASSION programme, which is looking at observations in the Arctic. We are part of the EU-PolarNet 2 programme, which is developing the next phase of European funding and engagement. Already the Commission is looking forward to what follows Horizon for the polar regions. There is a European polar programme that will be developed. It will be co-ordinated, we think, through the European Polar Board, so the UK staying close to the European Polar Board and staying close to that development will be important. If we have access to that fund, that will be a step change in the UK's ability to maintain and develop these observations in the Arctic.

Chair: Does anybody want to add anything else on Horizon?

Dr Jones: I anticipated that we might talk about Horizon and I thought it might be worth articulating some of the amazing programmes that Horizon has or that the EU funding has enabled in the past. I remember when many of you came and visited us at BAS and we showed you the 800,000-year record of carbon dioxide and methane that came from the ice cores. That was enabled through EU funding. They did not fund the whole thing, but they underpinned it with additional national funding. They co-ordinated and they were the glue that brought the 10 nations together. The UK was one of the nations that was involved in this. Had it not been for the EU funding, it would have been very difficult for the UK to have a role. It meant that the different countries that had different types of expertise could come together.

It is just one example because I think that you are familiar with that diagram. We talked about it when you were at BAS. That diagram would not have happened. We would not know that had it not been for EU funding underpinning, because individual countries just did not have that money.

Q168 **Chair:** That graph you showed us struck a clear chord. What I am not clear about is whether those ice cores came from the Antarctic or from



Greenland. We have heard talk of two sets of ice cores.

Dr Jones: They came from the Antarctic, so it is an Antarctic example, but it is the longest record in time. It came from the Antarctic because it had the right icing behaviour with the ice sheets. You could not get that far back in Greenland. There were some complementary ice cores in Greenland but they had a shorter time span. I just wanted to bring that out because it is an example. I know that it is an Antarctic example but it is the power of the EU funding and what it has achieved in the past.

I have a few other points. If the UK associates to Horizon Europe, it will mean that UK scientists can lead proposals. They will not just be collaborators or small partners; they can lead and bring together these big programmes. That is very good for the individual scientists. It is also good for UK science as a whole.

The prestige was touched on earlier. We want the best scientists to come to the UK and to stay in the UK. We want to grow the best scientists in the UK. If people decide that they do not want to come here because we do not have access to that funding, that will be a very bad place to be.

Association to Horizon Europe enables scientists to lead big, ambitious and exciting programmes with EU funding. I just wanted to throw that in as well.

Q169 **Chair:** That is very helpful. My last question is on Arctic Council and diplomacy. Henry, I think that when we were visiting the Arctic Council in Tromsø we talked about the role and I think that there was a degree of scepticism about how the Arctic Council is going to function with Russia giving up its presidency and being an ineffective president for the last 12 months. With the UK's presence on working groups in the Arctic Council and our observer status, how can we help to ensure that the Arctic Council has a role? If we cannot ensure it, is it useful for us to continue to participate in the Arctic Council?

Henry Burgess: Yes, it has been an extremely delicate time and it still is a difficult time. Russia handed over the chairship of the Arctic Council to Norway on 11 May. Norway has ambitious plans around oceans, climate and environment, sustainable economic development, and people in the north, and it has very much said that it would like to restart as much as possible.

There are 130 projects essentially ongoing or paused in total through the Arctic Council. This is an enormous body of work, not just the six working groups themselves. The UK has had a relatively ad hoc participation in those working groups and in those projects over time. We are not funded in the NERC Arctic Office to support UK engagement in those projects or working groups. Responsibility for the UK's engagement across the piece for the Arctic Council rests with the Foreign Office. We support, we guide where we can, but we are not funded to co-ordinate or provide that representation.



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Where UK researchers can get involved in those projects it is enormously beneficial. We have had recent engagement within work on plastics, black carbon, tourism, safety in the Arctic sea ice, and those kinds of issues. I would hope that we can continue and build on that engagement in the future as Norway begins to restart all these different initiatives. It is now easier, because of covid essentially, to participate in these events through Zoom. It used to be incredibly expensive to send people to the various events all across the Arctic. One of the silver linings of covid is that we can participate more easily in these.

We are thinking about the opportunity to co-ordinate this work more and I hope that at the UK's Arctic science conference in September, we will have a session on how we can look across the piece as to where the UK's engagement in these working groups should be. We will know more by then about what has been able to restart.

Q170 Chair: Again, looking to our report, which will come out around that time, is there something that you know at this point you wish us to put forward to the Foreign, Commonwealth and Development Office to ensure that we can participate as well as possible?

Henry Burgess: We are very happy to support the FCDO, DSIT and others if they would like to up the UK's engagement and incentivise UK participation in these processes. We are very happy to work with them on that, that is for certain.

Q171 Chair: Thank you. This is the final question from me before I bring in Claudia Webbe to conclude the session. Is there anything that we can be doing from a diplomatic perspective to try to ensure that any data emerging from the Russian sector of the Arctic can be accessible to others or is that at the moment very difficult? I think that it was mentioned in the previous panel that it has not been possible to communicate with many of our Russian interlocutors for reasons to do with sanctions and their own safety. Therefore, is there anything we can be doing at the moment to try to ensure that there is a continuing dialogue with them when that becomes possible?

Henry Burgess: It is a very mixed picture at the moment. In those organisations where Russia is a treaty member, information is still being provided. They are still providing meteorological information, as we understand it, into the World Meteorological Organisation system. They are still running positioning systems as other countries run, and that all feeds into global navigational positioning areas. They are still part of UN processes. They still work within the International Maritime Organisation. They recently signed the high seas treaty on biodiversity beyond national jurisdiction. They are active members within the central Arctic ocean fisheries agreement. It is not the case that everything has ceased.

What has tended to cease is, of course, the involvement with Arctic Council, or at least the Arctic 7's ability to deal with Russia within the Arctic Council. There has been a chilling effect on the programmes that we were working on with the Science and Innovation Network in the



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British embassy in Moscow, which was fundamental to the UK's recent engagement in Russia.

The individual scientist-to-scientist links have not been severed in all cases, and particularly through quiet contacts and personal links people are able to maintain some of those links. Whether that leads to much data being transferred, I am not sure. There will be an opportunity at some point in the future for the diplomatic community to recognise how important science data from Arctic Russia is. It does not mean that Arctic data is more important than peace and justice for Ukraine. It is not, but it is also important.

There will be an opportunity, I think, for moral and practical support for researchers to begin to rebuild carefully and gently some of these links. You heard from Terry Callaghan in the first evidence session about all his work building up INTERACT and building up those links. Where we can preserve some of that and develop it in the future, that would be a positive. That is work for the future, not necessarily exactly for now.

Q172 **Barry Gardiner:** Supplementary to that, while we have sanctions in place and are not engaging in formal research collaboration, other countries around the world still do maintain scientific collaboration and research programmes with Russia. Are there any of those countries that we should now be trying to collaborate with that would backfill some of the gaps?

Henry Burgess: There is an obvious risk and, with my International Arctic Science Committee president's hat on, I am extremely worried that there will be a bifurcation in Arctic data—that some countries will be able to work with Russia because they are legally able to and others of us will find it is not possible at all. That is—not quite, but more or less—an east-west split.

We will have to see what happens and we will have to see what people's appetite is to share their data. It is not always straightforward. The UK has a very open data-sharing model. All the data that is publicly funded goes into publicly available databases, and that is accessible to all. That is not a model that all countries follow and it is not a model that all countries in the east follow. If those countries are going to work more with Russia in the future, then there is an obvious risk that the data that they collect, which we used to be able to have access to through our own links, we do not have anymore. That will take some serious diplomacy to make those connections and links. As a global community, I would be worried that we would begin to lose access to that, yes.

Q173 **Claudia Webbe:** I also add my thanks to Henry, Anna and everyone involved in the research visit that we had who made our visit so enjoyable. I can tell you that having shared that information in my own community of Leicester East, there was a sense of pride, if not new awareness and awakening, not just because of the Natural Environment Research Council and the fact that we have a UK scientific base in the Arctic, but also that I was able to share that there is an India House; that



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sparked a level of interest and intrigue that India, as an observer on the Arctic Council, had a presence there.

We know that the Arctic is warming faster than anywhere else on earth. Right at the start of this panel, Anna made clear the action that was needed, and the science is very clear. Therefore, I beg this question: to what extent is the scientific research into the Arctic's climate and environment informing UK policy? It would seem to me that the UK would be treating this as an absolute emergency, given what we learnt and given what we know about what is happening in the Arctic.

Dr Jones: In a way, you have exactly hit the nail on the head. We talk about the climate emergency, so we know. When we think back to the Al Gore programme "An Inconvenient Truth", it is the truth but it is inconvenient. It is hard. It is difficult. Scientists and policymakers have struggled to engage action on this. They are difficult problems to solve—very hard.

When I started out, I was working on the ozone question. My parallel is the Montreal protocol. It shows that with the right action, we can do something about it. In comparison, the problem of the ozone hole was easier to solve. We run our world on energy consumption, so it is very difficult. Equally, we have to do it because the concept of not doing something is inconceivable. We are struggling with the heat today. This is nothing compared to what we would be looking at.

Progress has been made and that is something to hold on to. I think that is good. It is about the rate of action and making sure that it is not just what people say, it is what they do. We need action. We need to reduce the emissions into the atmosphere and ultimately we need to get the greenhouse gas concentrations down. It is incredibly difficult but we have to do it. For the benefit of the whole world, everybody needs to embrace and do this. I am not telling you anything you don't know, but in a sense that is the way that I can respond to your question. I will let the others come in.

Dr Williams: To add to this from a funder's perspective, as part of our national capability funding through our centres, as I referred to earlier, we have a small strand that is called national and public good, which is designed to help the centres to fund activity to engage in often emergency work but also to support Government, and to engage in discussion and research that is beneficial to Government directly.

Alongside that, as we evaluate our centres periodically, we evaluate not only their scientific quality but their impact. We use a slightly different formula to universities, which has a slightly higher weighting on impact, to indicate that we do value and we do put money behind that part of our centres' activities as well as the scientific funding, if that makes sense.

Q174 **Claudia Webbe:** How can we improve the link between science and UK Government policy?



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Dr Williams: That is a continuous to and fro between the scientists and the relevant Government Departments. It is important that those links are there and that they are open. Some of the funding enables those activities to go on. I would also say that the enduring funding that we have by having centres means that they can provide a very helpful conduit for Government to work with the science community. I see that all the time with our centres. It is very helpful to not just the centres but as a conduit to the wider research community. That is very exciting and I see it a lot right across our centres.

Q175 **Claudia Webbe:** I do not know if you want to add anything, Henry, but it is clear to me that the science is clear and the ongoing scientific research is clear and continues to make clear that the Arctic is warming incredibly fast. I am not so sure that UK policy is moving as clearly as that.

Henry Burgess: There is not just one model for researchers influencing what happens in Government. It is very much not the Hollywood model of rushing in with a document and saying, "Minister, you must—". It just is not like that. Through things like the Government's Arctic policy framework, the research councils have an input into this. What they say about science in here is informed by what we tell them and what we recommend. It is their words, but we have input into this. We produce a synthesis of funded research programmes. This is advice for policymakers and others in a relatively easily digestible format. We are not relying on Ministers, special advisers and senior officials to go and read the actual article themselves. We are trying to boil it down in ways that are helpful.

I sit on the cross-Whitehall Arctic network, which is run by the Foreign Office. That brings together several times a year representatives from all the different Government Departments, together with research councils and others, to have a discussion about where things are going and what is happening. The Met Office, as you have heard, has a fantastic channel into Government for providing climate advice and many others now, too. There is not just one model, but as people said in the previous panel, there is definitely room for researchers to get closer and reduce the time from their findings to impact within Government.

Q176 **Claudia Webbe:** Anna, can I bring you in again? What do the Government need to do to ensure that the UK keeps producing world-class research?

Dr Jones: It needs to do a number of things. In a way, it is the basic things we talked about before. We need research funding. We need support for collaborations nationally and internationally. We need our good facilities. We need to make sure that the UK is an attractive place for world-leading scientists to work. If we don't, then they can go to work in another country. We want to keep them here. Those are the basic ingredients—making clear that science is valued and needed.

On the links between research and policy, the Government can do whatever they want. Scientists are waiting to give information to



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Government. We have all this knowledge and we want to share it. We want to help policymakers work out what they need to do. We want to provide that evidence. If the Government would like us to provide information, we are more than ready to do that. It is a two-way thing. If the Government would like us to provide it, all they need to do is ask. There are many people who are very keen to do that.

Q177 **Claudia Webbe:** Thank you. Iain, in terms of prioritisation, where does Arctic research sit within UK Research and Innovation priorities?

Dr Williams: It is an absolute priority. There is no doubt about that. As I mentioned earlier, we have been funding it at strong rates for a long time, through long-term national capability funding and through a continuous stream of grants and strategic programmes that, as I said, come down from head office. It is a priority. It is a critical part of the climate system of the globe and particularly the northern hemisphere.

If I may—a word of caution here. There is a danger we will focus on research that is taking place in the Arctic rather than necessarily research that looks at the whole system that is impacted. We need to understand what is going on in the Arctic, but as I mentioned earlier in relation to some of the long-term ocean monitoring at latitudes well below the Arctic, it is all part of the same system. It is important that we understand the climate system, of which, of course, the Arctic is an important part. I get a little bit nervous when we start drawing boxes around things because it is a big climate system that we have. However, there is plenty of evidence to show that the Arctic is a priority and we are funding it consistently.

Q178 **Claudia Webbe:** You do not, therefore, I suppose, believe that, given the pace of change and the need to be clear about understanding the impact of climate change and what is happening, there can be any higher priority in UK Research and Innovation than there currently is.

Dr Williams: We have understood that rate of change for some years in the research community, so that is why we have put in things like the Changing Arctic Ocean programme, which was a big £15 million investment into Arctic research, a few years ago now. They will continue. We also mentioned that in national capability funding, we have now two programmes, BIOPOLE, which Geraint talked about earlier, and CANARI. I cannot remember the full acronym but it is on the Arctic-north Atlantic circulation of atmosphere and oceans. Two of our big multi-centre collaborative programmes are now looking at Arctic and Arctic impacts, so it is significant funding.

Q179 **Claudia Webbe:** My final question relates to the level of increasing interest in the Arctic, be that financially, resources, minerals or otherwise. What more can the UK do to build resilience so that we protect the Arctic and we do not impact climate change any further?

Dr Jones: I suppose my first thought on a question like that is that we should be talking to the people who live there because they will know.



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They know their region and they know their system, so they will know what the important parts are.

We do need to feed in. We can bring in our scientific knowledge. Again, building on the comments earlier, it is about understanding which areas are critical for carbon drawdown because that feeds into the global system. That is critical for us all, but there will be things that are critical for the people who live in the Arctic, so they would be the ones. An example would be understanding changes in the climate and the effect on the caribou and their migration paths. There is a project that is being done at BAS about forecasting sea ice conditions to provide advice to caribou herders. That is something we can do, but it has to be co-designed with the people who live there.

Claudia Webbe: Henry, do you want to come in on that?

Henry Burgess: I think that Anna has summed it up well. That focus on “nothing about us without us”—with indigenous and other local people in the Arctic—is growing in importance. You cannot go to an Arctic conference now, rightly, without hearing indigenous voices, and their lived experience and desire not just to be listened to but to direct, to be involved in, to fund, and to be responsible for the research that happens where they live and work. That will only gain in importance. The ideas about the resilience of the Arctic, conservation or marine protection are all discussions that now should and will happen with the indigenous people and other residents of the Arctic.

Dr Williams: We have not talked too much here about how we do our science as well, which is very important. We need to ensure that we undertake our research in the Arctic and elsewhere in a responsible way. We need to reduce the carbon emissions that we emit while doing our research. That means changing approaches, and using more autonomy, remote sensing and so on, as we have touched on. It is incumbent on us as a research community to model this and to make an impact.

Q180 **Claudia Webbe:** If you were helping us to come up with some clear recommendations about what the UK ought to be doing to build resilience, knowing what is coming because of climate change, the pace of change and the opportunities that people are seeing, what would you say we should be putting in our series of recommendations?

Dr Williams: I would agree with Anna and others about the importance of engaging local communities in doing our research and understanding the priorities in how we do the research in that area.

Claudia Webbe: Is there nothing you would say as to what the UK Government should do to build resilience?

Dr Williams: I am not entirely sure it is my role to advise on that one.

Claudia Webbe: I will not press you any further on that. Thank you so much.



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Chair: Thank you very much to all our panellists for staying so long. I think that two and a half hours is probably a record for this sub-committee. Thank you to those who have stayed from the previous panel and thanks to Dawn Amey and Rebecca Lees, who prepared our brief.