Third Arctic Science Ministerial Webinar Series

Theme 2, "Understand" Webinar

17 February 2021

Transcription

Start Time: 13:00 UTC

1. Housekeeping Remarks: Lindsay Arthur: Welcome everyone, we will start promptly at. 1:00 PM GMT. Although some people are still filtering in, but I will just start out with some housekeeping. My name is Lindsay Arthur and I'm from the Icelandic Ministry of Education, Science and Culture. I am also part of the Arctic Science Ministerial Organizing committee. I'm going to start out this webinar today with an Arctic Lands acknowledgement. This is adapted from the IASC state of the Arctic report for use in our webinar today.

> *The circumpolar Arctic is the contemporary home to many different Indigenous Peoples. Wherever you may be participating in this webinar, we honor and recognize the place-based knowledge of Arctic Indigenous Peoples and their ancestral and contemporary stewardship of their homelands. We welcome you to do the same.*

So, to get started with just some housekeeping, this webinar is being recorded and will be posted to the European Polar Board YouTube page and shared on the ASM3 website. For all attendees, your microphones and cameras are automatically turned off, so you don't have to worry about that. If you're having any trouble, you can use the chat box and ask for assistance, or you can also see the zoom website support page and will share a link for that in the chat box. The full program for today is available on the ASM3 website. We will also share a link to that in the chat box for you. As we go, we will have five panelists speaking today, and if you have any questions for them, you can direct them to the Q&A box. So please use that specific Q&A box, not just the general chat box. We will address what questions we have when we can, in the Q&A at the end. But also, if you have questions just as we go, you can put them in the box and maybe the panelists can answer them directly before we go to the Q&A. We do just have one hour today so we don't know how much time will have for the Q&A at the end. For this webinar IASC has agreed to let us use their code of conduct which they developed for ASW 2020. So, the link to this will be posted in the chat. What's most important to remember, though, is that we create a respectful atmosphere. We listen and ask questions with an open mind, so please know that abuse or harassment of any kind will not be tolerated.

Before we get started, we want to give an overview of the Arctic research information that has happened in this ASM3 science process. So, we've solicited updates on Arctic Science and research from many different channels. The countries, Indigenous Peoples Organizations, international organizations which include the working groups of the Arctic Council have submitted project updates, new projects and as well, they filled out

a survey on international cooperation through the ASM3 science process. So additionally, we've also solicited feedback through online surveys and research community workshops, and then our Science Advisory Board has reviewed all of the science submitted through this process and then it through this webinar series that we are beginning to share some of that information with all of you. As the ministerial draws closer we are now starting to wrap up the final products of this ASM which is a result of the science process. So, countries are collaborating right now on the joint statement of ministers with input from Indigenous Peoples Organizations. The final report is being developed and we are also planning to share more online resources, including recordings from this webinar series, which can already be found on the ASM3 website research page, on international research opportunities, the Arctic Research overview submitted by ASM3 participants, as a data project of the project database. The third Arctic Science ministerial will be held in Tokyo in May of this year.

Without further ado, I would like to introduce our moderator for today. Mia Bennett. Mia is an assistant professor in the Department of Geography at the University of Hong Kong. She is a member of our ASM3 Science Advisory Board. Mia is going to provide an overview of theme two before giving the floor to our panelists. Mia, you can take it away.

3. Moderator: Mia Bennett: Great thanks so much, Lindsey. And thank you for the opportunity to share the update for theme two. Theme two is about understanding and predicting capabilities regarding Arctic environmental and social systems and their global impacts and so our task here was to assess the progress that's been made across Arctic science in moving towards greater understanding of these issues. In trying to analyze all of the projects that were submitted, we identified close to 200 projects that fit into the scheme of 'understand'. Some of them had overlaps with some of our other themes such as 'observe', but the projects that I'll be describing and focusing on which will also see highlights of after this brief presentation - all touch upon trying to enhance our understanding effectively. I'm going to first synthesize a couple of main takeaways the Science Advisory Board concluded with some important advances that have been made with regard to understanding the Arctic. The first would be that there's been important progress made in understanding Arctic ecosystems and a lot of that work is increasingly focused on the intersection of different ecosystems, which happened to be some of the Arctic's most productive and biodiverse areas. Two key examples where we noticed significant advances being made were at the land-sea interface, so where Arctic coasts comes up against seas for instance in the Arctic Ocean. And equally, there's been a lot of work done at the Sea-Ice interface, which is really exciting and interesting X system as well, and one that's recently been in the news. You might have seen the other day with work from the opposite side of the planet, in Antarctica, where scientists have discovered an untold number of creatures on the bottom of an iceberg, thousands of feet below the surface. So really exciting advances can be made at these interfaces we have noticed.

A second area of progress is that a number of projects are looking into ecosystems that are either disappearing or emerging, so we all know that the Arctic is one of the fastest changing regions on Earth. And with that, on the one hand, we have projects such as one out of Canada that was focused on the last ice area, and this is

particularly focused on places where thick multiyear sea ice is fast disappearing. That area is concentrated largely in the Canadian Arctic archipelago in the North of the archipelago, close to northwest Greenland, and so looking at the kind of phenomena that are happening there as ice gets ever thinner is one area advances are being made in. In tandem with focus into disappearing ecosystems, we also have a number of projects that are looking at emerging ecosystems, largely coming about as a result of climate change. And perhaps the area of key focus here is the central Arctic Ocean. One area of focus within that region that is becoming more and more accessible as sea ice thins and shrinks, concerns fisheries. You might be familiar with the recent moratorium that was signed on commercial fishing in the central Arctic Ocean, which is predicated on the idea that more scientific research needs to be done before we can go into this area and begin carrying out commercial fishing. Some of that work has been carried out by NOA, but also in partnership with a number of other researchers from around the world. Both advances in terms of understanding, disappearing ecosystems, and emerging ecosystems. In concert with work on emerging ecosystems, there's been a lot of work into societal, commercial and geopolitical impacts of these opening areas. I think this reflects the growing importance of research into coupled human environment systems. We see this across scientific research worldwide with increasing recognition of the Anthropocene the era in which humans are having a larger impact than perhaps any other force on the planet. I think with this type of work scientists are acknowledging that nature is not just something existing separately from humans, but rather that we impact the environment and impacts society in return. A lot of the work in the Arctic is particularly attached to this type of framework.

A third overarching theme that we could identify in their research under this umbrella ‘understand’, is that there's been a lot of advances made in understanding the atmospheric circulation of pollutants and climate forcers, such as black carbon and carbon dioxide. One example of a project to highlight here would be from Japan, which has this major initiative called the Arctic Challenge for Sustainability, and one of those projects is looking at various greenhouse gases. To do so, instruments have been put on commercial airliners, on ships, on land and in various places. So, this also shows the really creative and resourceful ways in which scientists are trying to gather more and more information in order to understand all of the changes going on in the Arctic across different ecosystems.

Those are some of the main overarching areas of advances with regard to understanding the Arctic, but we also subset it into seven different categories of work under this theme of ‘understand’. So the seven categories, which of course are not necessarily mutually exclusive, but areas in which we could group projects, such as: the climate, marine issues, ice and permafrost, and then also ecosystems, humans and also pollution. Ecosystems was one particular area of research advances across a couple of different key areas. Marine ecosystems also work on wildlife, on terrestrial ecosystems, which is one area of particular research growth. Also, trying to understand how human and ecosystem health are interrelated. Then, under marine ecosystems, we also noticed a couple of projects are focused on marine pollution, which is an area of increasing research, as more and more commercial activity takes place in the Arctic Ocean.

Just a few highlights to pull out since I'm not able to overview everything, but just a couple of areas that we thought were important. First of all, in terms of looking at ecosystems, more understanding has been fostered with regard to looking at tundra, boreal forests and coastlines. With regard to terrestrial ecosystems, of course there's a noted emphasis on the major time domain looking at terrestrial systems that might have been somewhat understudied before, namely peatland swamps and soil contains more marginal ecosystems, but yet places that are major carbon sinks, is an area where we're seeing a lot of exciting research being done. Also, in terms of looking at how lichens could be a factor for bacteria work in both of these areas, peatlands and swamps and soil lichens -all of this kind of terrestrial work is coming out of Russia, which is perhaps unsurprising given that Russia comprises about half of the Arctic. So, there's been a lot of work in this area, and probably with regard to health, we would anticipate that more work will be done in this area when the pandemic has passed.

Another project I might highlight in terms of marine pollution is that I believe Arctic scientists are thinking about pollution in novel ways, not just involving atmospheric forcers, but also light pollution for instance. Looking at how species in the Arctic Ocean have been affected by light pollution during the polar night. Effectively using this Arctic as an experimental laboratory, taking advantage of those unique conditions of extreme day and extreme night. I think this type of research shows how the Arctic can inform broader understandings of natural phenomena elsewhere, so taking lessons out from the Arctic to inform understanding and set up just going vice versa is one exciting area, where Arctic understanding can contribute to broader understanding. I'm looking at pollution: I mentioned how atmospheric forcers, black carbon, CO2 and also methane are areas of particular interests. Moving to the marine environment and how we've advanced understanding there: obviously a lot of media coverage probably focuses on how scientists are trying to predict climate change, but a lot of that is based on our increasing knowledge, which has happened in recent years of the paleoenvironment, so trying to reconstruct past climates from, for instance sediment cores taken from the seabed. Also, advances have been made in oceanography, geochemistry, and the symmetry. A lot of this work is done very internationally, very collaboratively. For instance, I think the MOSAIC cruise launched by Germany involving dozens of different countries and institutes. This example of collaborative work is helping us to advance large scale understanding up the Arctic. In terms of CIS projects, this has been interesting because half of them have been led by Asian countries and this is perhaps reflects the fact that Asian countries have maybe easier access to sea ice thanks to their Ice Breakers. Also, the fact that ice is not always on land, it's maybe just a bit more of an accessible topic for non-Arctic countries.

Tying these together, we've had increasing work on trying to improve predictions of future change, both environmentally and socially. Looking at sea level rise at near term, regional and global climate, and also there's been a lot of cross cutting work on linkages as they mentioned, for instance, between coupled human and environment systems. So, this is kind of how we segmented all of the research. I'm just going to quickly highlight a couple of other areas in terms of climate, ecosystems and humans before I turn the floor over to the more specific presentations.

Looking at climate, a lot of exciting work has been done at a higher scale trying to integrate understanding of different parts of the climate. One project I'll just highlight here is called the changing Arctic Ocean, which is a

promising example of how the UK and Germany have collaborated to understand how atmospheric and Oceanic circulation changes are affecting the large scale ecosystem structure and biogeochemical functioning of the Arctic Ocean. This is an interface between different ecosystems, different processes. Second, as I mentioned, a lot of this climate research is directly integrating societal concerns, we will hear momentarily from Professor Bruce Forbes, who is helping to lead up the CHARTER program, which is a Finnish effort with lots of different international partners looking at how climate and biodiversity change will impact Arctic communities and their adaptive capacity. A lot of work, of course, is has been done of ecosystems and I think one thing to highlight is that scientists are not just focusing on these kind of iconic species such as polar bears and walruses, but also looking at fisheries and then maybe the slightly more mundane, but no less important creatures that our form critical part of the Arctic ecosystem, such as crustaceans, snow crabs, and even insects. One project out of Norway, the EISA project, is looking at snow crabs in that instance. A lot of this work is also increasingly adopting this social ecological systems framework. The REIN project out of Norway looking at reindeer is one example of that. And so overall, in terms of understanding ecosystems, collaboration between countries has been increasing, but we'd like to point out that still more could be done to truly integrate Indigenous knowledge and also leverage citizen science, especially at a time when scientists have decreasing access to the Arctic in view of the pandemic. And there are more and more opportunities to work with the residents who still live there.

One gap to point out that we notice was one project on reindeer herding did not actively mention Indigenous knowledge or partnership in the summary and so this represents a clear opportunity among many to further integrate Indigenous knowledge into the work that scientists do. The last section here to highlight is in terms of work into humans and societies in the Arctic. There's been a lot of exciting advances in understanding how we can foster gender equality and diversity, largely coming out of Norway and Iceland and one project to highlight here would be the recently funded Arctic Voices Initiative in art and literature in the long 19th century. Which here is presented a snapshot from the website and this project is really seeking to retell the history of 19th century Arctic exploration and shift away from this white male hero Explorer lens and re tell those stories involving Indigenous Peoples and wildlife and their voices. So, making it a much richer picture. I think we can see then how integrating humans into Arctic research can be done in the humanities as well in tandem with scientific research. Lastly, who is doing all of this research? Of course, we have really exciting international collaboration that's continuing to bring a new partners into the Arctic, such as Thailand. You'll hear from a researcher shortly, Singapore, so Asian countries and also other European countries, South American. The list continues to widen, which is really exciting for promising to push forward, knew understandings of Arctic. We also see women and Indigenous Peoples and early career researchers are becoming increasingly integral to Arctic research. Not only in carrying out that research, but equally in designing it. I think this is a really crucial part to make Arctic research and our understanding of it relevant to communities in a very inclusive and diverse sense.

I'm going to wrap things up and I'd now like to turn begin turning things over to our five presenters today. The first will be Gael Durand from CNRS. The project lead of the PROTECT project, projecting sea level rise from ice sheets to local implications.

4. Panelists:

Gael Durand (Project PROTECT): Hello everyone, thank you for the introduction and giving me the opportunity to give a brief overview of our projects. My name is Gael Durand, and I am a research scientist at CNRS, France, and the scientific coordinator of the 2020 Project PROTECT. The full name, which I think is rather self-explanatory being projecting sea level rise from ice sheets to local implications.

A few minutes on some details about PROTECT. It started last September, and our aim is to produce robust with quantified uncertainties projection of sea level rise to the melting of land ice. In short, we want to anticipate the mass loss of some 2200 thousand issues around the world. The mass loss of the Greenland and the Antarctic ice sheets as well. Altogether, this represents about 65-meter equivalent of sea level rise over the continents. Of course, most of the sea level rise will not be suddenly dropped into the ocean in the next decade, century, years, or even millennia, but a significant part of it might and our objective is to evaluate this contribution to produce global, but also regional and local projection of sea level rise for the coming decades. At 2100 and over the coming centuries up to 2500 at least. Some words about the project itself. 26 institutions are involved, grouping some 150 scientists coming from eight countries, six in Europe together with Greenland and …[?]. We are collaborating with many colleagues all around the world.

PROTECT is organized in six scientific work packages. Together with work package one, dealing with the project management and work package eight, for the coordination of the communication of the project and dissemination and exploitation of its results. I think the structure of the project presented on the right is of interest for you. Let me briefly explain why. Projection will only be pertinent if they are useful for the users and stakeholders, and this is the objective of work package two, as we want to Co-design and Co-produce or projections and related climate services. In the meantime, we need to improve our understanding of some processes, particularly the ones related to the potential drivers of the collapse of some regions, in Antarctica in particular, and this is the objective of work package tree. Then each specific land cryosphere component at it as its own work package, Antarctica in work package for the most uncertain contributor, and wear a therefore the most significant. Greenland, which will be a major contributor during the coming century is actually an Alpine glacier that will most probably shrink very significantly in the next 100 years. Finally, using the inputs from the previous work packages, work package seven will compute global and regional sea level changes and implications. It is not signified in this sketch. Designing is an iterative process, and this is why we will pass through all these work packages two times, at the beginning of the of the project. We have called the fast track for the methodology to produce first projections, and this should be completed in about a year. A meeting will be organized this fall to continue improving our interaction with stakeholders. Then the full track will follow to refine our results and in particular better take into account the progress on our understanding of critical ice sheet processes. To conclude, do not hesitate to ever look on our website for more information or

following us on Twitter. Within two weeks you should be advertised on some very nice first results to be published in Nature. So, thank you for your attention.

Mia Bennett: Terrific, thank you so much scale that was fascinating. Next, I'll turn things over to Professor Brynhildur Davíðsdóttir, from the University of Iceland, who will be presenting ARCPATH: Arctic climate predictions, pathways to resilient, sustainable societies.

Brynhildur Davíðsdóttir (ARCPATH): Thank you so much. So ARCPATH is a five-year international and an interdisciplinary research project and it is funded by North Force as a North for Center of Excellence in Arctic Research. One of the institutional partners out of the eleven institutional partners, is the University of Iceland. I am the team leader for the University of Iceland team.

The target regions for our projects are the northern coast of Iceland, next Husavík, as you can see on the map, and in Northern Norway, in particular close to Tromsø and Skjervoy and then eastern western Greenland, focusing on the areas around Ittoqqortoormiit and Illulissat.

The project itself has three overarching objectives. Those are improved climate predictions and then an increased understanding of how climate change interacts with multiple ecological and societal factors. What we do is that we combine the improved regional climate predictions with enhanced understanding of environmental, societal, and economic interactions. Basically what we're doing, is to address the complex relationship between climate and social economic change taking place in the Arctic and we're asking the question, what do these physical changes in climate, sea, ice, and the oceans actually mean to help people live in the area? Of course, with the overall goal of fostering responsible and sustainable development.

In our work on improved climate predictions, we are applying historical climatology as well as global climatological modeling and dynamic downscaling and then down to our study regions. When analyzing how climate change interacts with multiple ecological and social factors, we then consider several interrelated topics. So here, for example, we're looking at changes in the marine biological environment as a result of climate change, and then we reveal what social economic implications that may have. What is interesting here is that the prism we're playing this context as cetaceans, with a particular focus on whales. So, what we do is that we examine first what impact changes in climate ocean had for whale populations. Then, we established the societal benefits derived from whales and then based on that examine how climate change may affect the possibility to sustain those benefits. Finally, we focus on the synergies between climate change and marine management systems, and we evaluate their impact on the resiliency of coastal communities.

Just to give you a sort of a little insight into what I mean by benefits or importance of whales - we define that based on the benefits human societies derived from the natural environment that is here from whales. We call this is collectively called ecosystem services. As you can see on the slide, these services can be of a very diverse form ranging from provisional services such as food products over to regulation and maintenance services such as nutrient cycling. Cultural services such as music and arts, culture, identity, and

recreation. We reveal these services through their importance via interviews, social, economic, and social cultural services in all our study locations in Iceland, Norway and in Greenland.

To give you a brief taste of what we're seeing in the results, we are seeing that marine species such as blue whales are migrating northwards, possibly due to climate change. What we're also seeing is that whales are shown to be socially important in all our study locations, and they have diverse societal benefits with actually cultural benefits, including cultural and community identity, existence, value, in addition to recreation being considered the most important ones. We're also seeing that governance or whale ecosystem services in our regions is largely through informal institutions in self-governance, which then may be susceptible to external pressures derived from climate change. Finally, combined impact of ITQ systems in fisheries and climate change is increasingly stressed to coastal communities.

To conclude, so the results we're deriving from ARCPATH are illustrating that the understanding of the very diverse benefits local communities derived from the marine environment such as whales in our case and revealing the impact, climate change and economic development may have on the ability to sustain those benefits, provide important insights to the resilience. The communities to attract and interact precious derived from climate change. In turn, these insights are very important when designing pathways to action towards more resilient and sustainable societies.

Mia Bennett: Terrific, thanks so much. It was really fascinating to hear about all this work, and I hadn't really thought of whale ecosystem services really insightful. Thank you. Next, we'll be hearing from Suchana Apple Chavanich from Chulalongkorn University in Thailand and she will be discussing the linkages between Arctic climate change and marine debris.

Suchana Apple Chavanich: Thailand as an Arctic country is interested in doing research in the Arctic area. Actually, Thailand is interested in doing the research in the Antarctic first, because of Her Royal Highness Princess Maha Chakri Sirindhorn Tone visited Antarctic in 1993 and later she realized that joining the Antarctic research with other countries will not only strengthen the research abilities for Thailand, but also will give an opportunity for Thai scientists to contribute their knowledge to the World Science Societies. Thailand is aware that doing research in Antarctica is not easy, because Thailand does not have a lot of budget, no station, no icebreaker, and Thailand is not even part of the Antarctic Treaty. Trust to collaborate with other is one of the important things.

So, start from 2004 with the cooperation with Japan and later with China. Thailand has managed to send scientist to join with their Antarctic Expeditions, one or two researchers for years depending on the circumstances. Later again Her Royal Highness initiation would like to do a research to the Arctic.

Thailand has first officially collaborated with Norway in Arctic research in 2015, with an MoU between University Center in Svalbard and Chulalongkorn University with the Princess. In addition, Thailand also has a MoU with Chinese Institute for a joint research in both Arctic and Antarctic. Originally when Thailand started to be interested, we mainly focused on research, but later the pollution in the Arctic created by human activity that is not just from Arctic area but also from outside of the Arctic area and, particularly people who live in a

tropical area like Thailand, became an interest too. Their activities/polluting practices are for example releasing carbon dioxide into the atmosphere and dumping trash into the ocean. This pollution can up into the polar regions. Now our purpose is not just only doing the research in Arctic, but we also want to raise awareness on the importance of the polar region and how human activities around the world, including the tropical, can link to the change of the ocean in Arctic. This is a chart video of one-minute video showing what we did and what we found in our last trip to Arctic.

As we can see in the video. Oceans in Arctic have changed: more algae, more jellyfish, more traction up into the northernmost island in Svalbard. And we found quite a number of microplastic contaminated in the Arctic environment. It is time to send this message out to people who live outside the Arctic to let them know that their activity can have tremendous effect to the Arctic area. We all need to care no matter where we live, because the Earth is in our hands and Thailand would like to be a small messenger to show what really happens in Arctic and how non Arctic countries can help to solve this problem. Thank you very much.

Mia Bennett: Thank you so much Apple, that was fascinating and it's really exciting to see how collaboration with an Arctic country in another country can lead to all sorts of new research advances. And thank you. Next, we'll be hearing from Professor Doctor Hugues Lantuit, from the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research. He is the project lead of Nunataryuk, the co-designed adaptation and mitigation strategies for thawing permafrost and coastal erosion in Northern Canada.

Hugues Lantuit (NUNATARYUK): Thank you. We're not only North in Canada, we covering the entire Arctic. The Nunataryuk project that started in 2017 and it's running for six years. But more than a project, it's actually a fantastic group of people. I really want to thank all the participants in this project that make it possible and it's incredible to be at the head of this project and I'm very excited to report about it. We have 17 countries in the project, about 26 partners involved in this project: northern residents, engineers, social scientists, physical scientists - so it's very, very transdisciplinary project. That's why the six-year olds are essential, if you want these people to actually get to talk to each other in your room. And that's why we put it forward when we submitted the project.

So, what we really focusing on this project is on the coast in the Arctic. Mia showed you shortly that it's a very important and very alarming process right now that is going on that I will discuss. You see from this slide. Here is a version of the cost of Yukon of place that is called Stocks Point, and he is right as more than quadrupled. It's incredible. The increase in the right version that there this has implications for infrastructure for the coastal ecosystem, for harvesting for subsistence living. Many, many implications that we try to look at.

The way we are trying to do that is first, obviously, to talk to people on site to understand. What can we do and how should we do that, and then engage in a partnership to actually distribute a number of things that we want to do and understand who is going to do what? There are many things that are going on and then ultimately to get back to people inside to develop possible adaptation and mitigation strategies. I'm going to show you a couple of examples.

Consultations - we had many and these are pictures mostly from the Western Canadian Arctic as well as this post on Facebook from Svalbard. What I want to say here is that this is only one side of the - consultations are going on all the time and on Facebook very often. This is essential - building a relationship, friendships, relation of trust with community members, and this requires a lot of time and it is essential, and this is very important. This project is running for six years.

I'm going to give you a couple of examples. This is one thing that we can do in the project because we are active in Russia, in Canada, in the Nordic countries. What we're trying to do is take advantage of this, to look at some issues and we ask questions in communities in Greenland, in Canada and on Svalbard. To see how people, see the impacts of permafrost?

It's actually quite different. Most people in all of these communities in the Arctic, in Canada, in Greenland and Svalbard see permafrost as an issue. You see that in Aklavik it's much more burning issue than it is in other communities, so this is very interesting because those communities are actually very different. There is no such thing as devising a plan for all communities in the Arctic. It just doesn't work. You need to have a very dedicated and targeted way to approach this issue.

And that's what we are doing. I'm going to show you an example now from Illulisat and the impacts of subsiding permafrost. This is picture is a complex picture. What you need to take on is: here in Greenland, coastal erosion is not the main issue. It's very different in thawing permafrost that threatens the existence of these buildings. If you go to other communities then you will have some other issues. This is Tuktoyaktuk in Northern Canada. What we did, with high resolution drones and photogrammetry, is to try to map the extent of flooding in 2100 directly related to the system. We are not only doing things at the local level, but also doing things at the global level. This map is just a teaser for something we are building while walking on the net loss of Arctic permafrost, first which is being compiled by [...] in Norway and they are making this fantastic map. If you go see to Twitter, or you will see this popping up. What we're trying to understand here is how many people live on permafrost and what the impact is of thawing permafrost on the life of the people on the ground. And again, as I said, this is very different when you go from one community to the other.

Please go like our pages on Facebook. Would really appreciate it and it's nice you get a lot of news and videos and snippets and it's really cool. Thank you.

Mia Bennett: Wonderful, thanks so much. Really impressive work and great that you're working with so many communities across the Arctic and studying all these different interactions and interfaces. So terrific. Thank you. And our last but not least, presentation will be coming from Professor Bruce Forbes of the Arctic Center University of Lapland. He is the project lead for CHARTER. The project I mentioned global effort to understand how climate and biodiversity changes will impact Arctic communities and their adaptive capacity.

Bruce Forbes (CHARTER): Thanks Mia, thanks Lindsey and all the organizers for inviting CHARTER to present briefly here today. We're funded under the Horizon 2020 Project and we're just past our six-month milestones.

We began August 1st, and we had a virtual launch because of Corona in Rovaniemi in the first week of October. We are a large consortium - 21 funded research institutions in nine European countries and in-kind participation from Russia and China, seven work packages and a budget of €5.9 million.

We have three main aims. First is to better understand past and ongoing responses of Arctic terrestrial social ecological systems to changes in biodiversity, snow and ice cover across decades and centuries. Second is to simulate future effects of social ecological changes or Indigenous and local communities and traditional livelihoods out to the year 2050. Third, we work directly with Arctic communities to co-develop strategies and policy pathways for livelihoods such as reindeer herding, hunting, and fishing.

On the left a map of our consortium, the funded countries I mentioned. We're all in the EU, but you can see St Petersburg in there. You don't see Beijing University on the map, but they're also providing a super computing power. The map on the right shows in white the very large area. That's a couple million square kilometers where there's about 2,000,000 head of semi domesticated reindeer which are privately, some collectively owned. Then in the green dots, those are study areas where we have existing data from. We are working mainly with existing datasets and there will be some field work - not much. Mainly new infrastructure in Finland and in Yamal Russia.

That shows the circumpolar scope of our project. We have partners for example in Edinburgh, where we bring in data from the Canadian High Arctic and Keiko talks or Herschel Island in Canada. We have partnerships in Alaska and also extending to far Eastern Siberia.

These are seven work packages. I'm not going to give all the titles here, but they're working across multiple spatial scales from local to circumpolar, and multiple time scales from the Late Holocene, actually about the last 2000 years out to the year 2050. You can see on the bottom the Late Holocene. We chose that 2000-year period, because that's roughly where reindeer shifted from a wild hunting model in the Eurasian Arctic to the more semi domesticated mode of reindeer management we see now.

The overgrazing narrative is very persistent. I put a couple of media examples here from the last few years. Unfortunately, this overrides urgently needed discussion of biodiversity, climate change and adaptation. We see this in the media, that reindeer herders are portrayed as overgrazing the tundra. What we don't see is that they're also eating the seedlings and shrubs that prevent the tundra from becoming a forest. This is an ecosystem service. We don't use that rubric here, but it's clear that these types of livelihoods painting them as a consumer of lichens and green, biomasses, is a very simplistic worldview. Then, on the left you see the Russian anthrax outbreak of 2016, which also led quickly to a discussion of overgrazing. We have co-developed this starting from the very first draft call. When this came from Brussels three years ago, we started immediately discussing with our Indigenous and local partners what this research should look like.

We're partnering with other EU and US funded projects. I put one example here from the National Science Foundation where I'm a partner in the Arctic rain on snow study. We have a team in Finland and in Russia. We have here at CHARTER early career and senior career Indigenous scholars. The issue of rain on snow is also thaw- refreeze events. These lead to catastrophic starvation (see the bottom right) of reindeer in Finland. When this happens on small scales you see supplemental feeding of animals in Russia. This is under discussion now, so we're really at the edge of a potential systemic change.

This is the emphasis on participatory methods. As I already mentioned, we co-developed this from the very beginning and we're synthesizing existing datasets, so that's what sets CHARTER apart really from a lot of projects of this size and scope. We are putting the emphasis on previously run projects that haven't looked at the data sets in this way in an iterative process with our local and Indigenous partners. Thank you.
Mia Bennett: Thanks so much. Bruce stripper project. I think your last clients are really important to underscore the significance of co-production of knowledge and also data which you mentioned.

Mia Bennett: Wonderful, thanks so much and all this will be online for people to use. These go to these references later, so thanks again. Next, I'd like to turn things over to Henry Burgess who is also an ASM3 science Advisory Board member as well as the head of the UK Natural Environment Research Council. NERC, boosted by the British Antarctic Survey, so Henry will be presenting key recommended actions to enhance Arctic understanding and prediction capability.

5. Closing Remarks: Henry Burgess (ASM3 Science Advisory Board): Perfect thank you very much mirror and thank you to all of our panelists and speakers so far. It's always difficult to go left, but I will do my very best. What I'd like to give you is a sense of where this work might take us, where the whole ASM3 process might take us, particularly this theme in terms of the recommended actions.

The thing I really want to stress is that for me, the theme 'to understand' is a particularly critical section of ASM3 because it's about taking us from that 'observation' stage, theme one, to really understanding what the knowledge that we are observing and gathering really means in the real world. And then it's bridging to theme 3, the 'respond' theme - it's particularly the area as we've seen in many of the presentations today where non-Arctic States and others have so much to offer. Both in leading the work and in leading 'the understand' work and in cooperating with others, but also in framing the global importance of understanding Arctic change. I think, as we've seen there have been great strides in both the ambition and the engagement in this area and an increasing diversity of voices in terms of gender and Indigenous people of experience and knowledge and all that should be very much celebrated and encouraged. We're certainly not here or there yet, but now is absolutely the time to redouble our collective efforts.

There's some of the things that I think will turn out to be the recommendations, or the action points from the whole of the ASM3 process. Definitely, as we've seen in presentations already, truly understanding the environmental risks that the Arctic is facing. The role of humans as drivers of change, and they need to mitigate and adapt. Effectively, I think we're going to see recommendations around future global weather and climate patterns in particular extreme weather events the prediction of those extreme weather events and the implications of those at a local, regional, and global scale, and particularly understanding tipping points and cascading effects both within global weather and climate patterns, but also more generally. We've seen already the focus on cross cutting research to understand the detailed connections between environmental, social and economic systems, and I think we're going to see recommendations on those as part of the ASM3 process. What strikes me is the need to understand and generate predictions at pace. The Arctic is changing at record pace. The importance of predictions, accurate, but rapid predictions will be increasingly important to

support effective decision making. Then respectful and empowering partnerships that fully include Indigenous researchers and that produced new knowledge and importantly, where challenges fair and welcome challenge by Indigenous participants to traditional scientists and then also fair and welcome challenge in the other direction, leading to new long-term research partnerships.

I think we can group these potentially under three separate areas. So, the first of these, 'building', and this is particularly encouraging the development of new large-scale ambitious international partnerships and initiatives with effective data analysis and synthesis. Big is very much not always better, but in many cases, in some cases, there are definitely opportunities for a continuation of the big project. The big programs that are inclusive that look at the big questions and help us understand change at scale in particular interconnected scale. Then, increasing supporting research that shapes the prediction and mitigation of risks and hazards associated with Arctic change. Particularly they affect people that live in the Arctic and live in the near Arctic and have those global connections. We've seen some of those themes addressed so far in the presentations so far. And then prioritizing so focusing attention on projects that look at connections between the various environmental components and particularly those that enhance understanding of complex social human and ecosystems. That's a very quick summary, and it's by no means comprehensive. The detail of the recommendations that will come out through the ASM3 process, I hope will reflect some of that. Some of that focus, but the detail of that is it still to be agreed, and in truth this webinar and all the other webinars are part of the process of shaping and finalizing those recommendations. So, this is very much a continuing process. Thank you all for your input and that will be taken on board for these recommendations and for the process as a whole. Thanks Mia. Right back to you.

Mia Bennett: Thanks so much, Henry, for the terrific overview of understanding some of the key actions for turning those observations into actionable items that we can use to respond to all these challenges in the Arctic. I'm we have a few minutes left for a question and answer. Feel free to type them in the Q&A box.

You can now register for the next webinar, so that's on the ASM3 website. If you have any lingering questions from this webinar, you can submit those to the SMT organizing Committee and we can also get in touch with the panelists as well, if you can't reach out to him directly.

We have a question here from about whether the recording will be available on the website.

Lindsay Arthur: the recordings will all be on the website and accessible through YouTube will also share a PDF of the presentation and as soon as we can, we will also share a transcript. It's really our goal to make the information from this webinar series as accessible in public as possible so you can also catch up on the previous webinars if you haven't seen them yet, all on the ASM3 website.

Mia Bennett: I might pose a question to the panelists while we're waiting. Since we have a few more minutes, let's see, since we've had examples from both Arctic and Arctic countries and researchers. What do you think are some exciting ways forward for how we can foster that type of international collaboration across the Arctic Circle? Any of the panelist wants to jump in?

Bruce Forbes: I could just comment that unfortunately with the Corona it looks like the next COP meeting in Scotland might have to be virtual as well, but I participated several years ago when the meeting was in Marrakech, the COP meeting, and there was a session on Indigenous Knowledge and climate change and it was global and I learned so much in there, so I think the participation of non-Arctic countries in fora like that - because it's rare when I go to a meeting like AG or AGI mean all these Arctic or polar sessions -but the exposure to the non-Arctic countries was really good. Even if meetings like COP end up being online for another year, I think they're worthwhile for these kinds of interactions like we had today.

Mia Bennett: Thanks, Bruce, I think that's a great point, to think about how we can bring together Indigenous Knowledge from worldwide as well places as far afield as Morocco. I see question here from Paul Arthur Berkman: who are the recommendations going to, for support?

Henry Burgess: May I come in there? The process we're going through at the moment and, Lindsay and Jenny come in and correct me, but the process we're going through at the moment of drafting the joint statement that will be signed up by the Arctic Science ministers. That's the end of this process. So that's gone through one version already. It's going through a second one now. Then there will be a final version, so that's kind of going backward and forward in that in that happy kind of drafting phase. The recommendations and very much my words were the words you saw from me, where my words rather than the text that was in that joint statement. But that text is being agreed by all of the science ministers with support from the science advisory for as well. So that's an iterative process.

Mia Bennett: Great thanks Henry, and I think we have time for just this last question that's come into the Q&A from an anonymous attending who's asking whether the metadata for the submitted projects for ASM3 will become available for analysis, pointing out that it might be interesting to see which countries in which parts of the world are focusing on which part of Arctic science. Maybe Wednesday or Jenny, do you know about that?

Lindsay Arthur: Yeah, maybe Jenny and I can both answer that. Not just the joint statement is a result from this process, but this science report that's really trying to summarize all of the science that we've gotten through. All of the different feedback channels in one place and then of the resulting actions that we find from all of that, what we're working on. Jenny, you can talk about this more is providing kind of a platform for accessing that data online. This hasn't been done for the previous ASM, so this would be a new contribution through this ASM process, but we're looking at how to make all of that information more accessible so that cooperation opportunities can become more understood and maybe organic connections can happen through this process.

Mia Bennett: There aren't more questions. I believe we are out of time today, so I'll turn it over to Lindsay to back things up.

Lindsay Arthur: Thank you so much to all of our panelists today, it is just wonderful to be able to have this sort of forum with representatives from around the world talking about Arctic science and really showing how globally relevant this topic is. So we thank all of our panelists very much and we think especially our Science Advisory Board members, Mia Bennett and Henry Burges for joining us and really helping us contextualize all of the projects in science in the bigger picture today, so thank you all. Thank you to our attendees and we'll see what the next webinar on March 17th on theme three, 'respond'.