

# Vulnerability and Adaptation to Climate Change in the Arctic

ARCTIC COUNCIL SUSTAINABLE DEVELOPMENT WORKING GROUP (SDWG)



**Editors:**

Birgit Njåstad, Ilan Kelman, Stein Rosenberg



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ARCTIC COUNCIL  
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2006-2008



Norsk Polarinstitutt er Norges sentrale statsinstitusjon for kartlegging, miljøovervåking og forvaltningsrettet forskning i Arktis og Antarktis. Instituttet er faglig og strategisk rådgiver i miljøvernssaker i disse områdene og har forvaltningsmyndighet i norsk del av Antarktis.

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## PREFACE

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This document constitutes the final report of the Arctic Council Sustainable Development Working Group's project on Vulnerability and Adaptation to Climate Change in the Arctic (VACCA). The VACCA project was initiated on basis of the Salekhard declaration and had two aims:

- To undertake a scoping study which will collect and disseminate information on the expertise, existing and ongoing research and strategies/measures on adaptation to climate change in the Arctic.
- To arrange an international expert/stakeholder workshop in which leading experts, policy makers, working group representatives and key stakeholders will meet and discuss relevant issues related to vulnerability and adaptation to climate change, preparing recommendations for potential future work related to the issue within the Arctic Council.

Norway provided the coordination of the VACCA project, but engagement and input by all Arctic Council Members, Permanent Participants and Observers has been a prerequisite for the success of the project. We therefore extend our warmest appreciation to those Members, Permanent Participants and Observers who have put extensive time and effort into providing necessary input to the VACCA scoping study and the VACCA workshop. Without this engagement it would not have been possible to reach the level of success that was achieved! Our acknowledgement is also extended to the SDWG Secretariat and the Arctic Council Secretariat who provided invaluable assistance in the implementation of the project.

The VACCA project was formally completed at the end of the VACCA workshop (23 October 2008) at which time both the results of the scoping study and the findings of the workshop were forwarded to the Sustainable Development Working Group (SDWG) for consideration at their meeting in Tromsø 24 October 2008.

Tromsø, 24 October 2008

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## EXECUTIVE SUMMARY

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### BACKGROUND

This document constitutes the final report of the Arctic Council Sustainable Development Working Group's project on Vulnerability and Adaptation to Climate Change in the Arctic (VACCA). The VACCA project was initiated by Norway on basis of the Salekhard declaration and had two aims:

- To undertake a scoping study which will collect and disseminate information on the expertise, existing and ongoing research and strategies/measures on adaptation to climate change in the Arctic.
- To arrange an international expert/stakeholder workshop in which leading experts, policy makers, working group representatives and key stakeholders will meet and discuss relevant issues related to vulnerability and adaptation to climate change, preparing recommendations for potential future work related to the issue within the Arctic Council.

The VACCA project was organized in the following manner:



Norway as the proponent provides the project coordination, but the project is to involve all AC countries and PPs.



Norwegian Polar Institute serves as project coordinator ([www.npolar.no](http://www.npolar.no)).



CICERO (Center for International Climate and Environmental Research in Oslo) main consultant for the project coordinator ([www.cicero.uio.no](http://www.cicero.uio.no)).



SDWG Secretariat provides technical assistance to the project

The VACCA project was formally completed at the end of the VACCA workshop at which time both the analysis report and the findings of the workshop was forwarded to the Sustainable Development Working Group (SDWG).

## **MAIN FINDINGS OF THE VACCA ANALYSIS**

A scoping study was conducted within the framework of VACCA during the first half of 2008. The aim of the scoping study was to identify expertise, existing and ongoing research and strategies/measures on adaptation to climate change in the Arctic. A survey form was developed and made widely available through SDWG contacts (see Appendix #1). Responses to the survey were solicited via the web, word-of-mouth, email lists, specific meetings, and by contacting individuals one-on-one. After duplicate entries and partially completed responses were removed from the database, 138 completed responses remained in the database (see Appendix #2).

Climate change as defined by changes in temperature and precipitation, and hence with connections to extreme events, were the dominant climate change issues considered by the responses. Projects with a research component comprise the majority of the responses, with few projects addressing action in legislatures or on the ground.

Several countries and groups were not able to provide much input or they were uncertain of the relevance of their input. The responses were also dominated by people who are comfortable reading and writing in English. Others were hesitant to submit responses due to time or lack of information regarding how the survey data might be used and interpreted. Therefore, the data and results presented in the Analysis cannot be considered to be a complete overview of vulnerability and adaptation to climate change in the Arctic. The scoping study and the analysis represent only a first step towards understanding the topic.

Based on a strengths-weaknesses-opportunities-constraints analysis, the following questions were however identified for further discussions in the context of the Arctic Council:

1. Should the survey's scope be expanded to overcome the identified limitations and biases?
2. Should there be wider engagement with those not in the Arctic?
3. Is a coordination or information exchange mechanism needed?
4. Should an assessment be undertaken for Arctic climate change vulnerability and adaptation?
5. Should data sources, comparability, and availability be improved?

## **OUTCOMES FROM THE VACCA WORKSHOP**

As part of the VACCA project a Workshop on Vulnerability and Adaptation to Climate Change in the Arctic was held in Tromsø, Norway on 22-23 October 2008.

Approximately 80 relevant experts and decision makers participated at the workshop (see Appendix #9)

The workshop consisted of a number of presentations (see Appendix #7) and wide ranging discussions in smaller groups (see Appendix #8). The workshop identified the following potential directions for continuing with vulnerability and adaptation work within the SDWG and the wider Arctic Council context:

***1. Establish a (community-led) expert group / team / network [the exact term needs to be chosen] on vulnerability and adaptation in the Arctic***

- Work inside and outside the Arctic on vulnerability and adaptation could further share lessons and cooperate with other initiatives.
- Compiling and sharing information, pooling resources including data and stories, breaking down institutional barriers, and comparing similar methods across efforts, projects, and case stories is needed. Such actions help to build capacity and institutional memory, leading to more informed and more robust decisions.
- Adequate resources are required to support such work.
- Suggested tasks for the (community-led) expert group/ team / network [the exact term needs to be chosen]:
  - Enhance coordination, cooperation, and exchange of information for Arctic vulnerability and adaptation work.
  - Continue working on a database for collecting and disseminating information for Arctic vulnerability and adaptation work.

***2. Produce a series of analyses and assessments to promote and facilitate Arctic vulnerability and adaptation related action.***

- One conclusion in the Arctic Climate Impact Assessment was that an impact assessment is not sufficient, but needs to be expanded to include adaptation and vulnerability to climate change in the Arctic.
- More than an assessment is needed, but the activities should be specific and targeted with the following actions particularly highlighted: an infrastructure vulnerability and adaptation assessment; a food security assessment involving a workshop; an economic analysis of the costs and benefits of climate change impacts and adaptation; and an assessment of information needs.
- These analyses and assessments would build on previous work and would include ongoing work such as the Arctic Marine Shipping Assessment and the Arctic Biodiversity Assessment, in order to approach new endeavours in a strategic manner.

- These actions should be timely, accessible, useful, and useable so that the results have relevance and applicability for users. They should also be linked to other ongoing work in the Arctic Council, with one example being the Sustaining Arctic Observing Networks project.

***3. Encourage and foster Arctic vulnerability and adaptation related collaborations, meetings, and projects.***

- These actions should build on existing initiatives, including those mentioned above.
- Certain principles assist in ensuring action-orientated collaborations, meetings, and projects:
  - Partnerships amongst all people and all sectors are needed for dealing with climate change and these should be effected through collaborative efforts at all scales, from local to international.
  - Consultation should be completed with partners before acting, in order to involve them in developing projects, policies, and strategies on Arctic vulnerability and adaptation.
  - As part of the partnership-driven actions, knowledge acquired in or from a community should be returned to that community on their terms in a useful and accessible manner.

**DISCLAIMER**

This project was undertaken as an approved project of the Arctic Council Sustainable Development Working Group. The project report was prepared by a project team and does not necessarily reflect the policy or positions of any Arctic State, Permanent Participant or Observer of the Arctic Council.

## Part I: The VACCA Analysis

*VACCA aims to undertake a scoping study which will collect and disseminate information on the expertise, existing and ongoing research and strategies/measures on adaptation to climate change in the Arctic.*

# VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE IN THE ARCTIC (VACCA): AN ANALYSIS OF THE SCOPING STUDY DATA<sup>1</sup>

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## EXECUTIVE SUMMARY

Reducing vulnerability and implementing adaptation to climate change in the Arctic represents a significant challenge for the region. This Arctic Council project, VACCA (Vulnerability and Adaptation to Climate Change in the Arctic) was approved by the Arctic Council in 2007 and was designed to provide practical, useful knowledge and information sharing at different governance levels and for different sectors, so that this learning could be incorporated into policies and decision making.

The output from VACCA has two components:

- A survey on the expertise, previous and ongoing projects, and strategies and measures on adaptation to climate change in the Arctic.
- An international workshop on Arctic vulnerability and adaptation to climate change.

This report represents the background document analysing the scoping study for the workshop held in Tromsø, Norway from 22-23 October 2008.

Responses to the survey were solicited via the web, word-of-mouth, email lists, specific meetings, and by contacting individuals one-on-one. After duplicate entries and partially completed responses were removed from the database, 138 completed responses remained in the database.

This report provides data from the survey. 104 of the responses cover only one country, suggesting plenty of scope for multi-country approaches and comparisons. 83 of the responses were relevant to both vulnerability and adaptation, possibly implying that projects should not try to separate vulnerability and adaptation, but instead cover both activities.

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<sup>1</sup> This report was prepared for the Sustainable Development Working Group of the Arctic Council, by Ilan Kelman, CICERO, Oslo, Norway with Kim van Dam, Arctic Centre, University of Groningen, the Netherlands. The text of the report is kept in its original form. Its appendices have been moved to the end of this full report.

Climate change as defined by changes in temperature and precipitation, and hence with connections to extreme events, were the dominant climate change issues considered by the responses. Many responses, though, indicated that issues and sectors not in the main survey form lists were of importance. Projects with a research component comprise the majority of the responses, with few projects addressing action in legislatures or on the ground.

The survey does not appear to be comprehensive, because several countries and groups were not able to provide much input or they were uncertain of the relevance of their input. The responses were also dominated by people who are comfortable reading and writing in English. Others were hesitant to submit responses due to time or lack of information regarding how the survey data might be used and interpreted.

Therefore, the data and results presented here cannot be considered to be a complete overview of vulnerability and adaptation to climate change in the Arctic. This report and the responses on which it is based represent only a first step towards understanding the topic.

Nonetheless, based on a strengths-weaknesses-opportunities-constraints analysis, the following questions are provided for further discussion:

6. Should the survey's scope be expanded to overcome the identified limitations and biases?
7. Should there be wider engagement with those not in the Arctic?
8. Is a coordination or information exchange mechanism needed?
9. Should an assessment be undertaken for Arctic climate change vulnerability and adaptation?
10. Should data sources, comparability, and availability be improved?

## **1. BACKGROUND TO VACCA**

The Declaration from the Arctic Council Ministerial Meeting held in Salekhard, Russia in October 2006 states that the Ministers:

Request the SAOs to direct the SDWG, drawing on the expertise of other Working Groups, experts and stakeholders,

- to identify and share adaptation expertise and best practices and possible actions, unique to the needs and conditions of the Arctic, so that indigenous and other residents can better adapt to climate change,
- and to report on the status of this activity at the 2008 Ministerial meeting,

- and to make publicly available any results or lessons learned from this undertaking.

Reducing vulnerability and implementing adaptation to climate change in the Arctic represents a significant challenge for the region given the predictions in the Arctic Climate Impact Assessment (ACIA, 2005) as well as other work such as the Intergovernmental Panel on Climate Change (IPCC, 2007). Although ACIA did not specifically assess vulnerability or adaptation needs in the Arctic, it highlighted the climate trends and projected their impacts on Arctic environments and people. ACIA provides basic information that can inform the planning of vulnerability reduction and adaptation measures including at the local level.

This Arctic Council project, VACCA (Vulnerability and Adaptation to Climate Change in the Arctic) was approved by the Arctic Council in 2007 and was designed to provide practical, useful knowledge and information sharing at different governance levels and for different sectors so that this learning can be incorporated into policies and decision making. VACCA has direct and indirect links to several SDWG priority subject areas, and activities of other working groups, including follow-on to the Arctic Human Development Report (AHDR, 2004); management of natural resources; Arctic human, community, and environmental health; energy; marine shipping; and information and communication technologies.

The output from VACCA has two components:

- To undertake a scoping study which, via a survey (Appendix #1), collected information on the expertise, previous and ongoing projects, and strategies and measures on vulnerability and adaptation to climate change in the Arctic. The scoping study also forms the basis for the preparation of this background document for the workshop described in the next bullet point. Responses to the survey were solicited via the SDWG website, word-of-mouth, email lists, specific meetings, and by contacting individuals one-on-one to fill in the survey form.
- To arrange an international workshop to discuss relevant issues about, and to exchange information on good practices and lessons related to, vulnerability and adaptation to climate change. The workshop will prepare suggestions to give guidance for potential future work on climate change within the Arctic Council.

This report represents the background document analysing the scoping study for the workshop held in Tromsø, Norway from 22-23 October 2008. It reports on the data from the survey responses while analysing them through a strengths-weaknesses-opportunities-constraints analysis. Suggestions are made to assist the Arctic Council in moving forward with reducing vulnerability and implementing adaptation to climate change in the Arctic.

## 2. THE VACCA SURVEY

### *Main data and discussion*

After duplicate entries and partially completed responses were removed from the database, 138 completed survey forms were in the database (Appendix #2). A single spreadsheet was developed to encode the data from the responses for the analysis presented here. This section presents only the principal data. Other data are used throughout this report where appropriate.

Tables 2.1 and 2.2 present the geographic distribution of the countries to which the responses apply. As shown in Table 2.1, many responses were relevant to more than one country, so the total in Table 2.2 is more than 138. Since no responses listed zero Arctic countries, the survey was successful in capturing only projects with Arctic relevance.

**Table 2.1: Number of Arctic countries covered by responses (survey form question 5a)**

# Arctic countries	# Responses
0	0
1	104
2	9
3	5
4	3
5	3
6	4
7	1
8	9

**Table 2.2: Arctic countries covered by responses (survey form question 5a)**

Arctic country	# Responses
Canada	47
Denmark/Greenland	19
Finland	43
Iceland	14
Norway	59
Russia	23
Sweden	21
USA	41

# responses marking "other countries"	5
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The overwhelming dominance of projects covering only one country might indicate the local nature of climate change vulnerability and adaptation. It might also provide scope for multi-country approaches and comparisons, especially multi-country comparisons of local approaches.

The large number of responses covering Norway was a direct result of one-on-one contact being made with people working on climate change across the country to request, and then to follow up continually, that they fill in the survey form. The language barrier likely affected the response from Russia and partially explains the low number of responses relevant to this country. However, the Northern Forum translated the survey form into Russian and both the English and Russian versions were circulated amongst many Russian contacts.

Table 2.3 on the next page shows the distribution of projects in terms of being relevant to vulnerability and/or adaptation. The decision was made to leave in the five responses marked as neither vulnerability nor adaptation because all these responses had relevance to one or both topics even though the submitter did not mark either box. The submitter had made an effort to fill in the survey form in these cases, in comparison to instances where other responders stated that they would not fill in a survey form since none of their projects were linked to vulnerability or adaptation.

The overwhelming dominance of projects covering both vulnerability and adaptation, rather than just one topic, suggests the strong links between reducing vulnerability and implementing adaptation. A lesson could be that projects should cover both vulnerability and adaptation rather than separating these activities, supporting the conclusions already reached by many involved in climate change research, policy, and implementation.

**Table 2.3: Responses dealing with vulnerability and adaptation (survey form question 4a)**

Category	# Responses
Neither vulnerability nor adaptation	5
Vulnerability not adaptation	15
Adaptation not vulnerability	35
Vulnerability and adaptation	83

The topics—referring to climate change issues and sectors—from the responses are shown in Tables 2.4 and 2.5. The totals add up to more than 138 because most responses covered several topics. The “other” issues (Tables 2.4) included additions such as access to resources, insurance, seasons changing, species changing, and technology. The “other” sectors (Table 2.5) included additions such as emergency planning, forestry, governance, immigration, public sanitation, and traditional knowledge.

**Table 2.4: Responses marking specific issues (survey form questions 2a at left & 2b at right)**

Issue	# Responses
Damage to human settlements and infrastructure	70
Other	70
Loss of/changes in livelihoods	69
Change in resource base	67
Changes in economy	55
Loss/degradation of land	55
Cultural changes	50
Food security	44
Health related changes	35
Changes in demography	32
Water shortage	32

Issue	# Responses
Changes in temperature	106
Changes in precipitation	104
Increases/changes in extreme events	90
Flood	71
Changes in wind	63
Permafrost degradation	63
Melting sea ice	58
Sea level rise	58
Coastal inundation/erosion	47
Drought/aridity	43
Other	42
Avalanches/landslides	38
Vector-borne disease	27
Increased UV-radiation	23

**Table 2.5: Responses marking specific sectors  
(survey form question 3)**

Sector	# Responses
Infrastructure	74
Natural systems management	62
Coastal zones	53
Wildlife management	53
Water resources	53
Tourism	44
Protected areas management	42
Other	41
Energy production	40
Fisheries (including aquaculture)	38
Human health	38
Recreation	34
Agriculture	31
Energy consumption	31
Non-renewable resource extraction	30
Animal husbandry	29

Amongst the named (i.e. not “other”) issues, increased UV-radiation and vector-borne disease were the least covered, matching the comparatively low numbers of responses covering human health. Human health, though, was covered by more responses than some energy sectors and than the food sector represented by agriculture, animal husbandry, and fisheries.

Climate change as defined by changes in temperature and precipitation, and hence linked to extreme events, were the overwhelmingly dominant issues considered by the responses. That indicates a strong bias towards working with issues that can be most readily quantitatively modelled and with the most readily available data. It would also

be important to investigate how the projects considering factors other than temperature and precipitation are conducting these analyses.

Appendix #3 compiles the survey responses by country and sector/issue, so that the issues and sectors being of more influence or less influence in each country could be identified, potentially suggesting areas to target more in specific countries. Lessons learned are provided in Appendix #4, from the 64 responses that provided answers to this question.

Table 2.6 lists the different types of projects. The total adds up to more than 138 because many surveys marked several types. The projects with a research component predominate, with far fewer focused on action in legislatures or on the ground. This result might be an artefact of the audience available for completing the survey, because researchers are more likely to be connected to research-orientated email lists, than policy makers and practitioners. This result might also be indicative of the dominance of research in adaptation work in the Arctic, which is similar to the state of adaptation in some other locations that are just starting to implement adaptation. Further work would be needed to identify the reason.

**Table 2.6: Type of project (survey form question 4b)**

Category	Type of project	# Responses
Study	Case study	25
	Research project	70
	Assessment	35
Action	Policy	30
	Strategy	26
	Legislation	8
	Regulation	15
	Planning tools	34
	Concrete physical actions	11
	Capacity building	29
	Communication, education and outreach	46

As well, 66 of the responses were classified as only one activity type suggesting a high level of focus for the projects rather than trying to encompass multiple interests, approaches, or outcomes in a single project. Within the single-activity projects, 36 were research, again indicating the survey's bias towards capturing research activities.

### ***Limitations***

The survey is unlikely to be comprehensive from many perspectives. Out of the 138 projects, 7 are under consideration, 75 are ongoing for a finite period, 31 are ongoing for indefinite period, and 25 are completed. The responses are dominated by projects that are currently ongoing, presumably because those are the projects at the forefront of people's thoughts when they are asked to fill in the form.

The survey might also not be comprehensive with respect to projects from several countries and groups who were not able to provide much input or who felt that their input might not be relevant. One comment was that much work in a country is relevant to climate change even though climate change is not the core focus or reason for that work. Hence, survey forms were not completed. The survey did not garner a sense of (i) how much material was collected compared to how much is available or (ii) how comprehensive the survey ought to be in order to reach robust and consistent conclusions.

The bias towards ongoing projects also means that, overall, limited content is available on findings and recommendations (see Appendix #4), since completed projects would provide much more. Even with the completed or nearly completed projects, variation is considerable in length and content of answers for the open-ended questions. Some entries provide 1-2 sentences or a link to a website, whilst others sent detailed material and long lists of references.

Another aspect of the non-comprehensiveness of the survey is differing views regarding the survey's relevance to particular work. Some people filled in the survey form for only those projects near or above the Arctic Circle, matching their definition of "Arctic". Others considered the survey to be relevant for the subarctic or for any project in an Arctic country that could apply to the Arctic region.

Further questions were raised regarding the relevance of projects that were more related to observations only or to climate change impacts, whereas others adopted broad definitions of "vulnerability" and "adaptation". Also on the latter point, some respondents suggested that vulnerability and adaptation should apply to only humans and society, incorporating species and ecosystems where directly linked, but not covering projects that were only about vulnerability and adaptation of nature.

Other biases evident in the data, suggesting more survey limitations are:

- Some projects were sent in more than once by different organizations. Sometimes the entire project was covered, but sometimes different responses covered different parts of the same project. Where duplicate responses from a project were submitted, they were removed, even though some of the data entries were different from different partners. Where different parts of the same project were submitted, they were retained as separate responses.
- Sometimes, the same climate change related process was adopted in different locations, but only one survey form was completed for covering all locations. If each location were considered to be a separate project, then the data reported would change significantly.
- Responses were dominated by people who are comfortable reading and writing in English.
- Responses were dominated by people who have good access to, and who are comfortable using, the internet.
- Several responses were not completed for projects because the project personnel stated that they did not have time.
- Some VACCA participants reported that they were hesitant to submit survey forms because they did not know how the data would be used or interpreted.
- The majority of the projects are research-related or are top-down, suggesting either that many bottom-up and practical endeavours were missed or that research and top-down work dominate Arctic climate change projects.

As such, the data and results presented here cannot be considered to be complete or comprehensive regarding vulnerability and adaptation to climate change in the Arctic. Instead, they are only a first step towards understanding this topic because there are many areas and aspects that need to be more thoroughly detailed. The opportunity exists to continue the work of the survey, especially to overcome the limitations by targeting the areas which might not have been covered in the current work—as long as continuing the survey work would enhance the conclusions and results.

### 3. SWOC ANALYSIS

A SWOC (Strengths, Weaknesses, Opportunities, Constraints) qualitative analysis was selected as being the most appropriate way of interpreting the data (Appendix #5).

#### *Strengths*

The greatest strengths of the survey are the large number and the impressive variety of responses, showing that interest and capacity are increasing for, and are being used to

deal with, climate change vulnerability and adaptation in the Arctic. Despite being a minority, the number of community-based projects is also important in demonstrating the bottom-up approaches that are used. Examples are the *W010*, *W011*, *W012 Ealát* projects. The use of local knowledge for dealing with climate change is also highlighted as being particularly important, with projects such as *M010 Inuit Food* exemplifying the necessity and methods of doing so.

The variety of respondents and sectors is important. The respondents demonstrate interest and action from governments (e.g. the Government of Norway's Directorate for Civil Protection and Emergency Planning with *W021 CCA*), researchers (e.g. the University of Alaska Fairbanks with *M053 Alaska Infra*), international organisations (e.g. UNEP/GRID-Arendal with *W017 ECORA*), and non-governmental organisations including indigenous people's groups (some are noted in the previous paragraph). The sectors include comprehensive work on buildings (e.g. *S044 Climate2000*), energy (e.g. *W037 Barents Energy*), fish (e.g. *S043 FishExchange*), and health (e.g. *S021 Nunatsiavut GI* and *S022 Nunatsiavut Water*).

Some projects show valuable integration of local, traditional, and scientific knowledge bases (e.g. *M032 CAVIAR Yukon* and *M047 Polar View*) yielding principles and methods that could be transferable elsewhere in the Arctic and beyond. This balance helps to bring local issues to the international arena such as *S015 NCE* and *W033 NordTrøndelag* focusing on local needs for climate change adaptation using comprehensive and participatory methods respectively that could be emulated elsewhere. *W023 WWFCW* is specifically set up to record local experiences and to publicise those internationally. Meanwhile, national (e.g. *M037 NRTEE*) and international (e.g. *W015 GFORS*) approaches can make their ways to the local level such as through combining art and science to better understand local experiences (e.g. *S034 Arts*); through state-of-the-art modelling of Arctic climate and adaptation processes (e.g. *M012 FINESSI*); and through improved monitoring of Arctic climate and ecosystems (*M042 Palsa*).

The number of policies and programs in place is useful, so that these projects are not just about collecting information. Instead, the information is being applied and used to help people who must deal with climate change. Examples are *M028 Finland WP*, which defines challenges imposed by the Finland's National Adaptation Strategy and the necessary measures to respond to these; *W039 NunaGIS* which suggests making as much geodata-based information available as possible online for Greenland; and *W031 Buying Time* which is producing a manual for building resilience to climate change in natural systems.

Looking at climate change adaptation within the context of other challenges is another strength of the survey. *W029 Barents Stessor* considers climate change as one stressor on the Barents Sea and *S010 Inuvialuit* examines the effects of melting permafrost on

infrastructure within the context of other infrastructure challenges in one Canadian Arctic region.

### ***Weaknesses***

One weakness revealed by the survey is the lack of coordination and information exchange regarding initiatives on reducing vulnerability and implementing adaptation to climate change around the Arctic. Irrespective of the number of countries, sectors, or partners involved, few connections to or interchanges with other projects involving similar countries or sectors were explicitly identified. Sometimes, different parties at the same institution are involved in different but related projects, yet few links were obvious.

That is arguably fair if the projects are too different to permit overlap, but there might still be advantages in exchanging information and building on each other's work. The separation is not necessarily the fault of the project personnel. Sometimes funding and staffing mechanisms do not permit ongoing networking and exchange outside the project's remit.

Furthermore, projects continually start and finish and then the staff move on to other work which often results in a loss of institutional memory. This VACCA project (also provided as *W006*) was created to provide such links, but it, too, is temporary and it is dependent on people keeping their own project information up-to-date and using VACCA through their own initiative.

For instance, as discussed above regarding limitations of the survey, there are many more VACCA-relevant projects than responses that were filled in. Some countries, groups, and sectors have limited representation and the fault is rarely theirs. Barriers include language, time to support this form of networking, uncertainty regarding how the collected data would be interpreted and used, and access to the communications means used for disseminating the survey form. Reaching the most isolated people and projects will always present a challenge, but without appropriate effort, those who are already isolated will become even more isolated. An example of a project designed to help overcome this weakness is *S003UArctic Thematic Network*. More work could emulate this project.

The challenge of fragmentation is also seen in the wide diversity of approaches, vocabularies, and interests displayed in the responses. Diversity is not necessarily a weakness; in fact, it is often a strength. However, for an issue-focused project, such as VACCA highlighting climate change, using different approaches, starting points, and phrases can cause confusion and communication difficulties if deliberate effort is not made to overcome those.

From a technical standpoint, the responses demonstrate clear weaknesses of climate change aspects which must be improved to effect appropriate vulnerability reduction

and adaptation. Baseline information comparable in different locations through time is lacking for many communities and regions—as evidenced by many responses with differing baseline information or lacking baseline information in their work—hence evaluating the success of projects can pose challenges. As well, there are limited projects which fully connect societal and environmental aspects, apart from projects submitted by indigenous groups. Sometimes, it cannot be clear whether or not climate change is the main issue to consider because climate change is only one of the many social and environmental changes which are affecting the Arctic positively and negatively. The survey also reveals an absence of the private sector, since very few responses had any such involvement apart from project-based consultants. Finally, although many projects implicitly include capacity building along with policy and practice impact, comparatively few projects mentioned such activities explicitly. That suggests that increased awareness is needed on the importance of highlighting that work.

### ***Opportunities***

Many opportunities have emerged from the projects available, most of them through imitating successful aspects of ongoing work. Given the applied research component of many of the projects (e.g. *M052 Upper Yukon*), connections amongst science, implementation, and communication would strengthen work across the Arctic. That encompasses communicating scientific results to non-scientists, basing research on community needs, and ensuring that the scientific results could be used to build capacity for vulnerability reduction and adaptation to climate change (e.g. *W040 Polar Affairs*).

Within that context, significant opportunities exist to deliver and pool baseline observations to facilitate an Arctic-wide assessment of vulnerability and adaptation to climate change, if that were deemed to be useful. Examples of possible contributors would be the data collected by *W009 DAMOCLES* and *S007 Nunavik Access* along with the methods described in *M011 MSV* and *W038 Crow Flats*. Such data, methods, and diverse approaches indicate the importance of and opportunities for transferring ideas and methods across the Arctic region. The higher education approach of *S003 UArctic* illustrates the coordination and networking that could be achieved, as does *S033 Survey*. In particular, opportunities could be considered for conducting multi-country projects in order to combine data and to learn from and exchange with places around the Arctic.

Transfer does not need to take place just within the Arctic. The submissions from Australia, Germany, Japan, and the UK indicate that interest in the Arctic exists from non-Arctic locations and is likely to increase with the expanding realisation that the polar regions represent barometers for climate change that the rest of the world will soon experience. Responses were also received from parts of the USA and Canada not close to the Arctic, such as Colorado, southern British Columbia, and southern Ontario. Therefore, the Arctic could play a leading role in addressing climate change

vulnerability and adaptation worldwide, if the region felt that to be appropriate and worthwhile. If useful, that could happen not only by embracing the interest in the Arctic from the non-Arctic, but also by actively pursuing non-Arctic climate change opportunities in order to spread the Arctic's expertise and experience.

Strong opportunities exist to draw on indigenous knowledge to meld with and corroborate the scientific observations regarding dealing with climate change. Some projects were predominantly scientific (e.g. *W020 BlackC*) while others highlighted indigenous knowledge (e.g. *S016 Auyiittuq*) or local knowledge (e.g. *W007 Nature 2020*). These knowledge bases could be further linked—exactly as done by *M007 Nunavut Integrated*—especially through the normal indigenous approach of considering society and the environment together rather than separating them. An excellent example combining indigenous and non-indigenous approaches is *S024 Wetlands* which explores the feasibility of using constructed wetlands for treating wastewater.

Further opportunities exist to link research, policy, and practice. Some of the pure science projects could have significant input into policies and practices, yet the project scope does not cover any listed action. Some policy and practical projects are demonstrating innovative approaches which scientists could benefit from knowing about, yet research or publishing the material in an academic forum is not within the projects' mandates. Other policy and practice projects might benefit from a greater basis in past research and past experience. The VACCA project provides an opportunity to exchange such information.

### **Constraints**

Time to deal with identified climate change concerns was a major constraint emerging from the responses. It is clear that climate change is already significantly affecting the Arctic but many of the projects do not have the resources to act in the manner in which they wish to act at the speed at which they would prefer to act. Some responses highlighted the urgency of action related to or involving climate change (e.g. *M020 Salluit* with regards to the community's housing), especially in terms of capacity building, but the options were not always available to act faster.

Simultaneously, although somewhat conversely, several projects reveal that another constraint could be trying to do too much too quickly. That is evident in the number and extent of non-climate change challenges noted by the responses. For instance, *052 Upper Yukon* highlights “the economic, institutional, and state and regulatory frameworks that structure and influence everyday activities” as being challenges throughout the Yukon Flats in addition to climate change.

Compiling these responses suggests that tackling climate change should be done within the context of other challenges and opportunities, supporting the conclusions already reached by many involved in climate change topics. A balance should be achieved

between (i) lack of speed of action constraining vulnerability reduction and adaptation and (ii) the need for proper time and planning to have adequate information to make appropriate and effective decisions which are not confined to climate change. Given the prominence of climate change in the Arctic, it could constrain knowledge and appropriate action if climate change overshadows other topics, such as by attributing other trends and changes to climate change.

Within that context, limited knowledge of the past is a significant constraint. As noted earlier, the responses tended to highlight ongoing projects with limited input regarding past work. To some extent, it appears as if previously completed work might not be fully accounted for in much ongoing work. That is not the case with all projects. *W001 Nesseby* deliberately builds on past and ongoing work by *S039 CAVIAR Norway*. If that approach were adopted elsewhere, this constraint could be overcome.

The second component of limited knowledge of the past is with regards to data to understand the trends being witnessed. Many of the projects are confined to a contemporary snapshot, rather than involving the context of past decades and centuries of Arctic change. To do so might not be feasible given the lack of long-term baseline data, as noted earlier. Attempts to deal with climate change might therefore be constrained by the lack of historical perspective emerging from the lack of comparable, historic data, both qualitative and quantitative.

Differences in interests and terminology are a further constraint to overcome. The scientific community extensively uses the terms “vulnerability” and “adaptation” even though those terms and concepts are difficult to translate for, and communicate to, many other contexts. Where projects are focused on a place, yet are by people not from that place, competing interests and different communication modes could constrain the project’s success.

Finally, significant constraints appears to be the English focus of the survey and its dissemination through English-speaking networks which leaves out many non-Anglophone projects, along with a heavy reliance on the internet which might exclude those who have poor internet access or who are not comfortable with the medium.

#### 4. QUESTIONS FOR DISCUSSION

Based on the results, the following questions are asked for further discussion:

***1. Should the survey's scope be expanded to overcome the identified limitations and biases?***

Future work related to this survey could be completed, including specific mechanisms for targeting the groups and people who are underrepresented in the current survey. Examples could be travel to key institutes by a native speaker of the first language of those institutes, translating the survey form into several non-English Arctic languages, having someone delve into completed projects in order to fill in survey forms for them, and spending time to contact policy and decision makers (rather than researchers) one-on-one to interview them and to fill in survey forms on their behalf. Before embarking on any tasks, it would be useful to have a further indication of how much material is missing, whether or not the analysis is robust irrespective of the missing data, and what level of comprehensiveness might be needed for the survey to move forward with addressing climate change. Would more completed survey forms assist in reducing vulnerability and adapting to climate change in the Arctic? How could any concerns be overcome about the survey and the use of the data?

***2. Should there be wider engagement with those not in the Arctic who could contribute to the Arctic?***

Climate change is a global concern and different regions might be able to assist each other, not only through exchanging ideas and information but also through collective action. The Arctic could potentially learn and teach through further engagement with those outside the Arctic, as long as the effort would justify the results. That could include those with interests in the Arctic as well as those focused on their own region but who could nevertheless contribute to the Arctic. Examples are places dealing with coastal erosion, less winter freezing, loss of indigenous and local knowledge, and changing species habitats and life cycles. Mountain areas, coastlines, and islands, in particular, have similarities to the Arctic. Yet other mechanisms and fora exist for such interaction. How relevant would such engagement be for the Arctic Council?

***3. Is a coordination mechanism or information exchange mechanism needed for Arctic climate change work?***

Diversity has advantages, but much work inside and outside the Arctic is being completed in isolation from similar work elsewhere. Sharing ideas, pooling resources, and comparing similar methods in different case studies has strong advantages, but the resources would need to be available to do so along with a focal point that could take a

proactive role in fostering these links and collaborations. Would it be appropriate to seek resources to create a coordination mechanism or information exchange mechanism? If so, what form would it take?

***4. Should an assessment be undertaken for Arctic climate change vulnerability and adaptation?***

ACIA (2005) was groundbreaking in assessing climate change impacts. That report is continually used as a benchmark for its topic. Similar work beyond impacts—covering vulnerability and adaptation—might help in knowing what is being done and what else needs to be done as well as supporting sharing and exchange of ideas, data, projects, policies, and actions. If such an assessment were needed, should the Arctic Council take the lead or would other bodies be more suited to conducting and disseminating it?

***5. Should data sources, comparability, and availability be improved?***

Much qualitative and quantitative data about Arctic climate change are being collected in many forms, but not always by Arctic partners and not always in a manner which is comparable across case studies or which is accessible to those who ought to have access. Possibilities should be explored to improve this situation—as long as the ultimate goals of such an exercise were clear and agreed upon. Existing databases and inventories should not necessarily be stopped or integrated, but they could be made more available. If such an effort were deemed to be appropriate, then the usefulness and usability of different data sets could be continually evaluated for improvement as part of this work.

## **5. REFERENCES**

ACIA. 2005. *Arctic Climate Impacts Assessment*. Cambridge University Press, Cambridge, UK.

AHDR. 2004. *Arctic Human Development Report*. Edited by N. Einarsson, J. Nymand Larsen, A. Nilsson, and O.R. Young. Stefansson Arctic Institute, Akureyri, Iceland.

IPCC. 2007. *IPCC Fourth Assessment Report*. IPCC (Intergovernmental Panel on Climate Change), Geneva, Switzerland.

## Part II: The VACCA workshop

*VACCA aims to arrange an international expert/stakeholder workshop in which leading experts, policy makers, working group representatives and key stakeholders will meet and discuss relevant issues related to vulnerability and adaptation to climate change, preparing recommendations for potential future work related to the issue within the Arctic Council.*

# OUTCOMES<sup>2</sup> FROM THE VACCA WORKSHOP<sup>3</sup> (VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE IN THE ARCTIC) HELD 22-23 OCTOBER 2008 IN TROMSØ, NORWAY

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## **PURPOSE OF THIS DOCUMENT**

This document discusses, from the workshop participants' points of view, what might need to be done with regards to vulnerability and adaptation to climate change in the Arctic. It does not necessarily state what the Arctic Council should or should not be doing.

## **BACKGROUND AND CONTEXT FOR VACCA**

VACCA stands for Vulnerability and Adaptation to Climate Change in the Arctic.

The *Arctic Climate Impact Assessment* from 2004 was groundbreaking in assessing climate change impacts in order to provide a basis for addressing climate change challenges in the Arctic. One of the recommendations from this process was the need to focus on community vulnerability and adaptation. On this basis, a *Workshop on Adaptation to Climate Change in the Arctic* held from 26-27 June 2006 in Oslo to start the dialogue.

The Arctic Council, through the *Salekhard Declaration* of 26 October 2006, requested the Senior Arctic Officers to:

“...direct the SDWG, drawing on the expertise of other Working Groups, experts and stakeholders, to identify and share adaptation expertise and best practices and possible actions, unique to the needs and conditions of the Arctic, so that indigenous and other residents can better adapt to climate change, and to report on the status of this activity at the 2008 Ministerial meeting [now scheduled for April 2009], and to make publicly available any results or lessons learned from this undertaking”.

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<sup>2</sup> This text was developed at and directly after the workshop, and was presented to the Sustainable Development Working Group as it stands during its meeting on 24 October 2008 (Tromsø). No changes have been made to the original text. The more detailed outcomes/suggestions from the various breakout groups can be found in Appendix #8.

<sup>3</sup> Workshop programme, presentation abstracts and list of participants are found in Appendix #6, Appendix #7 and Appendix #9.

The *Workshop on Climate Change Impacts and Adaptation Strategies for Arctic Indigenous Communities* held from 20-21 September 2008 in Copenhagen provided an important input into this process.

Principal messages for policy, practice, and exchange include:

- Climate change does not occur in isolation from other social, economic, and political factors. These factors interact to shape vulnerability and adaptation. Effective adaptation strategies address other stressors in conjunction with climate change. Climate change should be brought into ongoing discussions from other sectors; for example, natural resource management, land use planning, and social services.
- Climate change factors should be incorporated into decision processes in such a way that uncertainties are acknowledged, yet dealt with, including by delivering user-defined information in useful and timely formats.
- History and culture, indigenous and non-indigenous, can teach adaptation as part of the lifestyle and livelihoods. Such knowledge should be considered for regulations, laws, policies, decision-making, and co-management of the environment and natural resources. Mechanisms are needed to support such processes.
- Materials for and approaches to education, communication, capacity building, outreach, and training need to be tailored for different audiences and different venues and made accessible.
- Mitigation needs to be considered in addition to adaptation.
- Resilience needs to be considered in addition to vulnerability and adaptation.

## **POTENTIAL DIRECTIONS FOR CONTINUING WITH VULNERABILITY AND ADAPTATION WORK**

### ***1. Establish a (community-led) expert group / team / network [the exact term needs to be chosen] on vulnerability and adaptation in the Arctic***

- Work inside and outside the Arctic on vulnerability and adaptation could further share lessons and cooperate with other initiatives.
- Compiling and sharing information, pooling resources including data and stories, breaking down institutional barriers, and comparing similar methods across

efforts, projects, and case stories is needed. Such actions help to build capacity and institutional memory, leading to more informed and more robust decisions.

- Adequate resources are required to support such work.
- Suggested tasks for the (community-led) expert group / team / network [the exact term needs to be chosen]:

1.1. Enhance coordination, cooperation, and exchange of information for Arctic vulnerability and adaptation work.

- This action should synthesise and disseminate material and consider aspects of good practices, guidelines, and making connections.
- This action should consider thematic areas that are relevant to other working groups of the Arctic Council.

1.2. Continue working on a database for collecting and disseminating information for Arctic vulnerability and adaptation work.

- Continuing the database would capture initiatives that were not included in the VACCA scoping study survey, as long as that information were useful and made accessible.
- Lessons from the VACCA scoping study should be used to improve the database to ensure that it is useful for and accessible to the users.
- In compiling and sharing information, different knowledge systems, such as scientific, indigenous, and local, should be involved. These knowledge systems are not mutually exclusive, but complement each other.

***2. Produce a series of analyses and assessments to promote and facilitate Arctic vulnerability and adaptation related action.***

- One conclusion in the Arctic Climate Impact Assessment was that an impact assessment is not sufficient, but needs to be expanded to include adaptation and vulnerability to climate change in the Arctic.
- More than an assessment is needed, but the activities should be specific and targeted with the following actions particularly highlighted: an infrastructure vulnerability and adaptation assessment; a food security assessment involving a workshop; an economic analysis of the costs and benefits of climate change impacts and adaptation; and an assessment of information needs.
- These analyses and assessments would build on previous work and would include ongoing work such as the Arctic Marine Shipping Assessment and the

Arctic Biodiversity Assessment, in order to approach new endeavours in a strategic manner.

- These actions should be timely, accessible, useful, and useable so that the results have relevance and applicability for users. They should also be linked to other ongoing work in the Arctic Council, with one example being the Sustaining Arctic Observing Networks project.

***3. Encourage and foster Arctic vulnerability and adaptation related collaborations, meetings, and projects.***

- These actions should build on existing initiatives, including those mentioned above.
- Certain principles assist in ensuring action-orientated collaborations, meetings, and projects:
  - Partnerships amongst all people and all sectors are needed for dealing with climate change and these should be effected through collaborative efforts at all scales, from local to international.
  - Consultation should be completed with partners before acting, in order to involve them in developing projects, policies, and strategies on Arctic vulnerability and adaptation.
  - As part of the partnership-driven actions, knowledge acquired in or from a community should be returned to that community on their terms in a useful and accessible manner.

## Part III: Appendices

# APPENDIX #1: VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE IN THE ARCTIC SCOPING STUDY SURVEY

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*The Sustainable Development Working Group under the Arctic Council has, on the asking of the Council itself, undertaken a process to identify and share adaptation expertise and best practices and possible actions, unique to the needs and conditions of the Arctic, so that indigenous and other residents can better adapt to climate change. In this regard the project "Vulnerability and Adaptation to Climate Change in the Arctic" (VACCA) has been initiated.*

*The aim of VACCA is to undertake a scoping study which will collect and disseminate information on the expertise, existing and ongoing research and strategies/measures on adaptation to climate change in the Arctic.*

*The scoping study will also form basis for the preparation of a background document for a planned workshop in which leading experts, policy makers, working group representatives and key stakeholders will meet and discuss relevant issues related to vulnerability and adaptation to climate change, preparing recommendations for potential future work related to the issue within the Arctic Council.*

*The following survey questionnaire has been developed with the aim of collecting the appropriate information for this purpose. Relevant experts and contacts within the climate change work of the members and observers of the Arctic Council are hereby encouraged to submit information on relevant activities using the questionnaire below.*

*The survey questionnaire should be filled in for each identified vulnerability or adaptation activity. An activity in this context is defined as any action, process, project or study initiated to consider issues related to vulnerability or adaptation to climate change in the Arctic.*

## **A. TITLE OF THE ACTIVITY**

1. Provide a brief but descriptive title for the activity

## **B. ISSUES ADDRESSED**

- 2A. Please indicate which issue(s) (consequences for society) the activity addresses

- |   |   |
|---|---|
| <input type="checkbox"/> Water shortage                                 | <input type="checkbox"/> Health related changes   |
| <input type="checkbox"/> Loss/degradation of land                       | <input type="checkbox"/> Food security            |
| <input type="checkbox"/> Loss of/changes in livelihoods                 | <input type="checkbox"/> Changes in demography    |
| <input type="checkbox"/> Change in resource base                        | <input type="checkbox"/> Changes in economy       |
| <input type="checkbox"/> Damage to human settlements and infrastructure | <input type="checkbox"/> Cultural changes         |
|   | <input type="checkbox"/> Other (please describe): |

2B. If relevant, please indicate which of the below issue(s) (impacts of climate change) the activity addresses

- |  |   |
|--|---|
| <input type="checkbox"/> Changes in temperature              | <input type="checkbox"/> Permafrost degradation     |
| <input type="checkbox"/> Changes in precipitation            | <input type="checkbox"/> Melting sea ice            |
| <input type="checkbox"/> Changes in wind                     | <input type="checkbox"/> Avalanches/landslides      |
| <input type="checkbox"/> Increases/changes in extreme events | <input type="checkbox"/> Coastal inundation/erosion |
| <input type="checkbox"/> Sea level rise                      | <input type="checkbox"/> Vector-borne disease       |
| <input type="checkbox"/> Drought/aridity                     | <input type="checkbox"/> Increased UV-radiation     |
| <input type="checkbox"/> Flood                               | <input type="checkbox"/> Other (please describe):   |

### C. SECTOR

2. Please check the box(es) that best describes the sector(s) that the activity covers:

- |  |  |
|--|--|
| <input type="checkbox"/> Agriculture                       | <input type="checkbox"/> Non-renewable resource extraction |
| <input type="checkbox"/> Animal husbandry                  | <input type="checkbox"/> Energy production                 |
| <input type="checkbox"/> Wildlife management               | <input type="checkbox"/> Energy consumption                |
| <input type="checkbox"/> Fisheries (including aquaculture) | <input type="checkbox"/> Infrastructure                    |
| <input type="checkbox"/> Water resources                   | <input type="checkbox"/> Natural systems management        |
| <input type="checkbox"/> Coastal zones                     | <input type="checkbox"/> Protected areas management        |
| <input type="checkbox"/> Tourism                           | <input type="checkbox"/> Other (please describe):          |
| <input type="checkbox"/> Recreation                        |  |
| <input type="checkbox"/> Human health                      |  |

### D. TYPE OF ACTIVITY

4A. Please indicate whether the activity considers issues related to vulnerability to climate change or adaptation to climate change.

- Vulnerability  
 Adaptation

4B. Please indicate whether the activity is best described as a "study" or as an "action" and, if possible, provide further detail by selecting the description in the pull-down list that most appropriately fits the activity.

- |  |   |
|--|---|
| <input type="checkbox"/> Study:        | <input type="checkbox"/> Action                             |
| <input type="radio"/> Case study       | <input type="radio"/> Policy                                |
| <input type="radio"/> Research project | <input type="radio"/> Strategy                              |
| <input type="radio"/> Assessment       | <input type="radio"/> Legislation                           |
|  | <input type="radio"/> Regulation                            |
|  | <input type="radio"/> Planning tools                        |
|  | <input type="radio"/> Concrete physical actions             |
|  | <input type="radio"/> Capacity building                     |
|  | <input type="radio"/> Communication, education and outreach |

**E. GEOGRAPHIC LOCATION OF ACTIVITY**

5. Please indicate by checking off the appropriate box(es) which country/countries are involved in the activity. You can check more than one country. Provide also name of specific community/communities where appropriate.

5a. Country/countries:

5b. Community/communities (specify):

- Canada
- Denmark/Greenland
- Finland
- Iceland
- Norway
- Russia
- Sweden
- USA

**F. STATUS OF THE ACTIVITY**

11. Indicate the status of the activity, whether it is under consideration, ongoing or completed. If it is an ongoing project, please note whether.

- Under consideration
- Ongoing
  - Finite period (if possible, note estimated date of completion):
  - Indefinite period
- Completed

**G. DESCRIPTION OF THE ACTIVITY**

12. Give a short description of the activity (~200 words). Provide enough details so that others can understand the basic nature of the activity.

**H. LESSONS LEARNED**

13. If there already are lessons learned (both positive and negative) from the activity, please briefly outline them. Consider issues such as effectiveness, suitability, opportunities, challenges, barriers, constraints, gaps, etc.

**I. PRODUCTS AND OTHER REFERENCES**

14. Provide information about any products associated with the activity and any other relevant references.

9A. Products

- Report (title/link):
- Film (title/link):
- Website (address):
- Other (describe):

9B. Other references (list):

## **J. KEY CONTACTS**

*10A. List relevant key persons related to the activity. Provide name, institutional association and an e-mail address where this person can be contacted.*

*10B. Please provide contact details for yourself (ie. the person who has submitted the information about the activity) in order for us to know whom to contact if we need clarification regarding the input. This information is solely for the use of the project team and will not be distributed further.*

## APPENDIX #2: OVERVIEW OF RESPONSES TO VACCA SURVEY<sup>4</sup>

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Project #	Short Title	Full Title
M003	FINADAPT	Assessing the adaptive capacity of the Finnish environment and society under a changing climate
M006	Pribilof	Pribilof Islands Climate Change Vulnerability Assessment
M007	Nunavut Integrated	Integrated Assessment of Climate Change Impacts and Adaptation Options in Nunavut Communities
M010	Inuit Food	Impacts of environmental changes on traditional food security of Inuit
M011	MSV	Many Strong Voices – Climate Change Impacts and Adaptation in the Arctic and Small Island Developing States
M012	FINESSI	Integrated assessment modelling of global change impacts and adaptation
M013	Finland Strategy	Finland’s National Strategy for Adaptation to Climate Change
M014	ISTO	Climate Change Adaptation Research Programme ISTO
M015	Finland Energy	Government foresight report on climate and energy policy
M016	ASTRA	Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region
M017	Finland Roads	Adaptation to climate change in the road management; Prestudy
M018	Finland Power	Climate Change in Planning and Building of the Power-Distribution Network
M019	Espoo	Assessment of the Preparing for Climate Change in the City of Espoo

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<sup>4</sup> This overview provides only summary information about the projects/processes/activities submitted to the survey. Full access to the scoping study data will be made through the SDWG Portal (<http://portal.sdwg.org>).

M020	Salluit	Salluit: Analysis of significant climatic events relevant to public safety and town planning and assessment of their future frequency and intensity
M022	Uusimaa	Climate Strategy for the Uusimaa region
M023	MIL Forests	Functioning of forest ecosystems and use of forest resources in changing climate (MIL) –research program
M024	Finland Comms	Finland's Climate Change Communications Programme
M025	Uusimaa2020	The Environmental Program 2020, Uusimaa Regional Environment Centre
M026	AFLRA	Promoting Adaptation to Climate Change in Municipal Sector (Association of Finnish Local and Regional Authorities)
M027	YTK	Climate Change in Community Planning -information package (Centre for Urban and Regional Studies (YTK))
M028	Finland WP	A Work Programme on Adaptation to Climate Change (The Ministry of the Environment)
M030	Metsähallitus	Assessment of climate change in Finnish state-owned land and water areas, Metsähallitus, Finland
M031	PALSALARM	Global change impacts on sub-arctic palsa mires and greenhouse gas feedbacks to the climate system
M032	CAVIAR Yukon	"Climate change, vulnerability and institutional capacity in the City of Whitehorse": A case study the IPY funded "Community Adaptation Vulnerability in Arctic Regions Project"
M033	Canada Disasters	Disaster management and climate change adaptation policy in the Canadian North
M035	Canada Codes	The role of codes, standards and related instruments in enabling better management of climate change-related risks in respect of Canada's northern physical infrastructure
M036	Canada Infra	Understanding the significance of insurance, alternative risk spreading mechanisms, and related public policy for management of physical infrastructure in the face of climate change
M037	NRTEE	Program on Climate Change Adaptation Policy National Round Table on the Environment and the Economy

M038	Nunavut Capacity	Capacity for Adaptive Planning in Nunavut Communities
M039	Norway BioAssess	Assessment of effects of climate change on ecosystems and biodiversity in Norway
M040	Norway BioData	Database for projects and results on effects of climate change on ecosystems and biodiversity in Norway
M041	Norway Nature	Assessment of possible nature management measures to counteract effects of climate change
M042	Palsa	Monitoring of palsa mires
M043	Noradapt	Community Adaptation and Vulnerability in Norway
M044	Norway Workshop	Workshop on Adaptation to climate change in the Arctic, 26-27 June 2006, Oslo. Hosted by MFA, organised by CICERO
M046	Transport	Climate knowledge in the transport sector
M047	Polar View	Earth Observation for Polar Monitoring
M048	AWRVI	Arctic Water Resources Vulnerability Index (AWRVI) project
M049	IGERT	The University of Alaska Fairbanks (UAF) Resilience and Adaptation Program (RAP): An NSF sponsored Integrated Graduate Education and Training Program (IGERT)
M050	ACCAP	Alaska Center for Climate Assessment and Policy (ACCAP): A NOAA sponsored Regional Integrated Sciences and Assessments (RISA) Program
M051	Tundra Lakes	Tundra Lakes: Terrestrial water balance affecting tundra travel & access to resources
M052	Upper Yukon	The Synergistic Effects of Climate Change and Land Use in the Upper Yukon River Watershed
M053	Alaska Infra	Estimating Future Costs for Alaska Public Infrastructure at Risk to Climate Change
M054	CC Alaska	Climate Change in Alaska project
M055	USGCRP	Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change. Produced by the activities of the U.S. Global Change Research Program.
M056	Pew	A Pew Center series by on Global Climate Change Within this research series is the Alaska Climate Plan.

M057	ConsSol	Alaska Conservation Solutions
M058	Sub Cabinet	Alaska Climate Change Sub-Cabinet within the Alaska Governor's office (State Executive Branch)
M059	Alaska CIAC	Joint Alaska Climate Impact Assessment Commission (State Legislative Branch)
M060	North by 2020	North by 2020: A Forum for Local and Global Perspectives on the North
M061	Alaska SocVuln	Social Vulnerability to Climate Change in Alaskan Coastal Communities
M062	Sea Ice	Meeting Stakeholder Sea Ice Information Needs In A Changing Climate (Alaska Center for Climate Assessment & Policy)
M063	Newtok	Village of Newtok Relocation Planning and Action Group
M064	Rangifer	Heterogeneity and Resilience of Human-Rangifer Systems: A Circumpolar Social-Ecological Synthesis
M065	Knowledge Co-op	Arctic Borderlands Ecological Knowledge Co-op
S003	UArctic	University of Arctic Thematic Network on Global Change in the Arctic
S004	NWT Plan	NWT Climate Change Impact and Adaptation Plan
S007	Nunavik Access	Climate change in Nunavik: Access to territory and resources
S008	EcologyNorth	Climate Change Adaptation Awareness and Policy Development
S009	RADARSat	Community-based sea ice and weather forecasting and implementation of RADARSAT Ice Floe Edge Service
S010	Inuvialuit	The Impacts of Climate Change on the Availability of Granular Resources in the Inuvialuit Settlement Region, NWT.
S011	CAVIAR Canada	Community Adaptation and Vulnerability in Arctic Regions (CAVIAR)
S013	Atlin	Preparing for Change. Managing Climate Change Risks in the Atlin Area
S015	NCE	NCE Community Adaptation Project

S016	Auyuittuq	Inuit Perspectives on Land Use Safety in and around Auyuittuq National Park, Nunavut
S017	NEI	Northern Ecosystem Initiative- we are a Environment Canada (Government of Canada) program funding reseach across the Canadian North
S019	Clyde/Hall	Climate Change Adaptation Action Plans for Clyde River and Hall Beach
S021	Nunatsiavut GI	Climate change, water quality, and gastrointestinal illness in Nunatsiavut, Canada
S022	Nunatsiavut Water	1) Drinking water and potential threats to human helath in Nunavik : adaptation strategies under climate change conditions  2) Drinking water quality and climate change in Nunatsiavut : a pilot project for two Inuit communities
S023	Ecosystems	(no title provided)
S024	Wetlands	Assessing the efficacy of constructed wetlands for treatment of municipal wastewater.
S025	Yukon	(no title provided)
S026	Canada Policy	Developing policy to facilitate adaptation to climate change impacts.
S027	Boreal	Climate change adaptation and sustainable forest management in the boreal forest
S028	Polar Bear	Expert assessment of the uncertainties of polar bear population dynamics under climate change
S030	Beyond IPY	International Symposium: Looking beyond the International Polar year. Emerging and re-emerging issues in International Law and Policy in the Polar Regions
S031	Alaska Integrated	Integrated Assessment of Climate Change Impacts and Adaptation on the North Slope of Alaska
S032	Bering	Climate change impacts on traditional hunting and gathering practices in the Bering Sea area

S033	Survey	Survey of adaptation activities, polices, measures in northern countries including the Canadian arctic and Norway, Finland and Sweden for opportunities and comparison with climate challenges in Alaska and its adaptation efforts.
S034	Arts	Arts/Science collaborative expeditions to the Arctic
S035	Insurance	Understanding the significance of insurance, alternative risk spreading mechanisms, and related public policy for the risk management of physical infrastructure in the face of climate change
S036	Permafrost	Permafrost Test Section - Alaska Highway km 1928. (full scale testing of various adaptive techniques to mitigate highway distress due to melting of ice-rich permafrost)
S037	Oslo	Adapting to climate change in the Oslo-region (Norway)
S038	Rainy Day	Preparing for a rainy day: Configuring climate science for future society
S039	CAVIAR Norway	CAVIAR - community adaptation and vulnerability in Arctic regions
S040	Maps	Research project on the geography of social vulnerability, environmental hazards and climate change in Norway and middle Norway in particular
S041	Power stations	Director, Emissions Trading Authority at the Federal Environment Agency, Berlin, providing the administrative infrastructure for CO2-emissions trading in Germany; previously international climate change negotiator for Germany, with academic interest in Arctic affairs (law)
S042	Halogens	Observation of halogenated climate gases in the Arctic
S043	FishExChange	FishExChange- Expected change in the fisheries in the Barents Sea (a Norwegian Research Council-NORKLIMA project)
S044	Climate2000	Climate 2000 - Impact of climate change on the built environment
S046	Eider	Inuit, Eider Ducks and Sea Ice: Implications of environmental change in Hudson Bay

W001	Nesseby	Nature relations and perceptions of Weather in Nesseby, a coastal Sámi community in Norway
W002	ACTOR	Arctic Climate Change, Tourism, and Outdoor Recreation
W003	Russian1	Многолетний мониторинг изменений параметров многолетней мерзлоты и ресурсов грунтовых вод под воздействием глобального климатического потепления
W004	ClimATIC	Climate Change - Adapting to The Impacts, by Communities in Northern Peripheral Regions (Clim-ATIC)
W005	ArcAct	Unlocking the Arctic Ocean: The climate impact of increased shipping and petroleum activities
W006	VACCA	Vulnerability and Adaptation to Climate Change in the Arctic
W007	Nature 2020	The future of Norway's natural and cultural heritage: applying scenario, foresight and forecast methodologies within an ecosystem context
W008	Extreme	Adapting to extreme weather events in municipalities.
W009	DAMOCLES	Developing Arctic Monitoring and Observing Capabilities for Long-term Environmental Studies. EU 6th Framework Integrated Project and an EU contribution to IPY 2007-2008
W010	Reindeer Portal	IPY EALÁT-Outreach Reindeer Portal: Reindeer herding and climate change. (Reindeer Herders Vulnerability Network Study: Reindeer Pastoralism in a Changing Climate.)
W011	Reindeer Info	SDWG EALÁT-Information: Reindeer herding, traditional knowledge and adaptation to climate change and loss of grazing land
W012	Reindeer Comm	IPY EALÁT-Outreach Community-based workshops: Reindeer herding and climate change. (Reindeer Herders Vulnerability Network Study: Reindeer Pastoralism in a Changing Climate.)
W013	Municipal	Municipal actions in adaptation and mitigation
W014	Waterfront	Adaptation and Mitigation in Urban Planning and Waterfront Development
W015	GFORS	Governance for Sustainability
W016	Social Justice	Climate change and social justice

W017	ECORA	An Integrated Ecosystem Management Approach to Conserve Biodiversity and Minimise Habitat Fragmentation in Three Selected Model Areas in the Russian Arctic
W018	Fish	Investigation of how climate change might affect the fishing industry in Norway
W019	Elec	Three linked projects: CELECT: climate change impacts in the electricity sector (Under NRC's program NORKLIMA); ICEPS: Impacts of Climate Change and Energy Policies in the Electricity Sector (Under NRC's program RENERGI), and ADAM: Adaptation and Mitigation in Europe (under EU's 6th framework program). All with partners, analyse how mitigation and adaptation influences the electricity sector, both through demand and supply.
W020	BlackC	Climate effects of reducing black carbon emissions
W021	CCA	Norwegian climate adaptation program (a national response to climate change which aims to assist responsible authorities in their effort to adapt to climate changes)
W022	PhenoClim	PhenoClim - "Effects in Sapmi" – part of Phenology as an indicator of climate change effects
W023	WWFCW	Climate Witness is WWF's ongoing initiative to document the impacts of climate change on people and communities around the world and use the power of their stories to urge governments, business and individuals to take necessary actions to avoid dangerous climate change.
W024	Norway CC	Climate Change Impacts, Vulnerability, and Adaptation in Norway
W025	Stormwater Roads	Stormwater and roads - dimensioning for climate change (2007-2009)
W026	Airports Roads	Pollution risks and water management at airports and roads in a changing climate (2005-2008)
W027	Sectors	Towards assessing socioeconomic impacts of climate change in Norway: Sensitivity in the primary sectors: fisheries, agriculture and forestry
W028	Transport	Research and development program "Climate and Transport" 2007 – 2010, financed and managed by Norwegian Public Roads Administration

W029	Barents Stessor	Climate Vulnerability in the Barents Sea Ecoregion: A Multi-Stressor Approach
W030	Oil	Research Synthesis
W031	Buying Time	BUYING TIME: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems
W032	Institutional	Institutional adaptation to climate change
W033	Nord-Trøndelag	Nord-Trøndelag fylkeskommune: Temadag om flom og rassikring; 9.mai 2006
W035	PLAN	(no title given)
W034	Troms	Action Plan – cross-sectoral actionplan on clima changes, Troms fylkeskommune 2007 -2010
W036	NorACIA	NorACIA Temagruppe 4, Virkninger på folk og samfunn
W037	Barents Energy	Energy / Environment / Climate in the Barents region. Bilateral project on industrial cooperation between Västerbotten and Norrbotten in Sweden and Karelia and Murmansk in Russia. Focus on renewable energy supply for heating of houses and also waste management system.
W038	Crow Flats	International Polar Year (IPY) project: Environmental Change and Traditional Use of the Old Crow Flats in Northern Canada
W039	NunaGIS	NunaGIS; a web-GIS passed system for geodata in Greenland including data related to climate change
W040	Polar Affairs	Bringing together science, impacts, policy and law, politics, economics, and ethics and equity for both polar regions together.
W041	NSFRPP	Climate Change Adaptation in Norway, Sweden, and Finland – Do Research, Policy and Practice Meet?
W042	WMOWCRP	WMO/WCRP/IPY Workshop on CLIPS in Polar Regions: Climate product generation, user liaison and training.
W043	CCCRP	Climate Change Community Response Portal.
W044	Julia2030	Mitigation of and Adaptation to the Climate Change in the Helsinki Metropolitan Area – From Strategy to Implementation (Julia 2030).

W045	VACCIA	Vulnerability assessment of ecosystem services for climate change impacts and adaptation.
W046	temp health	Climate change and temperature related health effects.
W047	UVEUR	UV radiation over Europe (COST Action 726 and SCOUT-03 EU project).

## APPENDIX #3: SURVEY RESPONSES BY COUNTRY AND SECTOR/ISSUE

Each table cell provides the total number of survey responses matching the combination of country with issue or sector.

	Canada	Denmark /Greenland	Finland	Iceland	Norway	Russia	Sweden	USA	Other
<b>Survey form question 2a: Climate change issues</b>									
Water shortage	14	5	9	4	9	4	5	11	0
Loss/degradation of land	23	8	12	6	24	10	9	22	1
Loss of/changes in livelihoods	25	10	18	8	29	12	11	27	2
Change in resource base	22	8	18	6	31	14	9	26	1
Damage to human settlements and infrastructure	24	8	24	6	27	8	9	21	2
Health related changes	19	6	12	5	14	7	8	11	1
Food security	22	7	12	7	17	11	9	20	1
Changes in demography	10	4	7	4	16	7	5	11	0
Changes in economy	16	8	17	8	28	12	10	20	2
Cultural changes	22	9	9	7	22	8	9	21	2
Other	23	13	20	9	31	14	14	27	3
<b>Survey form question 2b: Climate change issues</b>									
Changes in temperature	35	12	29	10	47	14	15	31	1
Changes in precipitation	31	10	26	9	43	13	12	28	1
Changes in wind	23	7	16	7	32	10	10	16	1
Increases/changes in extreme events	31	9	25	8	41	11	11	24	1
Sea level rise	20	8	14	6	27	6	8	15	2
Drought/aridity	11	4	13	4	17	4	6	15	0
Flood	22	7	21	5	33	6	9	17	3
Permafrost degradation	29	11	15	8	25	10	14	26	2
Melting sea ice	31	13	15	9	24	12	13	22	2
Avalanches/landslides	19	8	8	6	22	6	9	11	1

Coastal inundation/erosion	20	7	10	5	23	7	9	18	1
Vector-borne disease	11	4	6	4	16	4	6	7	0
Increased UV-radiation	9	4	9	4	11	4	6	7	0
Other	15	8	16	6	16	10	11	17	1
<b>Survey form question 3: Sectors</b>									
Agriculture	7	6	10	4	15	4	5	13	0
Animal husbandry	7	5	12	6	20	10	9	14	1
Wildlife management	21	11	19	8	25	13	11	24	1
Fisheries (including aquaculture)	12	9	12	7	24	12	10	20	1
Water resources	17	8	17	5	22	7	7	19	0
Coastal zones	16	8	14	6	27	9	9	23	1
Tourism	14	9	20	7	23	9	11	16	2
Recreation	8	6	15	5	14	4	7	11	1
Human health	19	6	14	5	13	6	8	14	1
Non-renewable resource extraction	9	8	11	8	17	12	10	16	1
Energy production	12	9	19	8	19	10	11	14	1
Energy consumption	10	4	12	4	11	4	5	9	0
Infrastructure	21	10	29	8	32	11	10	20	1
Natural systems management	20	12	23	8	29	14	12	26	1
Protected areas management	13	8	15	5	17	8	8	18	1
Other	14	4	10	4	15	3	6	9	2
	<b>Canada</b>	<b>Denmark /Greenland</b>	<b>Finland</b>	<b>Iceland</b>	<b>Norway</b>	<b>Russia</b>	<b>Sweden</b>	<b>USA</b>	<b>Other</b>

Each table cell provides the normalised number of survey responses; that is the number of responses in the table cell divided by the total number of responses for the country.

	Canada	Denmark /Greenland	Finland	Iceland	Norway	Russia	Sweden	USA	Other
<b>Survey form question 2a: Climate change issues</b>									
Water shortage	0.30	0.26	0.21	0.29	0.15	0.17	0.24	0.27	0,00
Loss/degradation of land	0.49	0.42	0.28	0.43	0.41	0.43	0.43	0.54	0,20
Loss of/changes in livelihoods	0.53	0.53	0.42	0.57	0.49	0.52	0.52	0.66	0,40
Change in resource base	0.47	0.42	0.42	0.43	0.53	0.61	0.43	0.63	0,20
Damage to human settlements and infrastructure	0.51	0.42	0.56	0.43	0.46	0.35	0.43	0.51	0,40
Health related changes	0.40	0.32	0.28	0.36	0.24	0.30	0.38	0.27	0,20
Food security	0.47	0.37	0.28	0.50	0.29	0.48	0.43	0.49	0,20
Changes in demography	0.21	0.21	0.16	0.29	0.27	0.30	0.24	0.27	0,00
Changes in economy	0.34	0.42	0.40	0.57	0.47	0.52	0.48	0.49	0,40
Cultural changes	0.47	0.47	0.21	0.50	0.37	0.35	0.43	0.51	0,40
Other	0.49	0.68	0.47	0.64	0.53	0.61	0.67	0.66	0,60
<b>Survey form question 2b: Climate change issues</b>									
Changes in temperature	0.74	0.63	0.67	0.71	0.80	0.61	0.71	0.76	0,20
Changes in precipitation	0.66	0.53	0.60	0.64	0.73	0.57	0.57	0.68	0,20
Changes in wind	0.49	0.37	0.37	0.50	0.54	0.43	0.48	0.39	0,20
Increases/changes in extreme events	0.66	0.47	0.58	0.57	0.69	0.48	0.52	0.59	0,20
Sea level rise	0.43	0.42	0.33	0.43	0.46	0.26	0.38	0.37	0,40
Drought/aridity	0.23	0.21	0.30	0.29	0.29	0.17	0.29	0.37	0,00
Flood	0.47	0.37	0.49	0.36	0.56	0.26	0.43	0.41	0,60
Permafrost degradation	0.62	0.58	0.35	0.57	0.42	0.43	0.67	0.63	0,40
Melting sea ice	0.66	0.68	0.35	0.64	0.41	0.52	0.62	0.54	0,40
Avalanches/landslides	0.40	0.42	0.19	0.43	0.37	0.26	0.43	0.27	0,20

Coastal inundation/erosion	0.43	0.37	0.23	0.36	0.39	0.30	0.43	0.44	0,20
Vector-borne disease	0.23	0.21	0.14	0.29	0.27	0.17	0.29	0.17	0,00
Increased UV-radiation	0.19	0.21	0.21	0.29	0.19	0.17	0.29	0.17	0,00
Other	0.32	0.42	0.37	0.43	0.27	0.43	0.52	0.41	0,20
<b>Survey form question 3: Sectors</b>									
Agriculture	0.15	0.32	0.23	0.29	0.25	0.17	0.24	0.32	0,00
Animal husbandry	0.15	0.26	0.28	0.43	0.34	0.43	0.43	0.34	0,20
Wildlife management	0.45	0.58	0.44	0.57	0.42	0.57	0.52	0.59	0,20
Fisheries (including aquaculture)	0.26	0.47	0.28	0.50	0.41	0.52	0.48	0.49	0,20
Water resources	0.36	0.42	0.40	0.36	0.37	0.30	0.33	0.46	0,00
Coastal zones	0.34	0.42	0.33	0.43	0.46	0.39	0.43	0.56	0,20
Tourism	0.30	0.47	0.47	0.50	0.39	0.39	0.52	0.39	0,40
Recreation	0.17	0.32	0.35	0.36	0.24	0.17	0.33	0.27	0,20
Human health	0.40	0.32	0.33	0.36	0.22	0.26	0.38	0.34	0,20
Non-renewable resource extraction	0.19	0.42	0.26	0.57	0.29	0.52	0.48	0.39	0,20
Energy production	0.26	0.47	0.44	0.57	0.32	0.43	0.52	0.34	0,20
Energy consumption	0.21	0.21	0.28	0.29	0.19	0.17	0.24	0.22	0,00
Infrastructure	0.45	0.53	0.67	0.57	0.54	0.48	0.48	0.49	0,20
Natural systems management	0.43	0.63	0.53	0.57	0.49	0.61	0.57	0.63	0,20
Protected areas management	0.28	0.42	0.35	0.36	0.29	0.35	0.38	0.44	0,20
Other	0.30	0.21	0.23	0.29	0.25	0.13	0.29	0.22	0,40
	<b>Canada</b>	<b>Denmark /Greenland</b>	<b>Finland</b>	<b>Iceland</b>	<b>Norway</b>	<b>Russia</b>	<b>Sweden</b>	<b>USA</b>	<b>Other</b>

## APPENDIX #4: CATEGORIES FOR LESSONS LEARNED FROM THE RESPONSES

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64 of the responses reported lessons learned. This appendix consolidates those lessons into general points, deliberately not making them sector-specific or project-specific even when they were reported as such. Instead, the points consolidate and group many of the themes within the lessons learned that appeared in the responses.

The lessons are clustered into two groups based on the titles of the workshop panels, but significant overlap exists for all categories.

### Local approaches to vulnerability and adaptation to climate change

#### National initiatives supporting local climate change adaptation

- Climate change does not occur in isolation from other stresses, but the various stresses interact. Effective adaptation strategies address other stresses in conjunction with climate change. Adaptation is hindered by existing community weaknesses, but is also assisted by existing community strengths. Considering all stresses, with climate change as one that interacts with the others, can help in tackling the weaknesses while maintaining the strengths.
- The Arctic is diverse and complex, including the ecosystems, cultures, and governance. Lessons or approaches are contextual and might not be generalisable.
- Uncertainties surrounding climate change impacts influence strategies for vulnerability and adaptation. The best approach is to ensure that climate change factors are incorporated into decision processes as much as possible in such a way that the uncertainties are accounted for or that management techniques in the face of uncertainties are used.
- Often, it is known what needs to be done, but the capacity or resources do not exist to do it. Decision-making should be strategic rather than reactive and adequate resources need to be available to proceed.
- Environmental monitoring systems of diverse forms are needed so that observations can input into strategies.

### Exchange, teaching, and learning for climate change

- Partnerships amongst all people and all sectors are needed. These partnerships should include scientists, planners, community groups, community members, and governments amongst many others. Consultation should be completed

before acting with all these partners to involve them in developing policies and strategies. Top-down imposition does not work, so approaches should be locally-based. As part of the partnerships, knowledge acquired in or from a community should be returned to that community to help the people there.

- Often, information is available, but those who need it do not know that it is available or cannot access it. Improved dissemination of, availability of, and access to material would help.
- More awareness is needed about climate change and how to tackle it.
- Materials for and approaches to education, communication, and training need to be tailored for different audiences and different venues and made available to them.
- Not all aspects of climate change will be negative. There will be winners and losers. Yet all is not lost for the losers. There are always actions that can be taken, but the time is now to start systematically working out what actions to take, by whom, and where.
- Various tools should be used to deal with climate change, including indigenous knowledge, art, science, and insurance. Combinations are needed, such as systematic monitoring plus giving equal respect to local anecdotes and local knowledge; such as involving governance at all levels; and such as using storytelling in small groups and websites with technical information. No single approach can be successful. Together, they strengthen vulnerability reduction and adaptation activities.

## APPENDIX #5: BACKGROUND TO SWOC

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From T. Corsellis and A. Vitale. 2005. *Transitional Settlement: Displaced Populations*. Oxfam, Oxford, U.K., p. 179.

Full text downloadable from:

[http://www.sheltercentre.org/shelterlibrary/items/pdf/Transitional\\_Settlement\\_Displaced\\_Populations\\_2005.pdf](http://www.sheltercentre.org/shelterlibrary/items/pdf/Transitional_Settlement_Displaced_Populations_2005.pdf)

### Section 4.5.6: Strengths, Weaknesses, Opportunities, and Constraints (SWOC)

SWOC (also known as SWOT – Strengths, Weaknesses, Opportunities, and Threats – analysis) provides a framework for group analysis of a given situation. It encourages input from many people, helps people to brainstorm potential solutions (opportunities) and constraints, and is a way of gathering information that can be useful in problem analysis, monitoring, and evaluation.

The idea is to brainstorm under the following headings:

- Strengths: what has worked, why it worked; lessons learned for the future.
- Weaknesses: what has not worked very well; times when things could have gone better.
- Opportunities: ideas for how to overcome weaknesses and build on strengths.
- Constraints: the constraints that reduce the range of opportunities for change.

## APPENDIX #6: VACCA WORKSHOP PROGRAMME

**Workshop Chair: Grete Hovelsrud, CICERO (Norway)**

<b>October 22</b>		
0830-0900	Coffee and registration.	
0900-0920	Brief welcome.	Stein Rosenberg (SDWG Chair)
	Formal welcome	Svein Ludvigsen (Governor of Troms)
	Practical issues.	Ilan Kelman (CICERO)
0920-0940	Climate change and nature relations in Unjárga/Nesseby.	Stine Rybråten (CICERO)
0940-1000	Outcomes of the Permanent Participant Adaptation Workshop.	Gunn-Britt Retter (Sami Council)
1000-1030	VACCA survey and report.	Ilan Kelman (CICERO)
1030-1100	Break.	
<b>1100-1200</b>	<b>Panel #1: Local approaches to vulnerability and adaptation to climate change.</b>	
	Reindeer husbandry good practices.	International Centre for Reindeer Husbandry
	Polar View.	Joan Eamer (UNEP/GRID-Arendal)
<b>1200-1300</b>	<b>Breakout groups #1: Good practices in local climate change adaptation (Choose one of the groups below.)</b>	
	Local infrastructure (design and maintenance).	Facilitated by Michael Westlake .
	Livelihoods.	Facilitated by Ellen Inga Turi.
	Gender.	Facilitated by Dana Bellis.
	Youth and the elderly.	Facilitated by Amy Lovecraft.
1300-1400	Lunch.	
1400-1530	Plenary report from and discussion of breakout groups #1.	
1530-1600	Break.	
<b>1600-1700</b>	<b>Panel #2: National initiatives supporting local climate change adaptation.</b>	
	Lessons from Canada: <ul style="list-style-type: none"> <li>• Adaptation in Canada's North.</li> <li>• Climate Change Research and Adaptation Planning in Clyde River, Nunavut.</li> <li>• Old Crow Climate Change Risk Assessment and Final Agreement Analysis.</li> </ul>	Presented by: <ul style="list-style-type: none"> <li>• Leslie Whitby (Indian and Northern Affairs Canada)</li> <li>• Nick Illauq (Municipality of Clyde River) and Shari Gearheard</li> <li>• Lance Nukon (Arctic Athabaskan Council).</li> </ul>
	CARICOM Climate Change Adaptation Initiatives.	Ken Leslie (Caricom Climate Change Centre)

1700-1800	<b>Breakout groups #2: Good practices to support and link adaptation at the local and national levels (Choose one of the groups below.)</b>	
	Climate information.	Facilitated by David Mate.
	Methods and tools for understanding and assessing risk and vulnerability.	Facilitated by Don Lemmen.
	Energy infrastructure for adaptation.	Facilitated by David Pointing.
	Biodiversity/ecodiversity.	Facilitated by Linda Dalen.
	Health.	Facilitated by Alan Parkinson.
1930	Drinks and formal dinner.	

<b>October 23</b>		
0830-0900	Coffee and registration.	
0900-1030	Plenary report from and discussion of breakout groups #2.	
1030-1100	Break.	
1100-1200	<b>Panel #3: Exchange, teaching, and learning for climate change.</b>	
	Clim-ATIC - Communities adapting to the impacts of climate change in the northern periphery.	Clive Bowman (UHI Millennium Institute)
	FINADAPT.	Susanna Kankaanpää (Helsinki Metropolitan Area Council)
1200-1300	<b>Breakout groups #3: Good practices in climate change capacity building, education, and outreach (Choose one of the groups below.)</b>	
	Communication and outreach.	Facilitated by Martin Drews.
	Building capacity through networks and collaboration.	Facilitated by Thomas Voigt.
	Education and training.	Facilitated by Kirsi Latola.
	Research.	Facilitated by Miriam Geitz.
1300-1400	Lunch.	
1400-1530	Plenary report from and discussion of breakout groups #3.	
1530-1600	Break.	
1600-1715	<b>Final Panel: Future actions for the Arctic Council.</b>	
	Amy Lovecraft (University of Alaska Fairbanks)	
	Leanna Ellsworth (Inuit Circumpolar Council)	
	Victoria Tauli-Corpuz.	
1715-1730	Closing remarks.	Stein Rosenberg (SDWG Chair)

## APPENDIX #7: WORKSHOP PRESENTATION ABSTRACTS

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### **Climate change and nature relations in Unjárga/Nesseby**

*Stine Rybråten*

*Center for International Climate and Environmental Research – Oslo*

Experiences from one year of fieldwork in a coastal Sámi community in northern Norway.

Unjárgga gielda/Nesseby municipality, with its 869 inhabitants, is located in the inner part of the Varanger fjord in eastern Finnmark, Norway. The coastal Sámi municipality is bilingual, with Sámi and Norwegian as the official languages. Combining reindeer herding, agriculture, coastal fisheries, hunting and gathering has been of fundamental importance to the population in Unjárga/Nesseby for centuries. Although this combination of activities does not provide the same livelihood sustenance in the municipality today, natural resource-based activities and different kinds of harvesting remain of great significance for the residents, both as economic activities, for recreation and in people's sense of belonging.

In this presentation, I want to share my experiences of moving from Oslo in the south to Unjárga/Nesseby in Norway's northeast, to live and work as a young scientist, and—just as important—as a fellow human being, for one year. Through outlining my working methods for gathering information on the linkages between people's practical and experience-based relations to nature and the ability to adapt to climate change, some preliminary findings are presented. The ongoing fieldwork for my PhD in anthropology will be completed in January 2009.

### **Outcomes of the Permanent Participant Adaptation Workshop**

*Gunn-Britt Retter*

*Saami Council*

This presentation provided indigenous perspectives on vulnerability and adaptation to climate change in the Arctic and summarized the outcomes of the Permanent Participant Adaptation Workshop that was held in Copenhagen on 20-21 September 2008.

## Panel #1: Local approaches to vulnerability and adaptation to climate change

### Polar View

*Joan Eamer and the Polar View team  
UNEP/GRID-Arendal*

Polar View (part of the European Space Agency's Global Monitoring for Environment and Security initiative) provides satellite-based monitoring and information services related to ice and snow to a range of clients on a day-by-day to year-by-year basis. This information is used to adjust to changeable environmental conditions, primarily in the Arctic, but also in the Baltic Sea, North Atlantic, European Alps and Antarctica.

Examples of uses are: 1) ice charts for safe ship navigation and drilling operations (saving lives and money, and protecting the environment); 2) early warning to municipal authorities of river flooding from ice jams and snowmelt runoff; 3) weekly maps for Inuit hunters with information on ice edge location and conditions to help improve safety and hunting efficiency; 4) input to river flow forecasts to optimize hydro-electric generation.

The environmental conditions that are monitored—sea, lake and river ice conditions, snowpack characteristics and melt timing, and glacier dynamics—are being affected now by global climate change and are projected to undergo far-reaching changes in the decades to come. This translates into changing and emerging needs for timely and reliable information on ice and snow. Associated strategic and policy needs: 1) analysis of information gaps and needs related to public safety, environmental protection and local economies in the Arctic, 2) learning from the lessons of opportunistic adaptation under past and current ranges of climate variability, and 3) maintaining and improving technical solutions and institutional and funding arrangements.

## Panel #2: National initiatives supporting local climate change adaptation

### Adaptation in Canada's North

*Leslie Whitby  
Department of Indian and Northern Affairs, Canada*

In Canada's North, the need to adapt to current conditions will be part of a long-term continuing cycle of economic, environmental, cultural, and social change as the new

climatic conditions begin to emerge. Experience shows that the most effective and cost-efficient local adaptive responses tend to be anticipatory, integrative, and involve collaboration and partnership among different groups.

In 2007, the Government of Canada announced a number of initiatives on adaptation with three priorities: infrastructure, health and the North. The Northern Adaptation Program works with communities and other governments to assess community vulnerability and to develop sustainable options for the future. The program uses the best information generated by traditional knowledge and research programs such as the International Polar Year and ArcticNet. Through a broad partnership, together they exchange information and plans on projects, actions, and ideas with local communities and governments, contributing to the successful implementation of adaptation initiatives at the local level.

This presentation will provide an overview of adaptation activities across Canada's North and will preface more detailed descriptions of community-based adaptation planning in the communities of Old Crow, Yukon and Clyde River, Nunavut in the presentations to follow.

### **Climate Change Research and Adaptation Planning in Clyde River, Nunavut**

*Nick Illauq and Shari Gearheard*

*Ittaq Heritage and Research Centre, Municipality of Clyde River*

Our culture and our lifestyles are in jeopardy due to the unpredictability of weather patterns. We have to prepare for the changes and do research on what's really happening to the Arctic. There is a need for a lot more research using high technology and traditional knowledge together to better understand and make proper plans for the future. The resources were not available from our territorial government to go further on all the research subjects that we wanted to tackle; for example, alternative energies, better communications systems, and other resources.

The hamlet co-created a Climate Change Adaptation Plan for the territory with federal, territorial, and local governments and NGOs. The hamlet also created a committee which led to the creation of the Ittaq Heritage and Research Centre. We have attended international, national, and regional meetings to learn and give our voice for our concerns. We actively recruited scientists in these meetings for our cause so we can do some proper research. We also had community meetings and workshops to exchange ideas from local elders and scientists. We did multi-year research with Natural Resources Canada and universities from across Canada.

We created the Climate Change Adaptation Plan for the community of Clyde River with the help of local organizations and elders to cover all areas and supported by new data collected.

The larger implications require more research and better preparation in order to make informed decisions and apply for funding to implement the plans across the territory. Mitigation practices will have to be revised and the results will have to be properly documented and released to the communities so they are not looking like we are trying to scare every citizen. The main problem will always be funding, due to the population, we do not have numbers to qualify for the actual amount we need. It was good to collaborate with many different organizations which, was good for getting different perspectives on climate change.

### **Greenland: NunaGIS**

(Due to weather, this presenter was unfortunately unable to reach the workshop.)

*Klaus Georg Hansen*

*Head of Department, Spatial Planning, Greenland Home Rule*

NunaGIS provides the national, geographical, and digital infrastructure of Greenland on the Internet and was launched in April 2008 at [www.nunagis.gl](http://www.nunagis.gl)

As NunaGIS is the national web-GIS solution, it will contain much more than strictly climate change related information, but climate change related information is a priority area and is expected to become one of the main areas of information provided on NunaGIS.

The main challenge for Greenland is the lack of updated, basic, digital maps. The responsibility of mapping in Greenland is still placed on Denmark. Partly due to the focus on climate change in general and specifically due to changes like the retreat of the ice cap, Greenland is now pushing Denmark for new, updated, digital maps.

As the size of Greenland makes it impossible to monitor all the local effects of climate change, and to acknowledge the local knowledge of people, NunaGIS also provides an interactive possibility for reporting local observations of natural phenomenon amongst local changes caused by climate change. This reporting facility is expected to be operational in 2009.

## CARICOM Climate Change Adaptation Initiatives

*Ken Leslie*

*Caribbean Community Climate Change Centre*

Starting in 1997, the CARICOM member states embarked on several initiatives and projects aimed at quantifying the vulnerability to the projected impacts of climate change on the socio-economic development of the region. The outcomes from the initiatives and projects laid the foundation for the development and implementation of the first set of concrete pilot adaptation projects. The pilots are aimed at supporting efforts of Small Island and Low Lying Coastal CARICOM States to implement specific pilot adaptation measures addressing the impacts of climate change on biodiversity, land degradation and the use of renewable energy. The pilots are being conducted in three typical Small Island States: Dominica, Saint Lucia and Saint Vincent and the Grenadines. A review of the results and lessons learned from the projects and initiatives will be presented. Also, an overview of the details and status of implementation of each pilot will be discussed.

## Panel #3: Exchange, teaching, and learning for climate change

### Swedish climate change adaptation: Involving forestry

(Unable to attend at the last minute.)

*Per Rosenqvist*

*Ministry of the Environment, Sweden*

The Swedish Commission on climate and vulnerability was instigated by the Government in 2005. Its remit was to map the vulnerabilities in the Swedish society and to come forward with proposals on adaptive measures. The Commission concluded its work in 2007. Many of its proposals that cover all parts of society will be included in a climate bill scheduled for late autumn 2008.

Sweden is one of the most heavily forested nations in Europe. The significance of the forest for Sweden's economy is great and so any impact on the sector from climate change will be important. The Swedish Commission on climate and vulnerability concluded that the Swedish forestry sector will be affected by climate change with potentially 20-40% increase in tree growth, but increased risks for storm fellings, pests, and disease. The Swedish Forest Agency is the Government's expert authority on forests and forest policy. As a result of the work of the Swedish Commission on climate and

vulnerability, the Swedish forest agency has been instructed to promote climate adaptation within the forestry sector.

### **Clim-ATIC – communities adapting to the impacts of climate change in the northern periphery**

*Clive Bowman*

*Research Fellow / Project coordinator for the Clim-ATIC project*

*Centre for Mountain Studies, Perth College – UHI, Scotland*

Climate change models for northern Europe show that high levels of CO<sub>2</sub> and other greenhouse gases will increase temperatures, change precipitation patterns, and increase the frequency and duration of floods, droughts, storms and other extreme events, but exactly what will be the impacts on vulnerable rural communities, and can these communities adapt? Clim-ATIC aims to provide some answers to these questions.

Clim-ATIC is a three-year, €2.4 million, international project primarily funded by the European Regional Development Fund through the Northern Periphery Programme.

The project involves a partnership of 13 public sector and academic institutions and a further 10 associated partner organisations, across five countries; Scotland, Sweden, Finland, Norway and Greenland, who will work together with community stakeholders to explore the potential for different community sectors and groups to develop adaptive capacity to climate change impacts, and deliver real adaptations that provide local economic and social advantages.

Clim-ATIC will evaluate and exchange experiences on the processes used to gather and communicate relevant climate change impact knowledge to a range of community groups, and it will also explore the issues surrounding implementation of real adaptation projects through arrange of community led pilot projects.

### **FINADAPT**

*Susanna Kankaanpää*

*Helsinki Metropolitan Area Council*

FINADAPT (Assessing the adaptive capacity of the Finnish environment and society under a changing climate) was a consortium of 14 sub-projects across 11 research institutes participating in the Finnish Environmental Cluster Research Programme coordinated by the Ministry of the Environment in 2004-2005. The objective of FINADAPT

was to undertake a scoping study on the adaptive capacity of the Finnish society and environment based on literature reviews, interactions with stakeholders, seminars and targeted research.

Preparation of Finland's National Strategy for Adaptation to Climate Change (2005) was on-going at the same time. Research information collected in FINADAPT was used as background material and FINADAPT researchers input into the strategy's preparation.

In terms of exchange, teaching, and learning for climate change, FINADAPT has influenced and triggered adaptation work at the national and local levels in several ways. Firstly, the project increased awareness of adaptation among researchers and other stakeholders. Secondly, FINADAPT produced new research on climate change adaptation that could be used in adaptation planning at national and local levels. Thirdly, gaps in knowledge and needs for further research were identified. Some of these knowledge gaps have been addressed in the ISTO Programme (The Climate Change Adaptation Research Programme).

- FINADAPT: <http://www.environment.fi/syke/finadapt>
- Finland's National Strategy for Adaptation to Climate Change:  
[http://www.mmm.fi/en/index/frontpage/environment/ilmastopolitiikka/ilmas  
tomuutos.html](http://www.mmm.fi/en/index/frontpage/environment/ilmastopolitiikka/ilmas<br/>tomuutos.html)
- ISTO Research Programme:  
[http://www.mmm.fi/en/index/frontpage/environment/ilmastopolitiikka/resea  
rchprogrammeonadaptationtoclimatechange.html](http://www.mmm.fi/en/index/frontpage/environment/ilmastopolitiikka/resea<br/>rchprogrammeonadaptationtoclimatechange.html)

## APPENDIX #8: SUGGESTIONS FROM THE BREAKOUT GROUPS DURING THE WORKSHOP

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(Agreement on all these suggestions was not necessarily reached during the workshop.)

### Breakout groups #1: Good practices in local climate change adaptation

#### *Livelihoods.*

- Resilience needs to be considered, not just adaptation.
- Indigenous communities must be able to use their own knowledge to adapt.
- Institutional barriers need to be broken down to support livelihoods.
- Knowledge sharing and use is needed, especially incorporating traditional and local knowledge.
- To support livelihoods, seek political stability of the Arctic where possible, e.g. social equity, safety, infrastructure.

#### *Local infrastructure (design and maintenance).*

- Arctic Council could focus on an information-sharing mechanism. How can the Arctic Council help to deliver this? In order to do this we must understand how people use the knowledge and what they use it for.
- Sharing between bodies and organizations is needed; for example, key user groups and professional organizations.
- Existing case studies need to be made useful and accessible.
- Often, a new solution is not needed.
- Build on existing Arctic Council assessments to move towards future work; for example, the Arctic Marine Shipping Assessment.

#### *Gender.*

- Gender is a necessary topic of discussion that is not limited to women.
- A follow up conference is needed to “Taking Wing – Conference on Gender Equality and Women in the Arctic”, held in Saariselkä/Inari 4-6 August 2002.
- We need to find a way to talk about gender indirectly and in context in order to be inclusive.
- The title and theme of the conference could be the “Arctic Food Conference”. (The following sentiments were expressed after the breakout groups meeting and presentation. A few felt that the use of the word “gender” is not a relevant topic of discussion, and should be omitted from the program and discussion groups. This was because gender is not perceived to be relevant to certain

indigenous cultures or communities. This perspective highlights an area of debate within the gender field, and for this reason has been included in the Gender Breakout Group summary. However, considering the wide and growing discourse on gender within indigenous academic discourse and the important points raised above, the group maintains that gender is a pressing issue within discussion of vulnerability and adaptability.)

#### *Youth and the elderly.*

- The overall goal should be to enhance capacity for elders and youth to spend time together. Successful examples are:
  - (1) Community-based monitoring projects where youth and elders are managing or “testing” their environs together.
  - (2) Creating schools on the landscape or schools that emphasise multiple forms of knowledge that can teach youth amongst their elders and in locations in which elders have environmental and other life knowledge. That helps more youth stay in their own communities rather than leaving for their schooling.
  - (3) There needs to be economic development in rural locations so that youth are able to return to a community where there are opportunities to flourish. There needs to be structures in place that can care for elders so they are there when youth return.
  - (4) Create an Arctic Council level conference on youth and elders, so that these groups across the Arctic and from many different communities can learn from one another and share experiences.

#### Breakout groups #2: Good practices to support and link adaptation at the local and national levels

##### *Climate information*

- Organize a meeting/conference on climate information that brings key users together. This audience should be asked what they need and in what format they need it in. Scientists and other technical experts could attend as well.
- There is a range of climate information that is needed in the Arctic environment. That includes downscaled temperature and precipitation, permafrost, sea-level (tide gauge), vegetation, etc.
- A dialogue with users (for example, Reindeer Herders) is the most productive way to determine what types of specific products need to be or could be produced.
- If data gaps for climate information are identified across one Arctic region, there may be a way for the Arctic Council to coordinate new work with countries to ensure that priority locations are addressed.

### *Methods and tools for understanding and assessing risk and vulnerability*

- Conduct an inventory of available methods and tools.
  - Should identify both the strengths and limitations of various approaches.
  - Need to first ensure this is not duplicating existing efforts.
  - Much is going on globally on this topic; for example, UNFCCC's compendium of methods and tools.
  - The group did not identify conditions unique to the Arctic which would dictate the necessity for new / unique tools and methods. Instead, an opportunity exists to benefit from, and contribute to, global initiatives.
- A workshop / forum to examine available tools and methods and to share practical experiences with their application might be useful.
  - Such a workshop would need to be driven by the users of tools, rather than by tool developers.
- The breakout group did not think it was useful, or even appropriate, for the Arctic Council to:
  - Endorse any specific method or tool as a best practice.
  - Develop guidance / guidelines for the application of methods and tools.
  - Insist on mainstreaming in the short term, although this is a desirable long term goal; for example, to integrate assessment of climate change risks with all other risks considered in planning processes.
- The group felt there was a need for consideration of the issues and challenges associated with implementing adaptation, beyond simply assessing risks and vulnerability.

### *Energy infrastructure for adaptation*

- Energy infrastructure contributes to not only mitigation but also to adaptation and can form a key part of sustainable Arctic communities.
- Many northern communities rely on diesel energy systems which are inherently unsustainable.
- Build on and promote existing initiatives, such as the SDWG's Arctic Energy Summit.
- Need to investigate the questions: What sort of energy? What sort of technologies? Who pays? What opportunities? How can energy be used to create jobs, livelihoods, self-sufficiency. Such studies would investigate the need for energy in Arctic communities, capability of infrastructure, positives and negatives of different energy approaches, education regarding sustainable energy solutions and access and skills (for example, auditing energy use, installing solar water heaters).
- The Arctic Council should not necessarily provide money for such work, but could help the communities to find and get the needed money.

- To support training, build on UArctic and Artek to develop a technical college which would assist in coordination and strengthening, also helping to raise awareness and to exchange and share experiences.
- The *Cool 100* project is capturing 100 examples of sustainable energy examples across the Arctic.

#### *Biodiversity/ecodiversity*

- The Arctic Biodiversity Assessment (Conservation of Arctic Flora and Fauna working group of the Arctic Council) should include relevant information and recommendations to policymakers with respect to climate change vulnerability and adaptation options. Include relevant aspects on ecosystem services; link and increase incentives to protect biodiversity.
- Support and strengthen the monitoring programs (Conservation of Arctic Flora and Fauna) of terrestrial, freshwater and marine systems. Implement the traditional knowledge strategy in the monitoring programs.
- A project within the Arctic Council would be to make available a catalogue/database of possible management tools and resilient building measures. Make the data from the VACCA scoping study survey accessible.
- Where possible/relevant, make connections amongst the different Arctic Council groups; for example, SDWG, CAFF, AMAP, and PAME.

#### *Health*

- The Arctic Council should encourage action on the Arctic Council Impact Assessment recommendations, and where appropriate provide technical assistance regarding monitoring strategies, pilot studies, data collection analysis, and evaluation.
- Need to establish a relationship between climate change and individual and community health.
- There is an urgent need to implement community-based monitoring strategies.
- Establish a network of communities within and across regions reporting a common set of standardised climate and health indicators.

#### Breakout groups #3: Good practices in climate change capacity building, education, and outreach

##### *Communication and outreach*

- The audience is broad. Trust must be established locally, such as through local champions and the media. The audience must be engaged and feel ownership, needs specific information, and provides guidance and information such as through community-based monitoring.

- The process of communication and outreach should involve a common “language”, plus information must be clear, understandable so that the right and relevant information is targeted to the right people. User feedback and demands need pathways.
- Providers must have a constant awareness of user needs and reception of information, so that messages can be targeted. Consistent messaging helps to build trust. Use the right method (many users, many purposes, many methods) guide how to use the information (education). Communicate uncertainties.
- A Centre of Excellence or similar mechanism (for example, virtual and user-driven) would bring together outreach and education, would share experience and workload, would build on national resources, and would optimise communication and translations of materials.

#### *Building capacity through networks and collaboration*

- Avoid overnetworking; that is, avoid being involved in too many networks.
- Reduce meetings by using phone/video/internet conferences.
- Maintain built-up capacity, especially when networks close.
- Results should be reported back to supporting bodies, especially funders.
- Transfer funded networks into unfunded forms before they formally stop in order to continue that work.

#### *Education and training*

- The audience would be communities and local people starting from the bottom level (children and youth) who could be reached by teaching teachers. Traditional knowledge should be collected, shared, and used in teaching (starting from day care to higher education) including also the knowledge of other than indigenous northern people.
- Elders visiting schools is needed to talk about their own traditional knowledge. Joint projects could be schools cooperating with other schools and researchers on the climate change, such as for data collection and community-based monitoring, along with a web site/portal (kidszone) gathering the data and information with local languages.
- The Arctic Council could establish a forum where traditional knowledge of people in north will be collected and shared in their own language and made accessible to the communities. Work done in the Arctic Council working groups should be taken to the communities.
- The education and training should be done in co-operation with other Arctic organizations, such as University of Arctic and its relevant strategic areas.

## *Research*

- To implement research, it should be (i) done through partnership with local and indigenous communities, (ii) inclusive of all knowledge systems, (iii) combined with education and capacity building at a local level.
- Synthesize adaptation relevant findings, and identify what is transferable and how to transfer it. Double efforts should be reduced. Results should be made available and “digestible”.
- The Arctic is fairly advanced in integrating different knowledge systems and could contribute to the rest of the world.
- In order to generate the knowledge that we think is needed to strengthen resilience in the Arctic, Arctic Council research activities (ongoing and future) should be multidisciplinary, more diverse in approaches, and have a resilience and adaptation relevant objective.
- Specific research needs identified are (i) improved understanding of the resilience of Arctic social-ecological systems, (ii) how can ethical and value-based considerations be more strongly reflected in research efforts, and (iii) a “Stern Report” for the Arctic.

## Final Panel: Amy Lovecraft

- There must be a searchable, user-friendly database that has peer review (minimal) and can serve as a digital library for climate change vulnerability and adaptation in the Arctic.
- There must be incentives for people to participate in populating the library with data.
- There must be a mechanism within the library for people to “meet in the stacks” and form communities of practice.
- The library must be publicised.

## Final Panel: Leanna Ellsworth

- Do not portray Arctic indigenous peoples as victims of climate change, but as part of the solution.
- The indigenous summit on climate change in Anchorage in 2009 will be an important venue for addressing climate change vulnerability and adaptation.
- The Arctic Council and SDWG need to support the involvement of Inuit in processes such as the IPCC to ensure that traditional knowledge is considered equally to the science being forwarded.
- The Arctic Council should facilitate work on adaptation and mitigation.
- The Arctic Council should facilitate Permanent Participants’ participation in UNFCCC’s COP14 and COP15.

### Final Panel: Victoria Tauli-Corpuz

- Indigenous peoples have shown their ability to adapt to changes in the climate “since time immemorial”.
- Indigenous people are doing their own climate change assessments using their own knowledge and worldviews, including using their own technologies and customary laws. That helps in training indigenous peoples to do their own research.
- Several summits are happening which will be summarised and presented at the UNFPII meeting in May 2009 and then presented formally to UNFCCC.
- IPCC is being lobbied include a chapter on indigenous peoples.
- Climate change is a social justice and human rights issue.
- UNFPII will support their indigenous counterparts in the Arctic Council in dealing with climate change.

### Offer from EALÁT

- The EALÁT Network offered to share their information resources for any one interested in vulnerability and adaptation to climate change in the Arctic.

### Offer from the World Meteorological Organization

- Work with the Arctic Council to create an Arctic Regional Climate Outlook Forum to help bring weather and climate information and forecasts to users on their own terms.

## APPENDIX #9: LIST OF PARTICIPANTS<sup>5</sup> - VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE IN THE ARCTIC, TROMSØ, NORWAY 22-23 OCTOBER 2008

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Last name	First name	Organisation
Andersen	Cathrine	Directorate for Civil Protection and Emergency Planning; Norway
Baldursson	Ragnar	Ministry for Foreign Affairs, Iceland
Bauer	Irene	Ministry of the Environment, Norway
Bellis	Dana	University of Tromsø, Norway
Bowman	Clive	UHI Millennium Institute, UK
Buanes	Arild	Norut Tromsø, Norway
Burgess	Philip	International Centre for Reindeer Husbandry
Cavalieri	Sandra	Ecologic-Institute for Int. and European Environmental Policy, Germany
Cunningham	Paul	Department of State, USA
Dalen	Linda	Directorate for Nature Management, Norway
Degteva	Anna	St.Petersburg State University, Russia
Drews	Martin	Danish Meteorological Institute, Denmark
Eamer	Joan	UNEP/GRID-Arendal,
Eira	Inger Marie	Sami University College, Norway
Eira	Olav Mattis	Saami Council, Norway
Eira	Ravdna	Sami University College, Norway
Eira	Ole Isak	International Centre for Reindeer Husbandry
Ellsworth	Leanna	Inuit Circumpolar Council
Espiritu	Aileen	Barents Institute, Norway
Filotas	Sarah	Foreign Affairs and International Trade, Canada
Finkler	Harald	Indian and Northern Affairs, Canada
Fleming	Laura	University of Guelph, Canada
Fortin	Claudette	Indian and Northern Affairs, Canada
Geitz	Miriam	WWF International Arctic Programme
Hansen	Klaus Georg	Greenland planning authority, Greenland Home Rule, Greenland
Hansen	Jesper	Arctic Council Secretariat
Hovelsrud	Grete	CICERO, Norway
Illauq	Nick	Municipality of Clyde River, Canada
Kankaanpää	Susanna	Helsinki Metropolitan Area Council, Finland
Kelman	Ilan	CICERO, Norway
Kibsgaard	Anne	Norwegian Polar Institute, Norway
Kristoffersen	Berit	University of Tromsø, Norway
Kvitberg	Trine	University of Tromsø, Norway
Källman	Stefan	Ministry of Agriculture, Sweden
Labba	Kristina	Association of World Reindeer Herders
Larocque	Bridget	Gwichin Council International
Latola	Kirsi	Thule Institute, Finland

<sup>5</sup> A few of the registered participants may not have attended in the end.

Lemmen	Donald	Natural Resources, Canada
Leslie	Kenrick	Caricom Climate Change Centre, Belize
Lindblom	Annika	Ministry of the Environment, Finland
Liukko	Anna-Maria	Arctic and Barents Cooperation Team, Finland
Lovecraft	Amy	University of Alaska Fairbanks, USA
Løbersli	Else Marie	Directorate for Nature Management, Norway
Mate	David	Natural Resources, Canada
Mathiesen	Svein	Association of World Reindeer Herders
Matthiassen	Darsie	Arctic Athabaskan Council
Mattsson	Tuija	Finnish Environment Institute, Finland
Mikkelsen	Eirik	Norut Tromsø, Norway
Morgan	Shaunna	Centre for Indigenous Environmental Resources, Canada
Mortensen	Philip	Ministry of the Environment, Norway
Njåstad	Birgit	Norwegian Polar Institute, Norway
Nukon	Lance	Arctic Athabaskan Council
Næss	Robert	NTNU, Norway
Olsen	Carl Christian	Inuit Circumpolar Council
Oskal	Anders	Association of World Reindeer Herders
Parkinson	J.	Arctic Investigations Program, USA
Perdue	Karen	University of Alaska Fairbanks, USA
Pilli-Sihvola	Karoliina	Finnish Meteorological Institute, Finland
Pointing	David	UNEP Risø Centre for Energy, Climate and Sustainable Development
Rasmussen	Henrik	University of Tromsø, Norway
Retter	Gunn-Britt	Saami Council, Norway
Rosenberg	Stein	Ministry of Foreign Affairs, Norway
Ruuhela	Reija	Ministry of Agriculture and Forestry, Finland
Rybråten	Stine	CICERO, Norway
Rygghaug	Marianne	NTNU, Norway
Rørholt	Anne Cathrine	University of Tromsø, Norway
Smith	Duane	Inuit Circumpolar Council
Solli	Jøran	NTNU, Norway
Stratton	Tana	Arctic Council Secretariat
Terpstra	Tekke	Arctic Centre, University of Groningen, Netherlands
Thomsen	Marianne Lykke	Greenland Home Rule Government, Greenland
Turi	Ellen Inga	Sami University College, Norway
Tøsse	Sunniva	NTNU, Norway
Van Dam	Kim	Arctic Centre, University of Groningen, Netherlands
Vistnes	Ingunn Ims	Norut Alta, Norway
Voigt	Thomas	ETC/ACC
Wessendorf	Kathrin	International Work Group for Indigenous Affairs
Westlake	Michael	Indian and Northern Affairs, Canada
Whitby	Leslie	Indian and Northern Affairs, Canada
Yefimenko	Alona	Indigenous Peoples' Secretariat