

Report from a scenario exercise in Ilulissat, Greenland, April 2018

Annika E. Nilsson¹

This report summarizes the method and results for an exploratory scenario exercise that was conducted in Ilulissat, Greenland, in context of the workshop “Fremtiden I Disko Bugt. Konsekvenser af f eks. Kliændringen og globalisering, which was organized as part of the project Sustainable Adaptation to Climate Change and Globalization in Disko Bugt, West Greenland, funded by Nordforsk and led by Morten Rasch, University of Copenhagen. The meeting had 38 participants representing local and national actors from Greenland as well as scientists with a focus on Greenland. The report was compiled shortly after the workshop. The data was made publicly available in 2022 via the Svensk Nationell Datatjänst (www.snd.se) as supporting documentation for a compilation of data from nine scenario workshops.²

Introduction: Thinking about the future

With rapid social and environmental change, we know that the future will look different from today. In a time-perspective of one to two generations, it could look very different. Exploratory scenarios can be used for mapping the space of uncertainty about the future in situations when it is necessary to start preparing for the unknown. Exploratory scenarios ask: “What *could* happen?” The approach can be placed in contrast with scenario approaches that try to predict what *will* happen based on current trends (forecasting). It is also different from so-called back-casting that focus on what *should* happen to achieve a specific goal.

Scenario methods have been used extensively in climate research, most prominently to provide input to studies of future emissions of greenhouse gases, which are then used for modelling future trajectories of climate change.³ Furthermore, a group of experts have developed a new scenario framework to meet the needs of both mitigation and adaptation studies.⁴ It includes, among other features, descriptions of five global futures called Shared Socioeconomic Pathways (SSPs).⁵ Scenario

¹ Corresponding address: annika.nilsson@vetani.se

² Nilsson A.E. *Drivers of change in the Nordic Arctic: Compiled keywords from nine exploratory scenario exercises 2015-2020*. Available through Svenska Nationell Datatjänst <https://snd.gu.se/en>. DOI: <https://doi.org/10.5878/4srs-fy44>

³ Nebojsa Nakicenovic et al., *Emissions Scenarios* (IPCC and Cambridge University Press, 2000), <http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=3812CC58A20DD91DB2A06D9D88752B6E?doi=10.1.1.260.1482&rep=rep1&type=pdf>.

⁴ Nebojsa Nakicenovic, Robert J. Lempert, and Anthony C. Janetos, “A Framework for the Development of New Socio-Economic Scenarios for Climate Change Research: Introductory Essay,” *Climatic Change* 122, no. 3 (January 30, 2014): 351–61, <https://doi.org/10.1007/s10584-013-0982-2>.

⁵ Brian C. O’Neill et al., “A New Scenario Framework for Climate Change Research: The Concept of Shared Socioeconomic Pathways,” *Climatic Change* 122, no. 3 (2014): 387–400, <https://doi.org/10.1007/s10584-013-0905-2>; Brian C. O’Neill et al., “The Roads Ahead: Narratives for Shared Socioeconomic Pathways Describing

methods have also become popular in Arctic research, for example in the Arctic Council study Adaptation Actions for a Changing Arctic (AACA), including an increasing focus on engaging with local and regional actors.⁶

For the workshop in Ilulissat 10-11 April 2018, we used a scenario method that combined a participatory approach with a link to the global climate change scenario framework in what can be described as an approach where the analysis focuses on local developments as nested in a global context, see Nilsson et al 2017 for detailed description and discussion of results from earlier workshops.⁷ The process includes three major steps: 1) Brainstorming about locally relevant drivers of change, 2) voting on importance and uncertainty, and 3) discussing how the drivers play on in different global development futures.

Brainstorming about locally relevant drivers of change

First, the workshop participants were invited to ponder a focus question and write down two suggestions on sticky notes. The focus question was: *What future changes can affect this region economically, environmentally and socially within one to two generations?* They placed their notes on a wall that served as a shared work-think space, with an opportunity to shortly comment on what they had written.



Figure 1. Notes on the wall from the brainstorming session

World Futures in the 21st Century," *Global Environmental Change* 42 (January 1, 2017): 169–80, <https://doi.org/10.1016/j.gloenvcha.2015.01.004>.

⁶ Annika E. Nilsson et al., "Future Narratives," in *Adaptation Action for a Changing Arctic. Perspectives from the Barents Area* (Oslo, Norway: Arctic Monitoring and Assessment Programme (AMAP), 2017), 109–26; Amy Lauren Lovecraft and Benjamin L. Preston, "Scenarios Thinking for the Bering-Chukchi-Beaufort Region," in *Adaptation Actions for a Changing Arctic: Perspectives from the Bering-Chukchi-Beaufort Region*, ed. AMAP (Oslo, Norway: Arctic Monitoring and Assessment Programme (AMAP), 2017), 217–38.

⁷ Annika E. Nilsson et al., "Towards Extended Shared Socioeconomic Pathways: A Combined Participatory Bottom-up and Top-down Methodology with Results from the Barents Region," *Global Environmental Change* 45 (July 2017): 124–32, <https://doi.org/10.1016/j.gloenvcha.2017.06.001>.

A smaller group then organized the notes into ten clusters. Table 1 presents the results as transcribed from the notes on the wall and translated to English.

Table 1. Workshop participants' answers to the focus question organized into ten clusters

	Workshop deltagernes svar på spørgsmålene: <i>Hvilke fremtidige ændringer kan påvirke denne region økonomisk, miljømæssigt og socialt i et tidsperspektiv på en til to generationer?</i>	Workshop participants' answers to the questions: <i>What future changes can affect this region economically, environmentally and socially within one to two generations?</i>
Politik <i>Politics</i>		
	Politisk vovemod, geopolitik, politisk samarbejde, framsynethed	Political courage, geopolitics, political cooperation, foresight
	CO ₂ kvoter med alle konsekvenser vedtagne	CO ₂ quotas with all consequences included
	Hurtig løsrielse	Quick detachment
	Rigsfælleskabet: Fælleskab eller ej	The Danish realm: Common realm or not
Tilpasning & fornyelse <i>Adaptation & renewal</i>		
	Naleqqussainen + nuttarterinuaq (Tilpasning/fornyelse)	Naleqqussainen + nuttarterinuaq (Adaptation / Renewal)
	Najugrisanni naligusar – tuarneq (Tilpasning "lokalt")	Naugrisanni naligusar - tuarneq (Local adaptation)
	Fremtidstro	Faith in the future
Turisme <i>Tourism</i>		
	Turismens påvirkning af økonomi kultur & miljø	Tourism's impact on economy culture & environment
	Øget turisme og mobilitet	Increased tourism and mobility
	Turisme	Tourism
	Ökad turism; Driver: Lufthavn	Increased tourism; Driver: Airport
	Masseturisme	Mass tourism
	Masseturisme	Mass tourism
	Øget turism	Increased tourism
	Flere som kommer till at leve af turister	More who make a living from tourists
	Turisme øges	Tourism increases
	Masseturisme	Mass tourism
	Economic change: tourism	Economic change: tourism
Klimaændringfer of effecter <i>Climate change and impacts</i>		
	Usædvanlig vejr og is	Unusual weather and ice
	Hurtigere end forventet tab af havis	Faster than expected loss of sea ice

	Stress på naturen	Stress on nature
	Environment: Effects of rising ocean temperatures	Environment: Effects of rising ocean temperatures
	Økosystem skift	Ecosystem shift
	Fisket (Driver: Klimat)	Fishing (Driver: Climate)
	Klima (Fiskeriet)	Climate (Fishing)
	Isfri periode antal måneder med havis	Ice free periods; number of months with sea ice
	Ændrede havstrømmer påvirkning af produktion i havet	Changed ocean currents impacts on marine production
	Klimaforandring	climate change
	Klimaforandringer. Påvirkning af udbredelse af levende resourcer	Climate change. Impact of the distribution of living resources
	Miljø: Iluliar suit allannguuuteqernen: Ændring i isforhold	Environment: Iluliar suit allannguuuteqernen: Change in ice conditions
	Skibturism of (uheld, miljø) Isbjergene!	Shipping tourism (accidents, environment) Icebergs!
Uddannelse & sprog <i>Education and language</i>		
	Uddannelses nive	Education level
	Angallanneq. (Infrastruktur) Udd. Og Arb.	Angallanneq. (Infrastructure) Education and work.
	Fremme uddannelse	Promote education
	Lokal uddannelse - Turisme – Fiskeri	Local education - Tourism – Fishing
	Soc.: A.R.	Soc .: A.R.
	Nye muligheder: For hvem? Dem der er med, sprogmæssigt	New opportunities: For whom? Those who are involved, language
Transport og infrastruktur <i>Transport and infrastrcuture</i>		
	Havne	Harbor
	Lufthavn	Airport
Teknologisk udvikling <i>Technological development</i>		
	Internet (hurtig bredband)	Internet (high-speed broadband)
	Teknologi og adgang til viden	Technology and access to knowledge
	Teknologi	Technology
Erhvervsudvikling <i>Business development</i>		
	Social: Demographic change og urbanisation	Social: Demographic change and urbanization
	Bæredygtig resourcerudnytt	Sustainable resource utilization

	Grøn energi	Green energy
	Større fokus på bæredygtighed	Greater focus on sustainability
	Nye forretningsområder	New business areas
	Ny primærindustri: Løsninger for erhverv i cirkulærøkonomi	New primary industry: Industrial solutions in a circular economy
	Små sateliy GN/innovationslaboratorier	Small satellite GN / innovation laboratories
	Global finanskrise	Global financial crisis
Styreform og forvaltning		
<i>Governance and management</i>		
	Uhensigtsmæssig central forvaltning/administration	Improper central management/administration
	Nuuk-regional-lokalt forhold (centralisering-decentralisering)	Nuuk regional-local relationship (centralization-decentralization)
	Beslutninger eller mangel på beslutninger om lokal nødvendig infrastruktur	Decisions or lack of decisions about necessary local infrastructure
	Øket sektorisering versus øget tværsektorielt samarbejde	Increased sectorization versus increased cross-sectoral cooperation
	Globalt ejerskab til værdier (vs lokals ejerskab)	Global ownership of values (vs local ownership)
	Globalisering ctr. Lokal vækst	Globalization ctr. Local growth
In- og udvandring		
<i>In- and out migrations</i>		
	Øget urbanisering	Increased urbanization
	Antallet af bygder falder markant	The number of settlements declines significantly
	Brain drain – manglende højere uddannelse i regionen	Brain drain - lack of higher education in the region
	Verdensomfattande migration(sbevægelser)	Worldwide migration
	Asiatisk turisme, investeringar behov for kompetenser	Asian tourism, investments require skills
	Kinesisk invandring af arbejdskraft, faglært + ufaglært	Chinese influx of workforce, skilled + unskilled

Voting on importance and uncertainty

Second, the participants were invited to vote on what they considered to be the most important drivers of change for the Disko Bugt region (at the cluster level) and what they saw as the most uncertain, i.e. most difficult to foresee. Each participant was given five colored markers for importance and five for uncertainty that they could distribute any way they wanted among the cluster headings. The results of the voting are presented in Figure 2 and Table 2.



Figure 2: Results of voting with sticky dots; red=importance; green=uncertainty

Table 2. Results from voting my workshop participants in response to the questions: Hvilke årsager til forandring er vigtigst i Disko Bugt? Hvilke årsager til forandring er mest usikre at forudsige?

Årsager/Drivers	Vigtigst/Most important		Mest usikker/Most uncertain	
	Votes	Rank	Votes	Rank
Styreform og forvaltning <i>Governance and management</i>	22	1	15	3
Klimaaendringen og effekter <i>Climate change and impacts</i>	22	1	32	2
Uddannelse og sprog <i>Education and language</i>	21	2	8	7
Turisme <i>Tourism</i>	20	3	3	9
Politik <i>Politics</i>	15	4	39	1
Tilpasning og fornyelse <i>Adaptation and renewal</i>	14	5	12	4
Erhvervsudvikling <i>Industrial development</i>	13	6	10	5
Transport og infrastruktur <i>Transport and infrastructure</i>	10	7	9	6
Teknologisk udvikling <i>Technological development</i>	5	8	7	8
Ind- og udvandring <i>In- and out migration</i>	4	9	12	4

Discussing how drivers of change play out locally in different global futures

Third, the workshop participants were presented with the four different global futures, based on the global SSPs, which in turn have been developed to span the space of uncertainty regarding challenges to climate change mitigation and adaptation. The axes represent carbon intensity and level of inequality in the world:

A: Fossil-fueled development: Taking the highway

B: Regional rivalry: A rocky road

C: Sustainability: Taking the green road

D: Inequality: A road divided

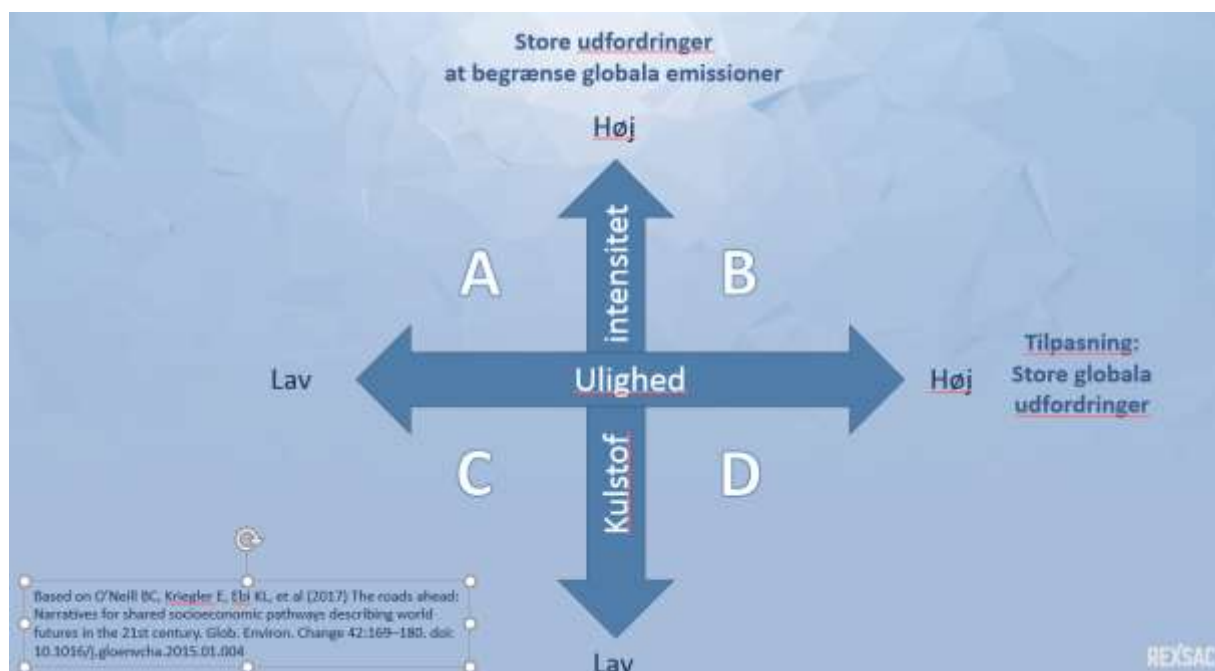
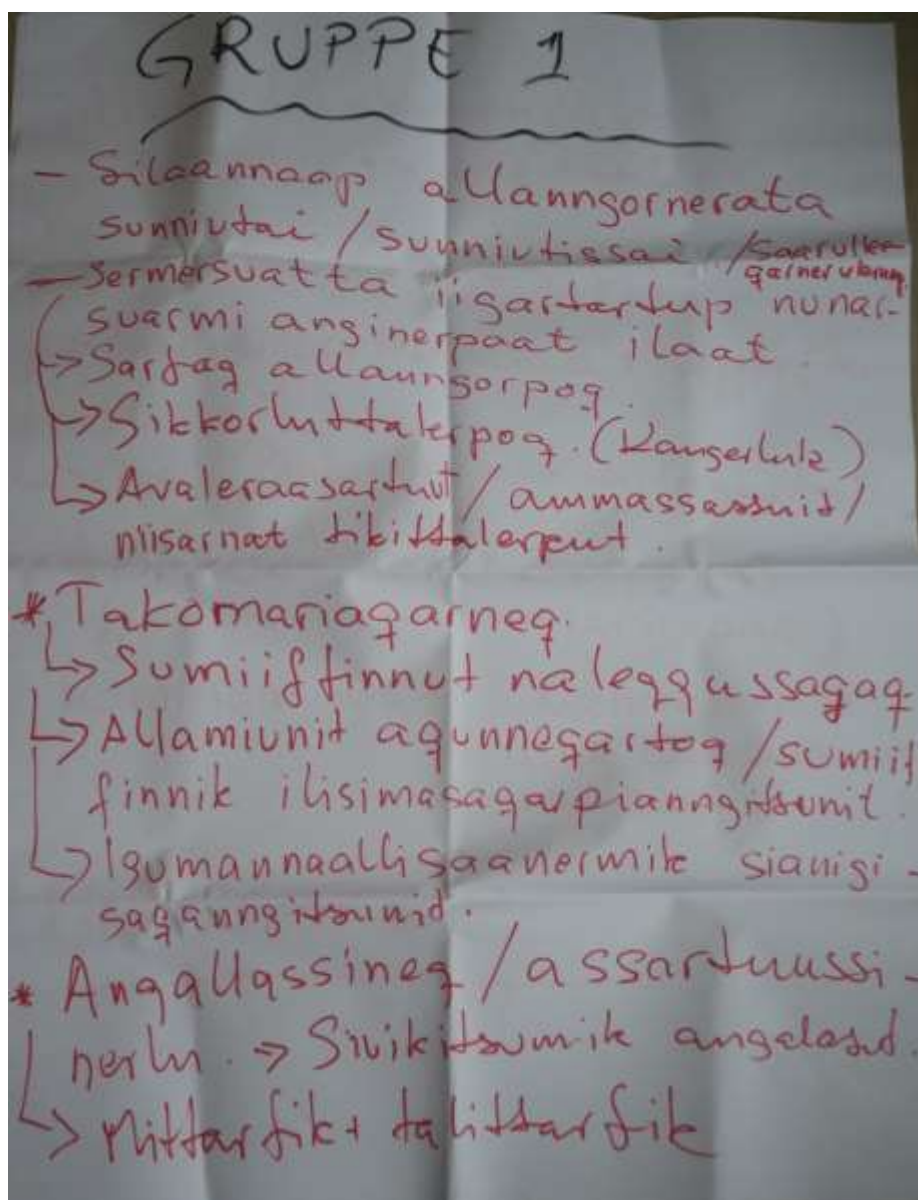


Figure 4. The four global futures were based on a space of uncertainty mapped based on challenges to mitigation, from and challenges to adaptation O'Neill et al 2017.

Split into group of 4-6 people, the workshop participants were asked to discuss how the drivers of change that the workshop had previously identified as locally relevant would play out in one of these global futures. Each group focused on one specific future in discussions led by facilitators who had prepared a description of the future in focus to help the participants get a sense of the context. The question for the group discussions was: *How will society and the environment of Disko Bugt region look like in these four different global futures?*

The results of the group discussion were reported in plenum the next day. Table 3 summarizes the group discussions focusing on the different global futures, based on the notes from the facilitators. The group discussions were held in Danish, except for one group that spoke Greenlandic. This group were asked to discuss at the more general level, rather than focusing on a specific global future. In practice their discussion centered more on current observations than future scenarios. Box A provides a summary of the group's presentation in plenum.



The ice disappearing and is of bad quality. Currents are shifting, and the icebergs used to follow a different path in the ice fiord. Fishers need to understand the current under the ice to assess the quality of the ice. Local fishers are good at reading the weather and the ice conditions but can no longer do so as well. Starting to see other fish species, such a mackerel.

Other living beings that create trouble are tourists. "We have not adapted to the boom in tourism. It is as if we must adapt to the tourisms, and that the tourists do not have to adapt to us." Moreover, nature guides do not always know about dangers they must look out for. The traffic in the Disko Bay is such that there is no longer space for us. Tourist fill all the spaces in airplanes and helicopters. It would be good if we had the power to make decisions. The lengthening of the landing strip will mean more tourists to Ilulissat, for which we do not have the capacity. Also, there is

not enough space in the harbor for cargo shipping. Sometimes we see tourists in their own sail boats. Does anyone manage their activities? Tour ships have an enormous number of passengers on boards. The ships pay a fee, but this money goes to Nuuk. It would be good if this money went to the region here.

The fishery and hunting regulations are very important for fishers and hunters, and many complain about how the management areas are set up, with delimitations that do not make sense in relation to tradition hunting and fishing ground. Some regulations create barriers and it can be a matter of crossing a line with a few millimeters to make someone a criminal. A key issue is political decisions, rules and how they are followed, which is a major political challenge. The rules can limit development potential. For example, the UNESCO World Heritage site has many strange rules and regulations. Eventually we have not energy left.

Table 3. Summary of group discussions. Compiled and translated notes from facilitators' presentations.

	Fossil-fueled development: Taking the highway	Sustainability: Taking the green road	Inequality: A road divided	Regional rivalry: rocky road
<i>General context</i>	Resumé: Tourism boom, population numbers tripled, alternative energy provides new opportunities for business, adaptation in exploitation living resources (other species, tourism)		<p>Starting point:</p> <p>Greenland is located in a global economy where it is an active participant. When there is a decline in the global economy, it also affects Greenland, and therefore also Disko Bay. There are three key resources that Disko Bay is dependent on: marine resources (especially halibut, cod and shrimp), oil, and tourism from the outside.</p> <p>Earnings from fishing and tourism are largely dependent on good conditions on the world market and generally a healthy world economy as fish and tourist travel to Arctic are luxuries. There is greater demand for Greenland oil.</p> <p>The living conditions and well-being of Disko Bay depend on both a formal economy and a natural / informal economy - both economies will worsen under this scenario.</p>	

<p><i>Governance and management</i></p>	<p>Decentralization of some administrative areas (some areas are maintained centrally)</p>	<p>High regional autonomy. independence for regulation from a regional level.</p> <p>Hosting many seminars sharing the fruitful cooperation between all stakeholders – high interest internationally on the Disko Bay model.</p> <p>Regional comparative advantage. Storage capacity and greenhouses growing vegetables and exotic fruits. Ongoing seminars about workshops about new technological options and how to nurture what is unique here.</p> <p>Fishing industry is based on cooperatives (no industrial fisheries).</p>	<p>The power is concentrated in Nuuk, where a growing Greenlandic elite resides. With less economic growth and greater inequality, there will be pressure on cuts in public spending, more centralization of power, and investment made at the expense of rural and small towns (Assiat, Sisimiut, Ilulissat).</p>	
<p><i>Climate change and impacts</i></p>	<p>Changes in species composition and number</p> <p>Does the icefjord exist? (tourism, new sights)</p>		<p>Impact on fisheries: Opportunities for shrimp and cod stock grow. However, the fat-filled plankton may fall in number to be replaced by leaner plankton with consequences for the food chain and marine resources.</p>	<p>More global CO2 emissions</p> <p>Increased temperature in the Disko / air - but also seawater</p>

			<p>In general, adaptation to climate change will deteriorate in a scenario of growing inequality and lesser economic growth.</p> <p>With growing inequality, downward growth, and polarization, there will be a risk that Disko Bay fisheries will turn into a system of “quota kings” where the quotas concentrate in the hands of few major players owned by the Greenlandic elite. Consequences include possible exhaustion of marine resources, fewer small companies, deteriorating conditions for subsistence living, and growing food insecurity among vulnerable groups. To compensate there may be major interests in maintaining and strengthening tourism.</p>	
<i>Education and language</i>	More local education, including tourist language, local occupation, technical school	Increase of education, research and innovation. Increase of competence capacity, entrepreneurial spirit. Many seminars sharing	<p>There will be increasing in migration of young people from rural areas and smaller cities to Nuuk and abroad.</p> <p>The young people will seek education opportunities</p>	<p>Growing needs.</p> <p>Pressure for tourism education in Ilulissat</p> <p>Private (foreign) funding</p>

		<p>unique system for management.</p> <p>High education level – speaking 3-4 languages (population will grow). Hub of expertise (greenhouse technology, environmental monitoring and science (taking traditional ecological knowledge and combining with technology). Business based on living resources. Science becomes a service industry of monitoring the environment. Attracts families and new investments in schools etc.</p> <p>E-learning – global connections to leading hubs in the world.</p>	<p>outside the Disko Bay as there will be less focus on establishing training opportunities in Disko Bay and fewer investments in business development in Disko Bay.</p>	
<i>Tourism</i>	<p>Strong increase; has exceeded fishing as the main source of income</p> <p>Winter tourism is a success and ensures tourism all year round</p>	<p>Tourists: Significant change in attitudes (among tourists and expectations about activities, swimming in dry suits/kayaking with whales and seals) and experience green technology solutions, culture e.g. shamanisms, singing, dancing, drumming.</p>	<p>Tourism in the Disko Bay could deteriorate / stagnate due to declining global growth and minor conflicts and turmoil in the world. However, global turmoil and conflict could make tourists look further north where it will probably be calmer, with a potential for some luxury tourist even if there would be</p>	<p>Icebergs still here</p> <p>Fewer - focus must be on the rich</p> <p>Uncertainty about demand</p>

		<p>Building zero carbon eco-houses inspired by new Greenlandic design.</p> <p>Following eco-footprint means restrictions for what people can do</p> <p>Technology and new techniques will go hand in hand with culturally inspired ideas.</p>	fewer tourists in total number.	
<i>Politics</i>	'Governance' ensures that economic resources remain in the area and stable conditions	High level of international and national regulation to have all actors comply with environmental protection guidelines. Also, cooperation and knowledge sharing about how to foster best practice regional green growth.	<p>The question of Greenland's independence from Denmark is put on ice as it is too risky with growing unrest and conflict in the world and global economic downturn.</p> <p>On the other hand, one could also imagine independence and isolation as a priority to protect Greenland's interests and resources, with potential positive consequences, such as better utilizing existing resources; more efficient use and utilization of resources, as well as more bio / green / circular sustainable economy and thinking; growing and closer cooperation across the Arctic regions, both in foreign trade and investment</p>	<p>Strong liberalization</p> <p>Fewer prohibitions - less regulation</p> <p>Foreign capital + labor</p> <p>High oil price / maybe oil extraction in Greenland</p>

			<p>between countries, as well as cooperation in the management of resources and political questions, security, etc. Arctic Council. Pooling the resources; and potential establishment of an Arctic trade block will come closer to being realized.</p> <p>Environment:</p> <p>Less focus on the environment - Potentially, Disko Bay will approach an environmental disaster where there will be more focus on meeting the elite interests in Nuuk rather than protecting nature and the environment.</p> <p>Potentially growing conflict between island tourism and the extraction of more resources with less focus on the environment.</p> <p>More short-term thinking and planning and prioritizing profit rather than environment, with political pressure to ease environmental and other regulations to promote growth and elite interests.</p>	
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<i>Adaptation and renewal</i>	Major cultural change due to increased tourism and immigration			
<i>Business development</i>	Changes in exploited species (distribution and number) New options: Aqua culture (gentle, so the marine environment does not deteriorate); Datacenters driven by sustainable energy; Local food production in greenhouses heated by solar and sustainable energy; Some living resources - whales, walrus (rehabilitation at former landings) and bird cliffs are used for tourism rather than catch	Shift away from industry based on living resources and focusing on using living resources in Greenland for own consumption. Inter-regional trade (Upernavik – certain fish – traded with south-Greenland Remote working places and export of expertise via internet, where broadband connect people. Extreme potential for energy technologies, including devices to store hydro-power energy. Huge surplus also used for farming vegetables and exotic fruits in green houses.	Energy use: Greater demand for oil in Greenland. Fewer investments in renewable energy. More attention to Greenlandic oil extraction and potential for exploration. A regional consequence is that economic growth will be in Assiat, while there is decline in Ilulissat due to fewer tourists:	Major changes for fisheries / new species More expensive fuel Smaller eco requirements / MSC Focus on quantity
<i>Transport and infrastructure</i>	Airport runway in Ilulissat extended to international standard for large aircraft Minor lanes for congested airplanes in Qeqertarsuaq, Qasigianniguit	Low-carbon, green tech airplanes- new technology for shipping.	Ports will be the primary infrastructure for both the oil and fisheries industry, which favors Assiat that has deep-water ports for large ships plus infrastructure for the oil industry, and less risk of encounters with icebergs than	

	<p>Port expansion Ilulissat, and smaller landing facilities in rural areas</p> <p>Multiple water tariffs ensure diverse and efficient transport between accommodations and to / from sights</p>		<p>Ilulissat. Assiat also has a major service industry that can support the oil industry.</p> <p>The airport: If the number of tourists drops due to global turmoil and conflicts, there may be no tourists to the Disko Bay to pay for the new airport (assuming an extension of the airport within the next 5-10 years). How to cover the costs? This can give rise to a huge bill and further worsening of inequality, polarization and living conditions.</p>	
<i>Technological development</i>	<p>Alternative energy sources established (no oil drilling platforms at Disko Bay)</p> <p>Preparedness for transformation of fishing and fishing industry</p>			
<i>In- and out migration</i>	<p>Ilulissat population tripled in 30 years</p> <p>Some settlements grow, some stable and decrease in number depending on</p>		<p>The number of settlements falls sharply. The depopulation that has begun in the smaller settlements will spread to the smaller cities - Ilulissat and Sisimiut (but less</p>	<p>Uncertainty: Movement towards settlements; Settlement pattern as today</p>

	<p>tourism / living resources accessibility.</p> <p>Immigration of unskilled labor from the south to service jobs in the tourism industry and educated people for professional positions (also Greenlanders returning after graduation)</p> <p>Changed demographics with more young people (in education or work in the tourism industry)</p>		<p>in Assiat as Assiat will get renewed growth from oil exploration). Human capital deteriorates and disappears</p> <p>The young people leave Disko Bay.</p> <p>The burden of supporting an older population is growing - and there are fewer in the working age. What is already slowly seen in the smaller towns will spread to the cities, etc.</p>	
Additional comments			<p>Generally increasing inequality, polarization.</p> <p>The living conditions and well-being of vulnerable groups will worsen, and this is especially true of local populations, unskilled labor, settlement population especially if the growing global inequality affects the fishing in the Disko Bay.</p>	
Name of scenario	Growth through adaptation	The green road	<ul style="list-style-type: none"> - Arctic polarization - The evil spiral - Meltdown - Need for conversion 	Disko's rocky road

Acknowledgements

Nilsson's engagement in the workshop, including organizing the scenario exercise and compiling the report was supported by the Nordforsk-funded Center of Excellence Resource Extraction and Sustainable Arctic Communities (REXSAC). I wish to express gratitude to all the participants of the workshop, the skilled interpreter who managed the Greenlandic-Danish communication, and the facilitators of the group discussions.