Text S1 – Strategic foresight

In environmental ecology, Cook et al. (2014) proposed 6 steps to strategic foresight (Fig. S1), explicitly involving a panel of stakeholders throughout all steps. At the start, scientists and stakeholders must together *set the scope*, where they identify the needs, determine the limits of the system, key issues, and actors to be involved, and this including a wide range of perspectives and alternatives. Second, *the inputs are collected*, gathering data and knowledge from various sources and using the past to build a solid understanding to anticipate the future. Third, *the signals are analysed,* integrating data, exploring signals and identifying drivers, and assessing uncertainties with analytical tools and simulations. Fourth, *the information is interpreted*, investigating the impacts of uncertainties and assumptions behind the results, planning scenarios, and exploring the consequences of alternative decisions. Fifth is the *determination of how to act*, using structured decision-making where actions that will enhance chances of reaching the desired future state and overcome potential obstacles are defined and explored across various timeframes. Finally, *actions are taken*, implementing the strategy and pursuing the monitoring of the system to assess how actions are implemented, the consequences of these actions, and the changes in the system that will affect either the objectives or the underlying assumptions of the models. Continued monitoring is thus essential to be able to adapt the strategy when needed.

Importantly, the progression of these steps is not necessarily consecutive. Feedback loops with different iterations and disruptions will occur as new evidence or politics arise, permitting actions to be taken and adjusted as we move forward and obtain more robust outcomes (Cook et al. 2014, OECD 2019). By including stakeholders through all steps of strategic foresight, alternative views are explored, broadening the perspectives on the potential futures and forcing academics to think outside the conventional box (Stokols 2006, Boone et al. 2020). This can allow to identify a broader spectrum of potential outcomes, monitor signals that will give early warnings and early detection of surprises, develop research guidelines to anticipate or detect emerging changes, synthesize available evidence on emerging issues to help decision-makers implement both short-term actions and long-term strategies to reduce or counteract undesirable impacts (Leigh 2003, OECD 2019).

The structured process of strategic foresight is particularly useful when the interests lie in long-term outcomes because it explores alternative future states to be able to better plan for the unpredictable while accounting for the uncertainties, all along with the aim of improving decision-making (Bengston et al. 2012, Cook et al. 2014, OECD 2019). Compared with classic adaptive management (Pollack 2007, Walsh et al. 2012, Westgate et al. 2013, Nichols et al. 2015), it increases attention to foresight, shifting the focus from one future to multiple potential futures, focusing on uncertainties linked to surprises to diminish the risk of unanticipated and unintended consequences. This aspect may be particularly relevant in context of ecosystem responses to climate change where uncertainty about the outcome is vast (Planque 2016) and surprises are almost inevitable (Lindenmayer et al. 2010). Indeed, strategic foresight is more than just forecasting, such as for instance based on scenario analyses where

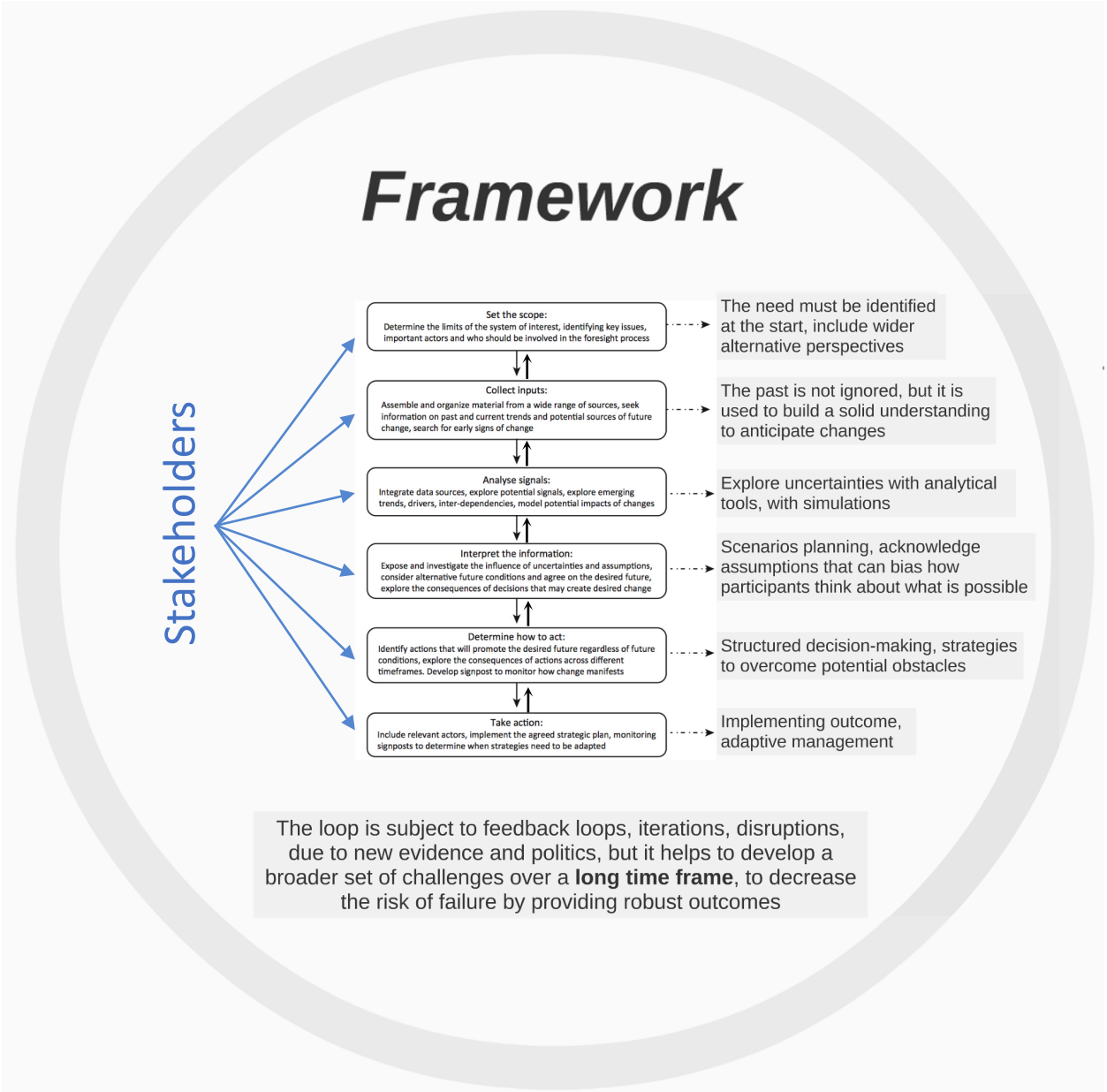

Figure S1. The six steps of strategic foresight proposed by Cook et al. (2014), illustrating the involvement of stakeholders to all steps of the process. Reproduced and adapted from Cook et al. (2014) with reuse permission from Elsevier.

the observed socioeconomic drivers of a system are varied to different extremes that are the basis for making climatological predictions (e.g. IPCC 2014). It goes further by attempting to integrate surprises not only on the drivers but also on the outcomes, and to quantify the likelihoods (Hausfather & Peters 2020) of "aspirational scenarios about the future" (*sensu* Bezold 2010) to perform a systematic exploration of different futures and decisions. Thus, strategic foresight allows defining and quantifying better the uncertainty, thereby improving its comprehension and the interpretation of its impacts for decision-making (Cook et al. 2014, OECD 2019).

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Text S2. Implementation of strategic foresight within the project SUSTAIN

This supplementary text presents the steps taken to implement the strategic foresight process within the SUSTAIN project. It is important to note that the project did not aim at studying the implementation of this process and at evaluating its success or failure. Therefore, the information gathered here is a summary of the events, actions, discussions and feedbacks we experienced through the implementation of the process. There has not been any systematic method used to gather this information. Thus, the information is presented based on our perception.

S2.1 The first steps

Many of the systems the project SUSTAIN studied had already been the focus of a network of researchers and stakeholders that had previously been collaborating. Still, the project proposal was not written in partnership with stakeholders, a consequence of the speed at which application time-lines goes. Gathering views and perspectives from all parties involved takes time and involves costs (Stokols 2006), resources researchers often do not have when application deadlines are coming up. As a result, not all objectives of the project were well-aligned with stakeholders' interests. In addition, training students and young scientists was a major aim of the project. Because recruiting such personnel takes time, some were recruited very early in the project, thereby requiring their study plans and objectives to be defined before our first meeting with the panel of stakeholders. Obviously, these two aspects limited the flexibility of the whole project regarding "setting the scope" together with stakeholders, the first step of strategic foresight.

Nonetheless, the project proposal was not very specific because of the 10-page limitation, which did provide some flexibility afterwards. For instance, the proposal did not allow to provide details on ecosystem-specific issues, thereby providing flexibility on many aspects that later proved to be important to stakeholders. Moreover, proposals are destined to be subjected to peer review by other scientists, which are highly qualified to evaluate the scientific strengths of research proposals, but often have too little competence for assessing the magnitude of public values and societal impacts of the proposed research (Bozeman 2020). Research proposals therefore generally tend to focus much more on broad state-of-the-art scientific questions and path-breaking methods than the detailed, practical, and ecosystem-specific solutions deemed worthy by stakeholders and for which current methods might be sufficient to obtain robust estimates. Consequently, the project proposal was rather vague regarding the three focal ecosystems, mostly pointing out the most important biotic interactions, environmental, and management drivers that could be investigated (Fig. S2).

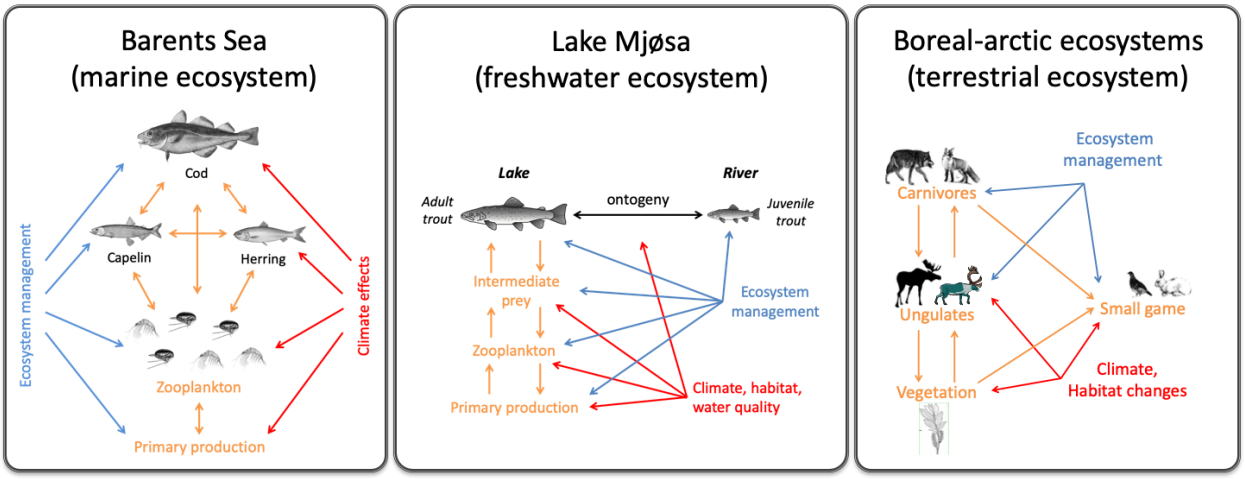

Figure S2. The conceptual models for the three ecosystems studied within the SUSTAIN project, illustrating the principal food web interactions (yellow), as well as management (blue) and climate (red) impacts expected to affect these ecosystems.

After receiving funding confirmation, we first held a meeting with the scientists involved and the students, postdocs, and researchers that had already been recruited. The what, why, and how of strategic foresight was presented. The need to build the bridge between stakeholders and academics was obvious directly from the start. Some researchers were surprised to learn that strategic foresight involved stakeholders to all steps of the research process, an idea that some were reluctant to, in particular regarding the choices of objectives. Scientific freedom is one reason why many researchers have chosen to stay in academia (Holbrook 2017), and so, for some, following the strategic foresight process felt a little like their scientific freedom was taken away. One highly respected researcher honestly mentioned that she was not interested in having people interfering with her research interests, which is also the reason why she avoided getting involved in applied research. Interestingly, the younger researchers about to start their PhDs were the most open to the process. Some mentioned that they felt the process could help their research results make a difference (Boone et al. 2020), but part of it could also come from their research interests not yet being fully defined and subjected to years of research.

For strategic foresight to be successful, participants selection must be wide ranging to avoid group-level thinking, and yet engage those with intimate interests, knowledge, and experience with management issues specific to the focal ecosystems (Stokols 2006, Cook et al. 2014). Thus, when planning the first meeting with stakeholders, the scientists tentatively defined seven case studies that were going to be discussed. These case studies focused on species subject to harvesting and/or management interventions (Fig. S2): 1) sub-arctic herds of semi-domestic reindeer (*Rangifer tarandus*), 2) high-arctic populations of wild reindeer, rock ptarmigans (*Lagopus muta*), and arctic foxes (*Vulpes lagopus*) in the Svalbard archipelago, 3) willow ptarmigan (*Lagopus lagopus*) populations in sub- and low-arctic tundra systems, 4) increasing red fox (*Vulpes vulpes*) populations and their impacts on red-listed species in tundra ecosystems, 5) moose (*Alces alces*) and small game in boreal forests, 6) fish stocks in the Mjøsa lake south-east Norway, and 7) fish stocks in the Barents Sea. Different researchers were in

charge of leading each case study. In the selection of stakeholders, researchers tried to be as wide as possible to broaden perspectives, including stakeholders that would be interested in a specific case, e.g. the Reindeer Herding Industry, and some that could be interested in all cases, e.g. the Norwegian Environment Agency and the Norwegian Biodiversity Information Centre. We invited the selected stakeholders to join our first annual meeting, where the goals were to develop objectives for SUSTAIN that are of interest to both scientists and stakeholders and to build a bridge to work together to achieve these objectives.

S2.2 First annual meeting – a success

Weeks before the first meeting, we sent an email to all stakeholders that had agreed to be part of the project to invite them to the first annual meeting. We sent along a series of short documents presenting the researchers' perspectives on each case study. We informed stakeholders that the goal was for them to come prepared to the meeting by knowing where researchers' interests lied, such that the meeting would focus mostly on their interests and not those of researchers. We also sent along the details of the program, with the goal and format for each part being explicitly stated (see Supplementary Text S3). This allowed stakeholders to know what to expect from the meeting and what researchers expected from them.

During the meeting, we first explained what strategic foresight was, why it was fundamental to a project like SUSTAIN, and how it should or could work. We also presented the challenges to overcome in a large project like SUSTAIN, namely the typical communication barrier between scientists and stakeholders had to be broken and a solid bridge needed to be built, as well as having to work across three contrasted types of ecosystems. Once the strategic foresight concept was well understood, we restated the main goals of the meeting: 1) to present the views and knowledge of all stakeholders to decide on common research objectives relevant to the management of harvested ecosystems under the influence of climate change, and 2) to develop a structure around the working groups that will enable all participants to continue working together after the meeting.

Most importantly, we stressed that this process was fully new not just to stakeholders but also to the academics involved, asking all participants to be indulgent and open-minded to the process. We also emphasized that stakeholders were not there just to make it look good, but that their inputs on all steps of the project were truly wanted. We also stressed the importance of respecting each other's views in all discussions, mentioning that moderators (see later) would lead the discussion sessions to ensure all voices would be listened. Stressing these elements was likely a key to the success of this first meeting (Newton & Elliott 2016). When we asked for feedbacks at the end of the meeting, some stakeholders mentioned that they felt on the same level at the discussion table, that their voice was respected, and their perspectives or comments were not discounted, stressing that this was not a feeling they were used to.

Another key to the success was having moderators for all discussion sessions. Although having completely independent moderators might have been a better way to go, we had already many people invited to the meeting. We therefore asked the international partners to act as

moderators because their role was to provide scientific assessments of the project, and hence, they had no direct interests in the outcomes. Moderators were briefed on the importance of their role and had a detailed checklist of topics to try to cover in the discussion (see Supplementary Text S4). The main goal of the discussion sessions was for representatives from each stakeholders group to present their views on the subject and, together with researchers, decide on common scientific objectives/management questions that are important for the future.

Each case study had a discussion session that involved between 10 and 30 participants. There were two sessions running in parallel, with each session having three sections planned to be covered. The first one aimed at hearing the perspectives of each stakeholders group on the system, i.e. the knowledge and data already acquired, their management needs, and their views on current/future challenges for this harvested system in the context of climate change. The second part aimed at setting the scope (i.e. the first step of strategic foresight), where each stakeholder group was first asked to formulate what they saw as the most important objectives/management questions for this harvested system in the context of climate change. This was followed by a discussion where each discussion group tried to reach common scientific objectives/management questions that took into account the views of all participants. Moderators had to make sure that all stakeholders had a proposition to be sure to include all perspectives in the common objectives. Because stakeholders' perspectives obviously differ, moderators reminded that this exercise would only work if everyone was willing to make some trade-offs (Bateman & Mace 2020). Once the common objectives were defined, the group discussion moved to the second step of strategic foresight, that is starting to collect the inputs and drivers. For the cases that reached that step at the meeting, they discussed what information was available or not, how missing information could be obtained, what were the known, expected, and potential unknown drivers, and what were the level of impact and uncertainty of each of these drivers.

Although not all case studies reached the same level during the meeting, we considered the meeting a success because everything moved smoothly forward within the strategic foresight process. Moderators mentioned they actually had an easy task because the dialogue was positive, constructive, open, and respectful, which allowed to reach consensus for common research objectives in most case studies. The discussions allowed to target questions and objectives that were possible with the data and time frame available, but also to pinpoint where data were lacking to really be able to address the kind of objectives some parties were interested in. It also allowed to target difficulties in some systems and to suggest some ways for improvement. For instance, some disagreements occurred regarding the numbers of large predators in the semi-domestic reindeer system, but the different stakeholder groups involved respectfully agreed about the disagreements. Most importantly, all parties agreed about the uncertainty regarding this driver of the system and acknowledged the need to answer this challenge to be able to move forward. Obviously, not all objectives could be tackled by the project, but because many people had already been working with each case study for a long time, participants felt that research targeting less central aspects of the project would continue in the long run.

Overall, although the strong barrier between academics and stakeholders was present at the start, communicating the importance of the process and insuring everybody had a voice allowed both scientists and stakeholders to accept the process better. The stakeholders felt listened and involved and they gained a better understanding of what the project could provide to their system, as well as what kind of data were lacking to answer some of the objectives they were interested in. For researchers, they gained a better understanding of the vision stakeholders had on science and a broader perspective on the different systems. The discussions drew attention on aspects they were not used to focus on, raising awareness for new research questions based on stakeholders' perspectives. We felt that the meeting had allowed to start building a bridge, but we were fully aware that there was still a lot to do to strengthen this bridge because the interests in the strategic foresight process and for the different case studies varied widely among scientists at that stage.

S2.3 Activities to strengthen the strategic foresight process after the first meeting

Many activities took place following the first meeting because the first two steps of the strategic foresight process were not reached with all case studies, and because some stakeholders could not join the meeting or were identified as missing during the meeting. The first action we took was to send the summary of the meeting to all participants for feedbacks. Some scientists also contacted stakeholders identified as missing, inviting them to provide their views and objectives regarding the harvested system of interest. This was done first through individual inquiries, with specific questions asked either in person, by phone, or email. Then, specific workshops were held for cases needing further discussions to settle the objectives and finish collecting the inputs. At the end of this process, common objectives had been settled by stakeholders and scientists.

By that time, the project leaders realised that all objectives would not be fulfilled because of issues with feasibility, as the project had limited time (4 years) and money. Many students were required to settle their project plans and objectives before this process was finished and their objectives were not often well-aligned with the common objectives settled by the panel of stakeholders. Researchers' interests also varied widely regarding some objectives and case studies, and the project leaders did not want to oblige researchers to work on topics they had no interest because it usually never leads to great achievements. Therefore, the scientists made a priority list according to feasibility and their interests, which included topics of intermediate complexity that were solvable in the course of the project. To ensure transparency, for each case study, the complete list of the common objectives settled together by the stakeholders panel and the scientists was sent to the stakeholders, but the priority order of the ecological issues researchers had decided to focus on was highlighted. Stakeholders were invited to respond if they had disagreements.

Half-way through the first year of the project, we held a workshop among scientists to assess where each case study was up to with respect to the strategic foresight process. For each case study, researchers summarized what had been accomplished and the needs lying ahead. Large

discrepancies among case studies became obvious by that time, already indicating some cases were struggling and would not reach far in the process. We decided to focus our time and effort to fully implement strategic foresight for the case studies that, by then, had demonstrated a strong willingness across both scientists and stakeholders.

S2.4 Second annual meeting

One of the benefits of the strategic foresight approach is that it creates an opportunity for genuine engagement between scientists and stakeholders to develop horizon scanning and scenario planning together to build more specific alterative hypotheses and management actions that can be tested in the relevant models (Leigh 2003, Cook et al. 2014, OECD 2019). To make progress on these steps, we wanted to encourage the relevant teams to frame their work in light of this for the second meeting. Unfortunately, the person in charge of the strategic foresight coordination and for pushing the strategic foresight steps (one of the authors) had been on leave for some time. In the end, the meeting program was not suited to attract stakeholders because it sent a signal of a unidirectional communication (see Supplementary Text S3). Thus, unsurprisingly, only a few stakeholders were present at the second annual meeting, leading to a meeting that was not as successful as the first one for moving forward with the strategic foresight protocol.

We identified many issues that can explain this outcome. First, the scientists failed to address and communicate to stakeholders their expectations for their presence at that meeting, something that had been made very clear for the first meeting. Indeed, a link to a very short program was sent to stakeholders, containing only a list of presentations and discussions without the details regarding the goals and expectations for their presence (see Supplementary Text S3). Most importantly, scientists also neglected to take into account the stakeholders' own expectations. Furthermore, for most case studies, there had not been enough contacts between the two meetings, contacts which would have helped to reinforce the bridge (Boone et al. 2020). For other cases, stakeholders and researchers felt the contacts were easier when communication was done on a smaller scale than at the large annual meeting. Overall, the goal of reinforcing the bridge at that meeting was never achieved, but at least some case studies were moving forward on their own.

S2.5 Third annual meeting

To ensure the third meeting would be more successful with respect to strategic foresight, we pushed forward the individual cases that were most promising and advancing at a smaller scale during the year leading to that meeting. Scientists continued having individual inquiries and specific workshops with stakeholders, where analyses and interpretation with stakeholders were made, fulfilling the third and fourth steps of the strategic foresight protocol. For instance, one objective defined jointly by stakeholders and academics (step 1 of strategic foresight) for the willow ptarmigan case study was to investigate the proximate and ultimate causes of ptarmigan decline, explaining present and potential future changes, focusing on interactions with climate change and harvest, and the links with predators, herbivores, and habitat availability. After having involved stakeholders in the collection of inputs (step 2 of strategic

foresight), scientists had analysed the data (step 3 of strategic foresight) to answer this objective and then met with stakeholders to present the preliminary results. They ensured not to provide their own interpretation of the results (step 4 of strategic foresight), letting stakeholders offer their perspectives. In the end, stakeholders wondered whether the caterpillar outbreaks seen in recent years (Jepsen et al. 2011) could have a play in the system, through their effect on habitat quality. At first, this variable had not been considered by researchers, but it turned out to be an important driver of the system (Henden et al. 2020). This example highlights the richness of including stakeholders through the entire scientific process to build knowledge co-production (Norström et al. 2020), rather than just presenting the results to stakeholders at the end, a time when scientists will be reluctant to adjust their analyses.

With respect with the two last steps of strategic foresight, deciding on actions to be taken depending on the modelled outcomes and taking and monitoring actions, the case study on the Svalbard ecosystem had been the only case advancing that far before the third meeting. At a specific workshop, scientists presented their results to stakeholders and the discussion led to the identification of some tools that could be developed, tailored to suit stakeholders' needs and help in the decision-making process. For example, a *Shiny App* where results of different harvest scenarios can be selected to see the expected response of the populations was planned to be developed. In the end, however, this app was never put in use because the key representative of the stakeholders group interested in this app left Svalbard. Because innovation and project success often depend on key promotors and personnel (Chua et al. 1999, Gurtner & Dörner 2009, Goduscheit 2014), reinforcing the stability in human resources and institutional arrangements seems like a fundamental aspect for strategic foresight to fully succeed in the long run (Stokols 2006, OECD 2019).

When decisions and actions need to be taken, it opens an opportunity for the emergence or the strengthening of the asymmetry of power among interested parties (Vallet et al. 2020). We did not observed such asymmetry within the case study on the Svalbard ecosystem, most likely because it was building on already established relationships between scientists and stakeholders, an element known to facilitate the strategic foresight process (Stokols 2006). These established relationships and the large interest among researchers for this case study (at least partly due to the high-quality scientific monitoring data that could be used to parameterize models) resulted in many objectives that could be started and pushed forward with stakeholders. We believe this is the reason why this case managed to reach the last steps of the strategic foresight process in contrast with the other case studies.

In addition to the efforts deployed through the year preceding the third annual meeting, we also worked specifically on stakeholders' expectations for that upcoming meeting. For cases that had been moving forward with respect to the strategic foresight protocol, scientists wrote to each stakeholders group to detail why their presence was central to that meeting and how they should prepare to ensure both parties would make the most out of the meeting. We also returned to a similar program description as the first annual meeting, a fully detailed program explicitly describing specific goals and formats for each section (see Supplementary Text S3). By targeting the expectations, specific to each stakeholders group, we succeeded in having many

stakeholders present at the third annual meeting, while avoiding unnecessary travel for stakeholders involved in cases where little progress had been made.

We organised the third meeting in two sessions, a first session of "Science-for-Science" followed by a session of "Science-for-Policy". Many scientists had indicated an interest for having discussions for presenting modelling approaches and results that were not necessarily relevant for policy. By splitting the meeting in two, we targeted the needs from both sides, ensuring scientists' fundamental research needs were fulfilled while giving the opportunity for stakeholders to join either both sessions or only the Science-to-Policy session. In the session for Policy, scientists first presented results and then both stakeholders and scientists were asked to provide their interpretation of these results (fourth step of strategic foresight). For three case studies, discussions on actions and decisions to be taken also took place (fifth step of strategic foresight). Overall, there was a strong bridge built for four case studies, which was pursued in the final year of the project.

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Text S3. Programs for the three annual meetings with stakeholders for the SUSTAIN project.

SUSTAIN

SUSTAIN – First Annual Meeting

14-15 January 2016
Quality Hotel Expo
Oslo

This meeting is intended as a "User panel meeting", where communication among users will be structured to develop objectives for SUSTAIN that are of interest to both scientists and end-users. Therefore, the main aim is to present the views and knowledge of all users to decide on common research goals relevant to the management of harvested ecosystems under the influence of climate change. For many cases, this will only be the start, i.e. the common goals are likely to be reached in the few months following the meeting because some systems are quite complex. The main objective of the meeting is to develop a structure around the working groups that will enable us to continue working together after the meeting.

The intended plan is as followed:

Thursday 14th January

10:00-10:30	Introduction
10:30-11:30	Strategic foresight
11:30-11:50	Coffee/tea/snacks
11:50-13:00	Case studies
13:00-14:00	Lunch
14:00-14:50	WP1 to WP5
14:50-15:50	International partners
15:50-16:10	Coffee/tea/snacks break
16:10-19:00	Group discussions on case studies (3h)
19:30	Diner

Friday 15th January

08:00-10:00	Group discussions on case studies (2h)
10:00-10:15	Coffee/tea break
10:15-11:45	Group discussions on case studies (1h30)
11:45-12:30	Lunch
12:30-13:30	Summary & discussion on unknowns in data
13:30-13:45	Conclusion

The goals and format of each of these sections are detailed below.

1. Introduction of SUSTAIN

Goal

Give an overview of the project aims and how we intend to reach them.
Discuss the book to be produced by SUSTAIN.

10:00-10:30 Nils C. Stenseth (UiO), Bernt-Erik Sæther (NTNU) & Rolf A. Ims (UiT)

2. Presentation of strategic foresight

Goal

Help all participants to understand what it is and how it can work.

10:30-10:45 Sandra Hamel (WP6, UiT)
Strategic foresight: what, why, how, and the challenges with SUSTAIN

10:45-11:30 Samu Mäntyniemi
Experiences on participatory modelling using Bayesian inference

11:30-11:50 Coffee/tea/snacks

3. Short overview of case studies targeted by SUSTAIN: Researchers perspectives

Goal

Provide a quick overview of the case studies (i.e. the harvested species and the system components they are strongly linked to/affected by) the researchers have agreed to focus on within SUSTAIN, and the researchers perspectives on these systems.

Format

To be effective, management questions will be regrouped in specific case studies. We will present the key case studies that SUSTAIN will be focusing on. For simplicity, some of these case studies are on a targeted species, but we will use ecosystem approaches even in these specific cases. The researchers will present their perspectives, presenting the knowledge acquired, the data available and the questions and challenges that might be relevant to each of these harvested systems in the context of climate change.

11:50-12:00 **Case 1: Semi-domestic reindeer**
Audun Stien & Torkild Tveraa (NINA Tromsø)

12:00-12:10 **Case 2: Svalbard terrestrial – reindeer, rock ptarmigan & arctic fox**

Åshild Ø. Pedersen (NP), Eva Fuglei (NP), Brage B. Hansen (NTNU), Audun Stien (NINA Tromsø) & Rolf A. Ims (UiT)

12:10-12:20 **Case 3: Rock and willow ptarmigan – Low Arctic and subarctic**
John Andre Henden (UiT)

12:20-12:30 **Case 4: Climate related invasive species and their impacts on native species and ecosystems** (the case of red-listed Fennoscandian tundra species [lesser-white fronted goose & arctic fox] impacted by expanding red fox populations - *other relevant cases may also be proposed and discussed*)
Rolf A. Ims (UiT)

12:30-12:40 **Case 5: Moose and boreal forest**
Erling Solberg (NINA Trondheim)

12:40-12:50 **Case 6: Mjøsa – Gudbrandsdalslågen system**
Jannicke Moe (NIVA)

12:50-13:00 **Case 7: Barents Sea system**
Joël Durant (UiO)

13:00-14:00 Lunch
(Note: please take the time to sign up for the specific case studies)

4. Overview of the scientific knowledge/analytical capacities of SUSTAIN

Goal

Inform the end-users of what SUSTAIN can bring to the management of harvested ecosystems in the context of climate change.

Format

Each of the 5 WP will be presented in a context of what kind of knowledge SUSTAIN can provide, highlighting elements and methods that might be less known to other users. Basically, what people within SUSTAIN are able to do that might be relevant for other users, and why these things might be important for management. It will be shown, as concrete as possible, how each WPs relates to the case systems. Importantly, each presentation will be presented in a language/format that is accessible to all end-users.

14:00-14:50 (10 min each)

1) WP1 – Øystein Langangen (UiO)
2) WP2 – Aline Lee (NTNU)
3) WP3 – Joël Durant (UiO)

4) WP4 – Ivar Herfindal (NTNU)
5) WP5 – John Andre Henden (UiT)

5. Presentation of the international partners

Goal

Give an overview of their scientific interests and what knowledge they contribute to SUSTAIN, keeping in mind that one important goal is to give an overview of what students and researchers within SUSTAIN could benefit from visiting their lab.

14:30-15:30 (10 min each)

1) Olivier Gimenez
2) Christian Damgaard
3) John Fryxell
4) Georgina Mace (presented by Nils C. Stenseth)
5) Steve Redpath (presented by Rolf. A. Ims)
6) Tim Coulson (presented by Nils C. Stenseth)

15:30-16:10 Coffee/tea/snacks break

6. Working groups on each case study: End-users perspectives and negotiations

Goal

Reach common scientific objectives/management goals for each case study. Representatives from each end-users group will present their views on the subject and, together with researchers, will decide on common scientific objectives/management questions that are important for the future.

Format

The researchers, NGO's, stakeholders, monitoring and management bodies concerned with each case study will be invited to take part in the negotiations. The negotiations on common management goals will take place separately for each case study and will be done in two steps. First, representatives from each end-users group will present their perspectives on the system, informing other users on the knowledge and data already acquired, their management needs and their views on current/future challenges for their harvested system in the context of climate change. (The researcher perspectives will not be presented again as they have been presented in section 3.) Second, these presentations will be the starting point for the negotiations, with the aim of finding common scientific objectives/management questions that are relevant for these harvested systems in the context of climate change. It is very likely that these objectives will not be solved for all case studies at this meeting, but this should be a very good start allowing these negotiations to be continued in the months following the meeting.

There will be three discussion sessions with three case studies running in parallel. Note that some case studies will span over two sessions. It is difficult to avoid overlap, but each SUSTAIN-node will try to have at least one representative for each case to be able to share the results of the discussions within each node. The summary of each case study has been provided by email. The international partners will act as moderators during the negotiations.

16:10-19:10 **Group discussions on case studies (3h)**

Case 2 – Svalbard terrestrial (Moderator: Olivier Gimenez)
Case 5 – Moose and boreal forest (Moderator: Christian F. Damgaard)
Case 7 – Barents sea (Moderator: John M. Fryxell)

Friday 15th

08:00-10:00 **Group discussions on case studies (2h)**

Case 4 – Invasive species (Moderator: Christian F. Damgaard)
Case 1 (part 1) – Semi-domestic reindeer (Moderator: John M. Fryxell)
Case 6 (part 1) – Mjøsa lake (Moderator: Olivier Gimenez)

10:00-10:15 Coffee/tea break

10:15-11:45 **Group discussions on case studies (1h30)**

Case 3 – Rock and willow ptarmigan (Moderator: Christian F. Damgaard)
Case 1 (part 2) – Semi-domestic reindeer (Moderator: John M. Fryxell)
Case 6 (part 2) – Mjøsa lake (Moderator: Olivier Gimenez)

11:45-12:30 Lunch

7. Summary and general discussion on unknowns in data

Goal

Summarize the results of the discussions on the specific case studies. Identify problems and solutions for unknowns relating to the three ecosystems we SUSTAIN will be working with. These unknowns are with regard to science (e.g. functioning of ecosystems and its response to future climate change) and management (e.g. which policy can be implemented in the future). While focusing on 'known unknowns', the meeting might also explore how we could address 'unknown unknowns', how 'surprises' can be quickly assimilated into science and management.

Format

We aim at integrating methodological and modelling aspects across the three ecosystems SUSTAIN is working with. Cook et al. (2014) identified 5 ways strategic foresight could contribute to improve environmental policies: '1) monitoring existing problems, 2) highlighting emerging threats, 3) identifying promising new opportunities, 4) testing the resilience of policies, and 5) defining a research agenda.' In this meeting, we will focus on the first four points, and discuss what kind of data and models (statistical and mathematical) are available to answer these questions. It is in particular relevant to assess data quality and model resolution (spatial and temporal), both with respect to e.g. ecosystem functioning and implementation of management actions.

12:30-13:30 Nigel G. Yoccoz (UiT)

8. Conclusion

13:30-13:45 Nils C. Stenseth (UiO), Bernt-Erik Sæther (NTNU) & Rolf A. Ims (UiT)

SUSTAIN

SUSTAIN – Second Annual Meeting

Programme

Wednesday 25 January 2016 (Day 1)

1000-1030 Introduction: Nils Chr. Stenseth, Bernt-Erik Sæther and Rolf A. Ims

1030-1115 Case study 1 – Semi-domesticated reindeer:

- 1030-1045 Audun Stien: "Introduction to the reindeer case study. Where are we and where do we go"
- 1045-1100 Jarad Mellard: "Combined effects of predation and scavenging in a food web model of the semi-domesticated reindeer"
- 1100-1115 Discussion

1115-1225 Case study 2 – Svalbard terrestrial:

- 1115-1125 Åshild Ønvik Pedersen & Eva Fuglei: "RECAP - Svalbard case"
- 1125-1140 Brage Bremset Hansen: "Svalbard reindeer population dynamics: interactions between climate, harvest, density and age structure"
- 1140-1155 Bart Peeters: "Hunting Svalbard reindeer: does outtake match management aims? – and some population genetics"
- 1155-1210 Chloé R. Nater: "Integrating data sources for Arctic Fox demography"
- 1210-1225 Discussion

1225-1310 Case study 3 –Willow and rock ptarmigan:

- 1225-1240 John-André Henden: "Status and progress with the Finnmark data"
- 1240-1255 Edwige Bellier: "Ptarmigan case study: a dynamic model for species interactions"
- 1255-1310 Discussion

1310-1400 Lunch

1400-1530 Case study 6 – Mjøsa:

- 1400-1415 Jannicke Moe: "Introduction to the freshwater case study"
- 1415-1430 Atle Rustadbakken: "Observed changes in growth patterns of the Hunder Trout"
- 1430-1445 Chloé Nater: "Brown Trout Vital Rates - Biphasic growth, complex mark-recapture models and educated guesses"
- 1445-1500 Marlene Stubberud: "Two-sex IPMs and harvesting - Fish model"
- 1500-1515 Discussion

1515-1545 Coffee & Tea

1545-1630 Case study 4 – Climate related invasive species:

- 1545-1600 Edwige Bellier: "Analysis of the demography of an invasive species"
- 1600-1615 Filippo Marolla: "Linking geese demography and red fox dynamics"
- 1615-1630 Discussion

1630-1715 Case study 5 – Moose and boreal forest system:

- 1630-1645 Ivar Herfindal: "Spatial and temporal patterns of climatic variation across ecosystems"
- 1645-1700 Ivar Herfindal: "Spatial structure of moose and domestic reindeer in relation to spatial variation in climate"
- 1700-1715 Discussion

1800- Dinner

Thursday 26 January 2016 (Day 2)

0900-1115 Case study 7 – Barents Sea:

- 0900-0915 Joël Durant: “Case Study 7: Barents Sea System”
- 0915-0930 Øystein Langangen / Joël Durant: “Pattern of migration: climate or demography”
- 0930-0945 Arne Melsom: "Variability in drift patterns of fish eggs"
- 0945-1000 Leana Deris: "The state-space population dynamics model of Norwegian Spring Spawning (NSS) herring (Clupea harengus)"
- 1000-1015 Joël Durant: “Effect of juvenile distribution and environment on the Northeast Arctic haddock”
- 1015-1030 Edwige Bellier: "Age-dependent interactions of two related species"
- 1030-1045 Sondre Aanes: “Spatial scaling for fish species in the Barents Sea”
- 1045-1100 Javi Jarillo: "Population synchrony scales in predator-prey systems"
- 1100-1115 Discussion

1115-1130 Coffee & Tea

1130-1300 WP leaders’ summaries

- 1130-1145 Øystein Langangen / Joël Durant: WP1 - Demographic structure in harvested ecosystems
- 1145-1200 Aline M. Lee: WP2
- 1200-1215 Joël M. Durant: WP 3 - Ecosystem resilience and climate change in a spatially structured and seasonal environment
- 1215-1230 Ivar Herfindal: WP 4
- 1230-1245 John-André Henden: WP 5
- 1245-1300 Sandra Hamel / Nigel Yoccoz / Rolf A. Ims: WP 6

1300-1400 Lunch

1400-1445 International collaborators' perspective

1445-1600 Early Career Stage "only" meeting (PhDs and postdocs)

1445-1530 WP leaders meeting

1530-1600 Administration meeting (WP leaders and PIs)

1600-1730 Mentoring sessions in parallel

1445-1730 Mingling with Coffee & Tea available throughout the afternoon for people not included in formal meetings

1730-1800 Closing session (Early Career Researcher feedback, status of various projects, future plans, next year's meeting, etc.)

1800- Dinner

SUSTAIN – Third Annual Meeting

SUSTAIN

SUSTAIN – Third Annual Meeting

Clarion Hotel The Edge, Tromsø
29th – 31st January 2018

We are delighted to invite you to the 3rd annual meeting of SUSTAIN. This meeting is assembled in two lunch-to-lunch communication sessions: a first session devoted to "Science-to-Science" (lunch-to-lunch 29th – 30th January) and a second devoted to a "Science-to-Policy" (lunch-to-lunch 30th – 31st January). Everybody is welcome to all sessions. The details of these sessions are provided below for those of you that wish to only join specific sessions.

The **Science-to-Science** session is devoted for purely research communication, with presentations of results or plans for coming up research, as well as discussions. This section is structured around the three specific questions SUSTAIN and the Work Packages aim to answer.

The **Science-to-Policy** session is intended as a user panel meeting/workshop with specific objectives structured around the different case studies within SUSTAIN. The details of these objectives are listed below.

SUSTAIN 3rd Annual Meeting Schedule Overview

Monday 29th January

12:00-12:45 Arrival and lunch
12:45-13:00 Welcome (Nils Stenseth, Rolf Ims, Bernt-Erik Sæther)

Opening of the **Science-to-Science** session

13:00-15:00 Theme 1 – chaired by Joël Durant
Effects of environmental change, harvesting, and their interactions on **"Dynamics of structured populations"**

15:00-15:20 Coffee/tea/snacks break
15:20-15:45 Georgina Mace (15+10 min)
"Towards a resilient ecological network: a case study from national plans in England"

15:45-16:30 John Fryxell (30+15 min)
"How supply and demand drive critical transition to dysfunctional fisheries"

16:30-16:45 Coffee/tea/snacks break
16:45-18:45 Theme 2 – chaired by John-André Henden/Aline Lee
Effects of environmental change, harvesting, and their interactions on **"Species interactions within and between trophic levels"**

19:30 Diner at Arctandria – Drink in the lobby from 19h

Tuesday 30th January

08:00-10:00 Theme 3 – chaired by Joël Durant/Ivar Herfindal
Effects of environmental change, harvesting, and their interactions on **"Spatial patterns and dynamics of species and their environment"**

10:00-10:20 Coffee/tea/snacks break
10:20-10:50 Christian Damgaard (20+10 min)
"Spatio-temporal structural equation modeling in a hierarchical Bayesian framework: wet heathlands"

10:50-11:45 SUSTAIN book (Nils Stenseth)
11:45-12:30 Lunch
12:30-14:00 General discussion – chaired by Nigel Yoccoz
What have we not answered yet, and what has been done to answer the general aim of SUSTAIN

14:00-14:15 Conclusion of the **Science-to-Science** session (Nils Stenseth)

14:15-14:30 Coffee/tea/snacks break

14:30-14:40 Opening of the **Science-to-Policy** session (Sandra Hamel)

14:40-15:40 John Linnell (45+15 min)
"Teeth, claws, laws, hearts and minds: what is shaping the future for large mammals and their ecosystems in Europe?"

15:40-16:30 Presentation of the strategic foresight achieved/planed for the three cases not discussed in a detailed workshop
- Semi-domesticated reindeer (Torkild Tverra, 10 min)
- Mjøsa (Chloé Nater, 10 min)
- Moose and boreal forest (Ivar Herfindal, 30 min)

16:30-16:45 Coffee/tea/snacks break
16:45-18:45 Workshop 1 – Ptarmigan case (chair: John André Henden)
19:00 Diner at Fiskekompaniet

Wednesday 31th January

08:00-10:00 Workshop 2 – Barents Sea case (chair: Joël Durant)
10:00-10:15 Coffee/tea/snacks break
10:15-12:15 Workshop 3 – Svalbard case (chair: Eva Fuglei)
12:15-13:00 Lunch
13:00-14:45 Workshop 4 – Invasive species case (chair: Rolf Ims)
14:45-15:00 Conclusion of the **Science-to-Policy** session (Rolf Ims)

SUSTAIN DETAILED SCHEDULE

The "Science-to-Science" session will include presentations and discussions grouped under three specific themes. Two hours will be devoted to each theme, with presentations of some results/planned analyses followed by a structured discussion on how to move forward on this theme.

Theme 1 – chaired by Joël Durant

Effects of environmental change, harvesting, and their interactions on
Dynamics of structured populations

13:00–13:05 Introduction – Joël Durant

13:07–13:17 Marlene Wæge Stubberud
Effects of size-specific harvesting on population structure and growth: a two-sex integral projection model approach

13:19–13:29 Chloé Nater
Individual heterogeneity and early life conditions shape growth in a freshwater top-predator

13:31–13:41 Øystein Langangen (presented by Joël Durant)
Exploring the benefit of long distance migration using a length structured population model

13:43–13:58 Edwige Bellier
Stage-dependent interactions of two harvested competitors

14:00–14:10 Joël Durant
Harvesting, climate and population structure of harvested stocks in the Barents Sea

14:12–14:22 Brage B. Hansen
How will different harvest regimes modify climate change effects on Svalbard reindeer population dynamics?

14:24–14:34 Edwige Bellier
Effect of body weight on demography of a harvested population

14:36–15:00 Summary and discussion

**Note that some titles may change slightly.*

Theme 2 – chaired by John André Henden/Aline Lee

Effects of environmental change, harvesting, and their interactions on

Species interactions within and between trophic levels

16:45–16:50 Introduction – John-André Henden

16:50–17:05 Filippo Marolla

Opposite predation-mediated effects of food web dynamics on an endangered arctic-nesting goose: implications for management

17:20–17:35 John-André Henden

Effect of climate, harvest and community interactions on willow ptarmigan population dynamics

17:35–17:50 Edwige Bellier

Harvest of interacting species affected by climate

17:50–18:05 Jarad Pope Mellard

Effect of scavenging on predation in food webs

18:05–18:15 Javier Jarillo

Effect of species interactions in population synchrony scales: competition and predator-prey interactions

18:15–18:25 Aline Magdalena Lee

Effect of environmental stochasticity on the covariance of two competing species

18:25–18:30 Aline Magdalena Lee

Summary and other relevant ongoing work

18:30–18:45 Discussion

**Note that some titles may change slightly.*

Theme 3 – chaired by Joël Durant/Ivar Herfindal

Effects of environmental change, harvesting, and their interactions on

Spatial patterns and dynamics of species and their environment

8:00–8:10 Introduction – Joël Durant/Ivar Herfindal

8:10–8:40 Ivar Herfindal
How does climate affect the spatial scaling properties in terrestrial species?

8:40–8:55 Brage B. Hansen
Spatial population synchrony on the arctic tundra: the role of climate and trophic interactions

8:55–9:10 Sondre Aasnes
Spatial dependence in fish population dynamics in the Barents Sea

9:10–9:25 Jonathan Fredricson
Life history traits and spatial scaling of population dynamics of marine fish in the Barents sea

9:25–9:40 Joël Durant
Cod migration and recruitment. Where and how to harvest?

9:40–10:00 Discussion

**Note that some titles may change slightly.*

The "Science-to-Science" session will end on a discussion relating to the whole SUSTAIN project.

The aim of SUSTAIN is to assess the influence of the interactions between climate and harvest on freshwater, marine and terrestrial ecosystems, the impact of these drivers on the management of these ecosystems, and the integration of science and management through the use of a strategic foresight protocol.

The first part of the discussion will be devoted to pinpointing areas that have not been answered by SUSTAIN yet, whereas the second part will focus on discussing what has been achieved and how can we strengthen it to answer even better the aim of SUSTAIN.

The "Science-to-Policy" session includes four workshops specific to four case studies in SUSTAIN. The work done in the three other case studies will be presented shortly but will not be discussed in details (see the explanation for each case at the end of the document).

Each case will be discussed in a round table, in the format of a workshop/open discussion with specific objectives for each case. The round tables for each case will last 2h and will run sequentially so everyone can join. The room will be organized to have a round table but also extra chairs outside the round table for those interested but less involved in some specific case studies.

Workshop 1 - Rock and willow ptarmigan

Leader:
John-André Henden (UiT)

Objective:
The main goal is to get the perspective of end-users on the results obtained based on the last round table in early November. This will be done in two steps:

1. The round table will start with a short presentation of the timeline of this case study, presenting which objectives were defined by scientifics and end-users, what has been done and what is still planned to be done.

2. Then, an open discussion will follow based on a document that will be sent in early January to end-users. The document will summarise results and the researchers would like if end-users could bring their own interpretation of these results to the discussion on whether these results are valuable for managing ptarmigans and useful in the decision-making process. They would also like to get feedback on whether some aspects could be improved and if they feel some essential objectives have been left aside and should be reconsidered.

Expectations:
Researchers - Prepare some discussion points and results to discuss with the end-users related to the document summarizing the ptarmigan work that will be sent in early January to end-users.

End-users - Read the document that will be sent in early January, which will include some questions/results for you to start reflecting on. Share your perspective on these aspects at the meeting.

Workshop 2 - Barents Sea

Leader:
Joel Durant (UiO)

Objective:
Unfortunately, no end-users could join to the meeting. The aim of the workshop will therefore be to use the time to tighten the links between the different Barents Sea researchers, and to get feedback on specific things done and what can be improved or done for this case.

Expectations:
Researchers - Prepare some discussion points and results to discuss.

Workshop 3 - Svalbard terrestrial

Leaders:
Eva Fuglei/Åshild Pederson (NP)

Objective:
The main objective is to present results on the three harvested species in Svalbard to the end-users and discuss if they meet the goals of the case. It is important for researchers to get the end-users perspective on the new results, obtained after our meeting in Longyearbyen early November 2017. During the November meeting, we agreed to start the following work before the annual meeting in January:

Svalbard reindeer

- Develop a simple tool to estimate the quota (number of animals by sex and age) based on current year's population counts, last year's off take, and the winter conditions the past winter (Bart/Brage/Åshild)

Svalbard rock ptarmigan

- Build a stochastic population model that combines the available data with parameter distributions from the literature and knowledge or best estimates of population processes. In this way, different scenarios that could cause observed patterns in numbers of territorial males and hunting output can be identified and analysed, allowing us to pinpoint what additional data is needed to gain an understanding of the population dynamics and predict future developments (Aline)

- Develop a simple model to calculate current and future possible harvest rates (John André/Filippo/Jarad)

- Develop/adjust a population model for ptarmigan based on the replicates of counts of territorial males in spring where we include habitat and terrain variables as well as predictors related to climatic conditions (John André/Filippo/Jarad)

- Look at interspecific interactions using structural equation modelling to study direct and indirect relationships between ptarmigans and pink-footed geese, arctic fox, reindeer carcasses, and climate. We aim to test hypotheses on the direction and strength of such relationships (Filippo)

Arctic fox

- Develop a demographic model to estimate survival across age and sex in the population, reproductive rates, and population age and sex structure. Such estimates will advance our ability to evaluate the interacting effects of harvesting and climate on arctic fox populations and the current management practice (Chloé)

We plan to do the discussion in two steps:

1. The round table discussion will start with a short update of the timeline of the case study, presenting which objectives were initially defined by the end-users and scientists, what has been done and what is still needed to be done. This will be followed by a short presentation from Bart, Brage, Aline, John André, Filippo, Jarad and Chloé on the progress of the tools and models that we agreed to work on.

2. Then, we will follow with a discussion based on a document that summarizes the results. We will send this document to the end-users in early January. The researchers would like if end-users could bring their own interpretation of these results to the discussion on whether these results are valuable for the management of the species. We would also like to get feedback on whether some aspects could be improved and if essential objectives have been left aside and should be reconsidered.

Expectations:

Researchers - Submit a summary of your main results to Eva/Åshild so that we can prepare a document summarizing the results. Prepare some discussion points and results to discuss with the end-users related to the document summarizing the work on the different models, which will be sent in early January to end-users.

End-users - Read the document that will be send in early January, which will include some questions/results for you to reflect upon. Share your perspective on these aspects at the meeting.

Workshop 4 - Climate related invasive species

Leader:
Rolf Ims (UiT)

Objective:
The main goal is to get the perspective of end-users on the results obtained after refining the model following a meeting in October as well as results not presented yet regarding the red fox. This will be done in two steps:

1. The round table will start with a short presentation of the timeline of this case study, presenting which objectives were defined by scientifics and end-users, what has been done and what is still planned to be done.

2. Then, an open discussion will follow based on a document that will be sent in early January to end-users. The document will summarise results and the researchers would like if end-users could bring their own interpretation of these results to the discussion on whether these results are valuable for managing these species and useful in the decision-making process. They would also like to get feedback on whether some aspects could be improved and if they feel some essential objectives have been left aside and should be reconsidered.

Expectations:
Researchers - Prepare some discussion points and results to discuss with the end-users related to the document summarizing the red fox and lesser-white fronted geese work that will be sent in early January to end-users.

End-users - Read the document that will be sent in early January, which will include some questions/results for you to start reflecting on. Share your perspective on these aspects at the meeting.

CASE STUDIES THAT WILL NOT HAVE ROUND TABLES

Semi-domesticated reindeer

Leaders:
Torkild Tveraa/Audun Stien (NINA Tromsø)

Explanation: SUSTAIN is working on a model that we want to present to the end-users for inputs, but this model is not ready yet. The aim is to have a round table later in the spring 2018. End-users concerned with this case have been contacted and informed about this plan.

Mjøsa – Gudbrandsdalslågen system

Leader:
Asbjørn Vøllestad (UiO)

Explanation: This case study has held a large end-user meeting earlier locally (Hamar), as well as have had several more informal interactions. Because it is easier to meet with end-users locally (Hamar or Lillehammer), this case will have a meeting/workshop in the spring instead of during the SUSTAIN Annual Meeting. End-users concerned with this case have been contacted and informed about this plan.

Moose and boreal forest

Leaders:
Ivar Herfindal (NTNU)/Erling Solberg (NINA Trondheim)

Explanation: This case will only be shortly presented and discussed (30 min) because most research in this case will take place in the coming year. The discussion will include a short update of the timeline of this case study, presenting which objectives were defined by the end-users and scientists. It will present results up to now and the plans of what is about to be done in the coming year. Specific end-user meetings will be held once more results have been achieved, in the spring/summer. End-users concerned with this case have been contacted and informed about this plan.

Text S4. Moderator check list for the group discussions of the first annual meeting with stakeholders.

Checklist for the working groups on specific case studies

SUSTAIN first annual meeting
Oslo, 14-15 January 2016

SUSTAIN

Main goal

Representatives from each end-users group will present their views on the subject and, together with researchers, will decide on common scientific objectives/management questions that are important for the future.

Section 1: End-users perspectives

Representatives from each end-users group will present their perspectives on the system, informing other users on:

- the knowledge and data already acquired
- their management needs
- their views on current/future challenges for their harvested system in the context of climate change.

It is possible that some end-users are not completely prepared for this because some of them registered late and others received the information a bit late. Therefore, if you feel that one of these three points have not been address by some end-users, feel free to ask them questions that will help them discuss further on these aspects.

Note: *The researcher perspectives will not be presented again as they have been presented in section*

Section 2: Setting the scope (first level of the strategic foresight framework)

Step 1 – End-users missing?

We should discuss whether some end-users should be taking part of these negotiations but are missing (e.g. couldn't join or have been neglected). In such case, we should organise to have some specific consultations sent out after the meeting to try to include these end-users perspectives in Step 2. The process in Step 3 can be started but it is likely to only be completed after these end-users have been included, hopefully within a few months following the meeting.

Step 2 – Formulation of all objectives

Ask each end-user representative to formulate what she/he sees as the most important objectives/management questions for this harvested system in the context of climate change. It is important that all end-users have a proposition to be sure to include all perspectives.

Step 3 – Discussion to reach common objectives

The point here is to have a discussion where we try to reach common scientific objectives/management questions that will take into account the views of all end-users. Of course, this will need to be presented as an exercise where most likely everyone will have to make some trade-offs because the perspectives are going to differ. We can remind people that this exercise will only work if everyone is willing to make some trade-offs.

Section 3: Start collecting inputs (second level of the strategic foresight framework)

If we have reached common objectives in Section 2, we can start working at the second level of the strategic foresight, i.e. discussing the inputs and working on a driver analysis.

Here are some examples of points that can/will need to be discussed to determine what do we know from the past and what do we expect for the future:

- What information do we have and don't have?
- Can we obtain other information by other means?
- What are the known, expected and potential unknown drivers?
- What are the level of impact and uncertainty of each of these drivers?

NOTE: It is essential that for each point discussed, the perspectives of all end-users are included, in particular for the last two points.