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OPINION PIECE

Challenges and opportunities when implementing strategic foresight: lessons learned when engaging stakeholders in climate-ecological research

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ABSTRACT: Ecosystems are currently experiencing rapid changes. Decision-makers need to anticipate future changes or challenges that will emerge in order to implement both short-term actions and long-term strategies for reducing undesirable impacts. Strategic foresight has been proposed to help resolve these challenges for better planning and decision-making in an uncertain future. This structured process scrutinizes the options in an uncertain future. By exploring multiple possible futures, this process can offer insights into the nature of potential changes, and thereby to better anticipate future changes and their impacts. This process is performed in close partnership with multiple actors in order to collect broader perspectives about potential futures. Through a large research initiative, we applied the strategic foresight protocol to a set of different case studies, allowing us as academic ecologists to reflect on the circumstances that may be influential for the success of this approach. Here, we present what worked and what did not, along with our perception of the underlying reasons. We highlight that the success of such an endeavour depends on the willingness of the people involved, and that building social capital among all participants involved directly from the start is essential for building the trust needed to ensure an effective functioning among social groups with different interests and values.

KEY WORDS: Strategic foresight · Ecosystem management · Stakeholder engagement · Social capital · Knowledge co-production

1. REASONS FOR INCLUDING STAKEHOLDERS IN CLIMATE-ECOLOGICAL RESEARCH

In the context of current rapid ecosystem changes, decision-making requires not only understanding how an ecosystem functions and might have been altered by known changes that have occurred in the past, it also needs to anticipate potential future changes or challenges that will emerge (OECD 2019). To reach such a level of knowledge and ensure it will be applicable for decision-making, close collaborations among all interested parties and scientists are required more than ever (Boone et al. 2020). This challenge requires that academics transform the way they do science, by being more probing in their scope and working more interactively with all interested parties (Stokols 2006, Newton & Elliott 2016, Boone et al. 2020). The latter can include all parties interested in or influenced by the focal ecosystem, such as managers, decision makers, social actors, end users, NGOs, and communities, hereafter collectively termed 'stakeholders' (sensu Newton & Elliott 2016).

Although communication between academics and stakeholders has always existed and is improving, a

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wide gap still exists between these 2 communities (Nichols et al. 2015). Typically, most communication is one-way and arises at the start and end of a project (Stokols 2006): scientists usually ask stakeholders to provide their views on a specific issue and then, at the end, present their results and recommendations to the stakeholders. All of the processes that take place in between are usually performed without communication with stakeholders, which can be problematic, because scientists and stakeholders typically have different interests and visions, but more importantly, they do not always share the same values (Sarewitz 2020). By performing most scientific steps without any communication with stakeholders, objectives and results are therefore at risk of not being well-aligned with the needs and values of the stakeholders (Stokols 2006). Thus, as academically interesting and valuable as results may be, they will often end up in a drawer, unutilized. By 'hiding' these processes, scientists also hinder the building of trust and social capital (sensu OECD 2001) among parties. Trust and social capital are attributes that can help in reducing the asymmetry of power among interested parties (Vallet et al. 2020), which becomes essential when the results of a study point to the necessity of implementing actions that are difficult to accept by the community (Stokols 2006, Newton & Elliott 2016, Boone et al. 2020).

2. STRATEGIC FORESIGHT AND THE PROJECT 'SUSTAIN'

Strategic foresight, the structured and explicit exploration of multiple futures, has been proposed to help resolve these challenges for better planning and decision-making in an uncertain future (OECD 2019). This framework has been used in various fields to obtain a more functional future view, and anticipate potential surprises (Martin 2010, Iden et al. 2017). Fundamentally, strategic foresight is characterized by 2 key aspects. (1) It scrutinizes the options in an uncertain future to better anticipate changes and their impacts. This is done by exploring multiple possible futures and offering insights into the nature of potential future changes (Slaughter 1997, Ringland 2010). (2) It is performed in close partnership with multiple actors to form broader perspectives about the potential futures (Slaughter 1997, Ringland 2010). In ecology, 6 steps were proposed for implementing strategic foresight, explicitly involving a panel of stakeholders throughout all steps (see Text S1 in the Supplement, www.int-res.com/articles/suppl/c086p029_supp.pdf; Cook et al. 2014).

The project SUSTAIN, 'Sustainable management of renewable resources in a changing environment: an integrated approach across ecosystems', was a large collaborative research project funded by the Norwegian Research Council. Its main aim was to determine how climatic changes in combination with other anthropogenic stressors affect different harvested boreal and arctic ecosystems, and how management strategies could be improved to ensure sustainable exploitation and resilience. The project aspired to produce outputs applicable to management, which needs to plan for an unpredictable future with respect to impacts of climatic change, as well as to other stressors and their interactions. Thus, the strategic foresight framework was well-suited for this challenge. The project was built to combine rigorous science to investigate the options for an uncertain future in partnership with a panel of stakeholders to ensure that the results could be applied to relevant, real world problems. Because we attempted to apply the same protocol to a set of different cases (see Texts S2, S3, & S4 regarding the detailed implementation within SUSTAIN), we were able to reflect on the circumstances that may be influential for the success of the strategic foresight approach. In this opinion paper, we summarize what worked and did not work, along with our perception of the underlying reasons, and how things could be improved.

3. A BUMPY ROAD FILLED WITH GREAT OPPORTUNITIES BUT ALSO CHALLENGES

3.1. Building social capital and enhancing social learning

We have seen great opportunities through the implementation of strategic foresight. Incorporating stakeholder engagement has not only widened the research perspectives of scientists and allowed their research to provide outcomes more timely and relevant to society, it has also provided an opening to build social capital. Social capital is built through interpersonal relationships that allow sharing identity, understanding, and various values (OECD 2001). These social connections are essential to build trust that will promote cooperation and receptive discussions on differing values, all of which will enhance social learning (see below, this subsection, for a definition of 'social learning') and ensure an effective functioning among social groups with different interests and values (Plummer & FitzGibbon 2006). These strong social connections are expressed as a form of

capital because they generate collective actions that produce benefits and public goods for society (OECD 2001). In SUSTAIN, the large annual meetings, where all academics and stakeholders gathered and brainstormed together, have been a boost for building social capital among numerous groups (see Texts S2.2, S2.4, S2.5). Nevertheless, the more frequent, but smaller workshops and individual inquiries have been essential in reinforcing these relationships among specific groups or individuals (Text S2.3).

Social capital can help enhance social learning, a process defined by Reed et al. (2010) as 'a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks'. Thus, the demonstration of social learning requires the occurrence of 'a change in understanding […] within communities of practice' (Reed et al. 2010). Although the SUSTAIN project did not aim to follow or document the process of social learning (see Text S2), we have witnessed changes in understanding among individuals working in some case studies (for instance in the willow ptarmigan *Lagopus lagopus* case, see Henden et al. 2020 and Text S2.5). These changes have not yet gone beyond the individuals involved, but we would argue that attaining changes within communities of practice requires long-term commitment, which is rarely reached within the time frame of most research projects. Nonetheless, through its activities and collaborative initiatives, SUSTAIN has provided 'enabling conditions' (sensu Armitage et al. 2018) to promote learning effects that can in the long run lead to sustainable outcomes (Armitage et al. 2011). By having established a fundamental dialogue among the different institutions and their actors, SUSTAIN will leave a legacy for pursuing the process towards social learning in the long term.

3.2. Time and willingness

Although large meetings are more costly and time consuming than smaller ones, the combination of both large- and small-scale opportunities has been fundamental in building strong interpersonal relationships within the project (see Text S2). Because different groups are likely to respond more positively to some types of engagements, providing a diversity of occasions to meet and discuss helped to ensure that various stakeholder groups committed to the SUSTAIN project and, importantly, that their needs were met. Building social capital is essential but it does take time and willingness from all people involved (Stokols 2006). Researchers are not used to having to take a different pace, but we learned that going full speed is simply not possible in such a process. Patience and tolerance are key for the success of the process, but not all researchers will be willing to accept this, often due to the 'publish or perish' culture putting constant pressure on scientists (Edwards & Roy 2017). Taking the strategic foresight road necessarily means slowing down for some research steps. Agencies that want to support such an approach must therefore realize that completing all the necessary steps in the protocol is a long-term endeavour that only exceptionally may be accomplished within the 3- to 5-yr funding cycle of standard research projects (Parrott 2017). A further challenge is related to the political process, which can be slow and suddenly accelerate or stop completely (or even reverse), thereby greatly impacting the success of these endeavours. Thus, to anticipate future changes and adapt decision-making in real-time, clear strategies and long-term, sustained commitments toward forecasting and strategic foresight processes are required from both political and research institutions (Parrott 2017, Boone et al. 2020).

The functioning and success of the strategic foresight process relies on the willingness of the participants involved to pursue common goals for the good of society, and this is equally important among the researchers involved as well as among stakeholders. We have actually seen greater reluctance to the process coming from researchers than from stakeholders, particularly at the start of the project (see Text S2.1). This likely resulted from starting the strategic foresight process after funding was received, with common goals being agreed months after some researchers and students had already planned their projects. More generally, engaging in organizationally demanding and slowly developing endeavours like strategic foresight may not be the best path for building CVs that are competitive for future projects and jobs within academia (Walters 2007). Hence, actions should be made to develop means to better credit researchers for making science operational for tackling 'wicked' problems (i.e. problems with no simple, optimal solution, Rittel & Weber 1973) such as mitigating ecosystem impacts of climate change (Parrott 2017). Finally, within SUSTAIN, the process has been delayed when the person in charge of coordinating (one of the authors) was on leave. This highlights the necessity of having all key people devoted to contributing and coordinating the overall process, not having the process conducted by a single person (Gurtner & Dörner 2009).

Among the case studies of the project (see Text S2.1, Fig. S2), interests also varied widely among researchers and stakeholders. For instance, although stakeholders were devoted and interested in the case of subarctic semi-domestic reindeer *Rangifer tarandus*, students did not show as much interest compared with projects associated with high Arctic wildlife (including reindeer) in Svalbard. The latter was more popular, perhaps due to the high rate of current climate change in the high Arctic (IPCC 2014), and moved faster in the strategic foresight process, likely due to the simplicity of the ecosystem and the high quality of the monitoring data. The Svalbard case, however, had major challenges at the end of the project due to the high turnover of stakeholders, which resulted in a shift in interests. For example, the employees at the Svalbard Governor's office are replaced every 3 yr, and by the time the tools were developed for this case study, the new employees did not see the value of using the newly developed tools for managing the reindeer population.

Another challenge was with the Barents Sea case study, for which researchers did not manage to gather the interests from any stakeholder even though this system involves a very wide array of actors. Stakeholders from this system are already highly solicited for taking part in many scientific projects, and researchers were not willing to push this solicitation further once they received a negative answer from stakeholders. This case contrasts with the very engaged and constructive stakeholder group of the willow ptarmigan case (Henden et al. 2020). The success of that case was likely due to several circumstances. The willow ptarmigan is the most popular small game species in Norway. The recent national red listing of this species had sparked a lot of attention and many unanswered questions among stakeholders regarding the causes of the population decline. Monitoring data both on the target species and potential food web drivers had just become sufficiently extensive such that the strategic foresight step of 'analysing the signals' (Text S1) rapidly resulted in new insights that sparked excitement among stakeholders. Moreover, the stakeholder group had much knowledge about the natural history of the target species, and had themselves observed changes in the climate and the ecosystem that contributed substantially to model building and interpretation of analytical results. Finally, a major stakeholder had a clear view on how science could help their management of ptarmigan harvest, which resulted in model developments for deriving near-term forecasts (sensu Dietze et al. 2018) of ptarmigan population dynamics.

3.3. Starting as early as possible

We cannot emphasise enough the need to start the strategic foresight process as early as possible, ideally before beginning to write applications for funding. This will help not only to make sure common objectives are clearly defined from the start, and securing that they will be fulfilled if funding is granted, it will also attract applicants interested in answering these objectives while fully participating in the strategic foresight process. Starting early will also help build a stronger 'bridge' (Cook et al. 2014, Newton & Elliott 2016). When ideas and perspectives from stakeholders are taken into account from the start and at all steps of the scientific process, a feeling of ownership in the results obtained will emerge, facilitating acceptance when difficult actions need to be taken (Newton & Elliott 2016, Boone et al. 2020). Within the project, the fact that stakeholders were engaged from the start and throughout the process was a help, since they were able to accept counter-intuitive results in one case study. That study was assessing whether the large-scale removal of red fox *Vulpes vulpes* had played a role in the recovery of the endangered population of lesser-white fronted geese *Anser erythropus* in Scandinavia. Some of the stakeholders and researchers had the impression that red fox predation on nests was a problem, and the population showing recovery since the red fox removal had started supporting this belief. In the end, it came to light that natural food web dynamics were confounded with red fox removal, and there was little evidence that this management action had a large impact on either survival or reproduction of this goose population (Marolla et al. 2019, Marolla 2020). The trust needed to accept this result was established by including the divergent opinions from the different parties through the whole process, particularly in linking data collection and analytical choices as well as in interpreting the results.

3.4. Communication

Like any project of this size, communication is fundamental but always challenging. The scientists did not develop the communication plan together with stakeholders. It was initially agreed that a website would be built to facilitate communication within the project. Although websites are useful and necessary, skills and devotion are required to build good webpages, and, once they are put in place, it is demanding to keep them sufficiently relevant and used by all

parties. Thus, they are usually not the best tool to keep people connected. Later, a newsletter was sent by email, but it was also not successful due to the limited commitment for producing it. As we look back, we would recommend using more dynamic and direct communication systems, for instance platforms like SLACK or TEAMS. These platforms provide the opportunity to keep the discussion between actors active and in real time, leading to a more successful communication. We used a similar system in recent projects and it definitely increased the flow of communication among actors. Most importantly, we strongly recommend planning the communication strategy with stakeholders. Different groups are accustomed to different communication systems and they are likely to be reluctant to use something else unless all actors have been discussing the options and reaching a consensus on the best strategy.

Within the project, the level and quality of communication between scientists and stakeholders varied widely among case studies, likely explaining the different levels of success in implementing strategic foresight among cases (Stokols 2006, Boone et al. 2020). Some case studies only contacted stakeholders occasionally to provide some information or results, whereas others had communication with stakeholders at every step in the process. As could be expected, the latter strategy was the most successful, but it did require more time to coordinate. For some groups, there was a strong dialogue built on prior long-term relationships, but for others, new relationships were hard to build. These groups might have benefited from the assistance of a professional facilitator who could have helped identify values and act as a bridge between the scientists and the stakeholders to enhance the effectiveness of their interactions (Mathevet & Marty 2020).

3.5. Stakeholder expectations

To keep stakeholders interested and engaged, scientists need to pay attention to their expectations and take actions to fulfill them. At the project scale, the scientists did fail to manage stakeholder expectations in many instances, which might have solved various issues that appeared down the road (see Text S2). Stakeholder expectations need careful management, otherwise there is a high risk that stakeholders will lose interest, become frustrated, or worst, feel exploited (Newton & Elliott 2016, Boone et al. 2020). Managing stakeholder expectations requires a clear distinction about what can be realistically delivered in the short term and what could be the longer-term goals (Stokols 2006, Boone et al. 2020). Four out of 7 case studies succeeded very well in managing stakeholder expectations (Text S2.5), building a strong bridge between scientists and stakeholders.

4. LEGACIES AND PERSPECTIVES

In many respects, strategic foresight shares similarities with the 3-horizon model that can lead to transformative thinking (Sharpe et al. 2016). As for implementing all steps of the strategic foresight process, moving from the first ('business as usual') to the second (innovations leading to transitions) and third horizon (long-term successor to the current first horizon, linked to emerging future patterns) is no easy task. SUSTAIN helped build recognition that rapidly emerging conditions due to current climate change require a different approach than 'business as usual'. Moving from the 'business as usual' approach is the starting point to move to the second horizon (Sharpe et al. 2016). Although some case studies have tried innovations and creative activities, actions that are typical of the second horizon (Sharpe et al. 2016), the SUSTAIN project as a whole has not reached that transitional horizon (see Text S2.5). We argue that challenges to reaching the third horizon will grow even further with the current attempts to achieve ecosystem-based management. Within a strategic foresight approach, ecosystem-based management will require the resolution of numerous compromises among the various stakeholders, bringing even more 'turbulence' in the second horizon, and making it even more difficult to move to the third horizon. A further challenge is that all steps of the strategic foresight process are unlikely to be fulfilled within the timeframe of most research projects, as occurred in SUSTAIN (see Text S2.5). Still, we think this process that considers the view of all stakeholders is effectively designed for planning for an unpredictable future and obtaining a more functional future view to help anticipate surprises and build more resilient systems.

Even though most case studies did not reach the last steps of the strategic foresight within the SUSTAIN project, we are expecting the results to have numerous influences on current management and monitoring because many objectives have been developed hand-in-hand with a panel of stakeholders. This is particularly true in the terrestrial arctic systems studied (see Mellard et al. 2022 in this Special),

for which strong bonds have been developed between scientists and stakeholders. For SUSTAIN case studies in the terrestrial arctic, strategic foresight was established and is likely to be maintained in the long term because it will be implemented as an integral part of the Climate-ecological Observatory for Arctic Tundra (COAT, Ims & Yoccoz 2017). In the end, the success of such an endeavour depends on both people and facilities. For COAT, social capital among all participants involved has been built directly from the start, and protocols, infrastructures, and analytical tools are already in place to enable such capital to be maintained and lead to further progress.

SUSTAIN has targeted 2 key features identified as necessary to foster learning (Gerlak et al. 2020, p. 661), namely 'a face-to-face dialog that is open and ongoing' through various types of meetings and discussion channels (see Text S2), and the 'investment in institutional rules, norms, and shared strategies for intentional learning' through the long-term institutional commitment that SUSTAIN has triggered. In the specific context of environmental policies, 'targeted mechanisms to acquire, translate, and disseminate knowledge into new policies are critical for adaptive environmental governance' (Gerlak et al. 2020, p. 653). Nonetheless, even though theories about learning in environmental governance have greatly increased recently, Gerlak et al. (2020, p. 653) argued that we still lack 'an examination of how these insights can inform practice'. We view this opinion paper as a contribution to 'informing practice', through the lens of scientists involved in specific case studies within a large research initiative driven by a strategic foresight umbrella. Here, we list our recommendations based on the the key lessons we have learned:

- Start the strategic foresight process as early as possible, preferably when the research proposal is elaborated.
- Aim at building strong social capital and do not underestimate the time and willingness it will require to reach it – it takes time to establish trust.
- Provide a diversity of occasions to meet and discuss, to ensure that various stakeholders will commit to the project and their needs will be met.
- Use direct and dynamic communication channels and develop the communication plan with all actors.
- Pay attention to stakeholder expectations and take rapid actions to fulfill them.
- Research leaders and funders should give scientists, especially those in early careers, due credit for contributing to stakeholder involved projects.

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