Title

Envisioning desirable futures for Arctic biodiversity to overcome “doom and gloom”

Authors

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Abstract

"Doom and gloom" has become a dominant narrative about the impacts of climate change on the Arctic and its unique cold-adapted biodiversity. However, recent work highlights that such narratives can prevent us from being proactive and taking the steps needed to create the best possible future. Visioning of "desirable" futures can help overcome negative mindsets and inspire transformative action. We co-created visions of desirable futures for Arctic biodiversity during a workshop including representatives from academia, Indigenous Peoples, business and policymaking. Appreciating our diverse perspectives, we identified common themes in our visions: governance, biodiversity-climate interactions, co-management of ecosystems, economy and infrastructure, and food security. Using backcasting, we determined high-level actions that would enable the positive outcomes shared by our visions: boosting education, rethinking Arctic biodiversity governance, elevating voices of Indigenous Peoples and voices of local communities, developing scalable monitoring systems, and evaluating impacts of policies and economic activities. Many of us reported a positive shift in attitude and feeling empowered after the workshop. Co-creating visions with a diverse group was perceived as particularly valuable. We report the workshop method and, building on our experience, encourage people from all backgrounds to envision and co-create the best possible future for Arctic biodiversity.

Key words: biodiversity, Arctic, desirable futures, transformative change, co-creation

Main text

The Arctic is one of the most rapidly changing regions on the planet, warming at three times the globe average (Zhou et al., 2024). This warming increases the accessibility to the region and accelerates human activities (AMAP, 2021a) including industrial development (Akandil et al., 2024). These changes have profound impacts on biodiversity and the livelihoods of people that depend on it. They endanger cold-adapted species and the resilience of ecosystems, they increase the likelihood of the spread of invasive alien species and pathogens, and they trigger losses in nature's contributions to people, including the mitigating role of many Arctic ecosystems in global climate-feedbacks (AMAP, 2021a). For example, warming causes range shifts in cold-adapted Arctic species, which move north until they reach biophysical limits, while sub-Arctic species move in from the south, resulting in a narrowing of the area occupied by Arctic species (CAFF, 2013). Additionally, the Arctic is experiencing rising pollution levels and new contamination sources are emerging (AMAP, 2021b). All this is happening in the context of colonial histories (Schlosser et al., 2022) in a populated region subject to geopolitical tensions, complicating governance and policy-making (Avango et al., 2013). Together, these changes paint a bleak picture; mirroring the broader climate and biodiversity discourse, the future of Arctic biodiversity is commonly framed as one of “doom and gloom” in media, funding proposals, and scientific publications (Lemelin et al., 2010; Swaisgood, 2010; Hinkel et al., 2020; Eerkes-Medrano & Huntington, 2021). However, this narrative can prevent people from being proactive and taking the steps needed to create the best possible future for Arctic biodiversity.

Visioning of “desirable futures” is increasingly recognised as a powerful approach to overcome a “doom and gloom” mindset and facilitate the (transformative) changes needed to address the challenges of the Anthropocene, including biodiversity loss (Wyborn et al., 2021). Desirable futures are those that improve the chances of our societies to overcome and/or

adapt to current crises (Bai et al., 2016) and thrive in coexistence with nature. Futuring allows us to openly explore and evaluate pathways for achieving more liveable futures in an uncertain world (Kim et al., 2023) and can inspire change and innovation (De Smedt et al., 2013). The value of desirable futures has been recognised in the context of global biodiversity loss (for example, “Nature Futures Framework” - Durán et al., 2023; Kim et al., 2023) and in Arctic contexts (for example, “Rights for Life” - Sarkki et al., 2023). Inspired by this, we set out to co-develop our visions of desirable futures for Arctic biodiversity during a one-day workshop to help us overcome “doom and gloom”, stimulate change and enable backcasting (sensu Dreborg, 1996), allowing us to identify actions that could make our visions reality.

To explore what desirable futures for Arctic biodiversity could look like, we (the co-authors) organised, facilitated and participated in a one-day workshop including representatives from natural- and social-sciences, Arctic residents (including Indigenous and non-Indigenous people), academia, policy making and business. We included industry-based experts on workshop facilitation to maximise the chances of success and open links to the business-sector. The workshop took place during the 3rd World Biodiversity Forum (WBF2024) in Davos, Switzerland, and had three aims: 1) enable participants not familiar with future visioning to actively imagine “desirable futures” in the context of Arctic biodiversity; 2) co-identify shared themes in these futures and 3) sketch out high-level recommendations that could make them reality. We captured the outcomes in this manuscript, which was co-authored by all participants, organisers and facilitators (one participant declined co-authorship).

The workshop consisted of individual and group activities with a focus on co-creation (Figure 1 and 2, Box 1). We started with a primer on “desirable futures” and three “Arctic biodiversity stories” to set the scene. These stories illustrated marine biodiversity in fishing villages, the annual cycle of subsistence living in a Greenlandic community, and challenges faced by reindeer herders in Europe. Next, each of us developed their own vision of a desirable future using an imaginative phone call made ten years from now. We shared these visions in small

groups and identified common themes. We then built out each theme in small groups and identified actions that could make our visions reality. We finished with a recap in the plenary and participants made individual commitments. Thus, the workshop allowed us to capture differences and commonalities in our visions of desirable futures for Arctic biodiversity, deepen our understanding of shared themes and identify actions that could enable them.

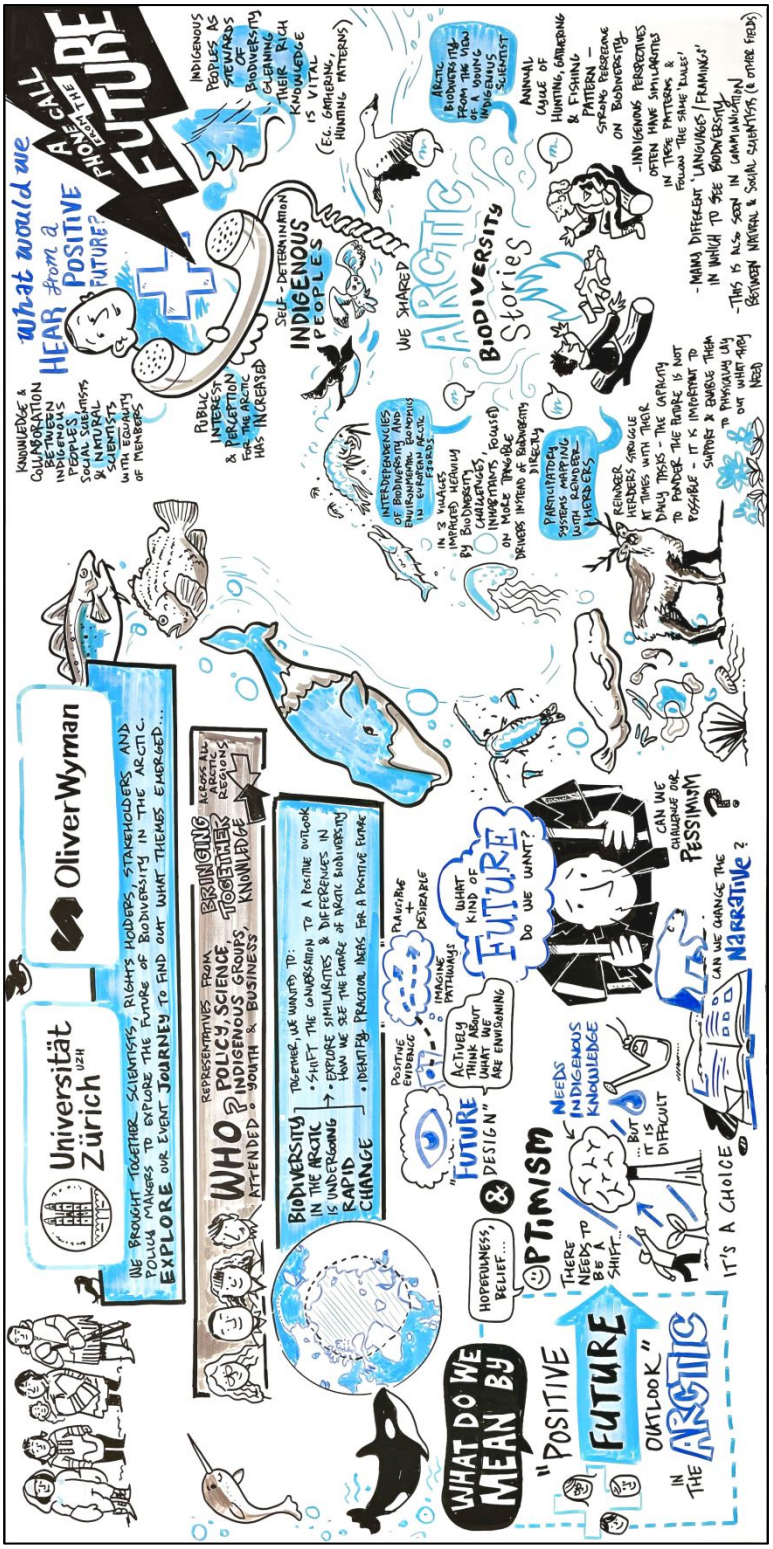

Figure 1: Workshop workflow and outcomes - Panel 1: Motivation and visioning. After introducing the motivation for visioning desirable futures for Arctic biodiversity (left), we set the scene with three "biodiversity stories" (bottom-right) and used an imaginary phone call made in the future to develop our individual visions (top-right). Artwork by Oliver Prothero.

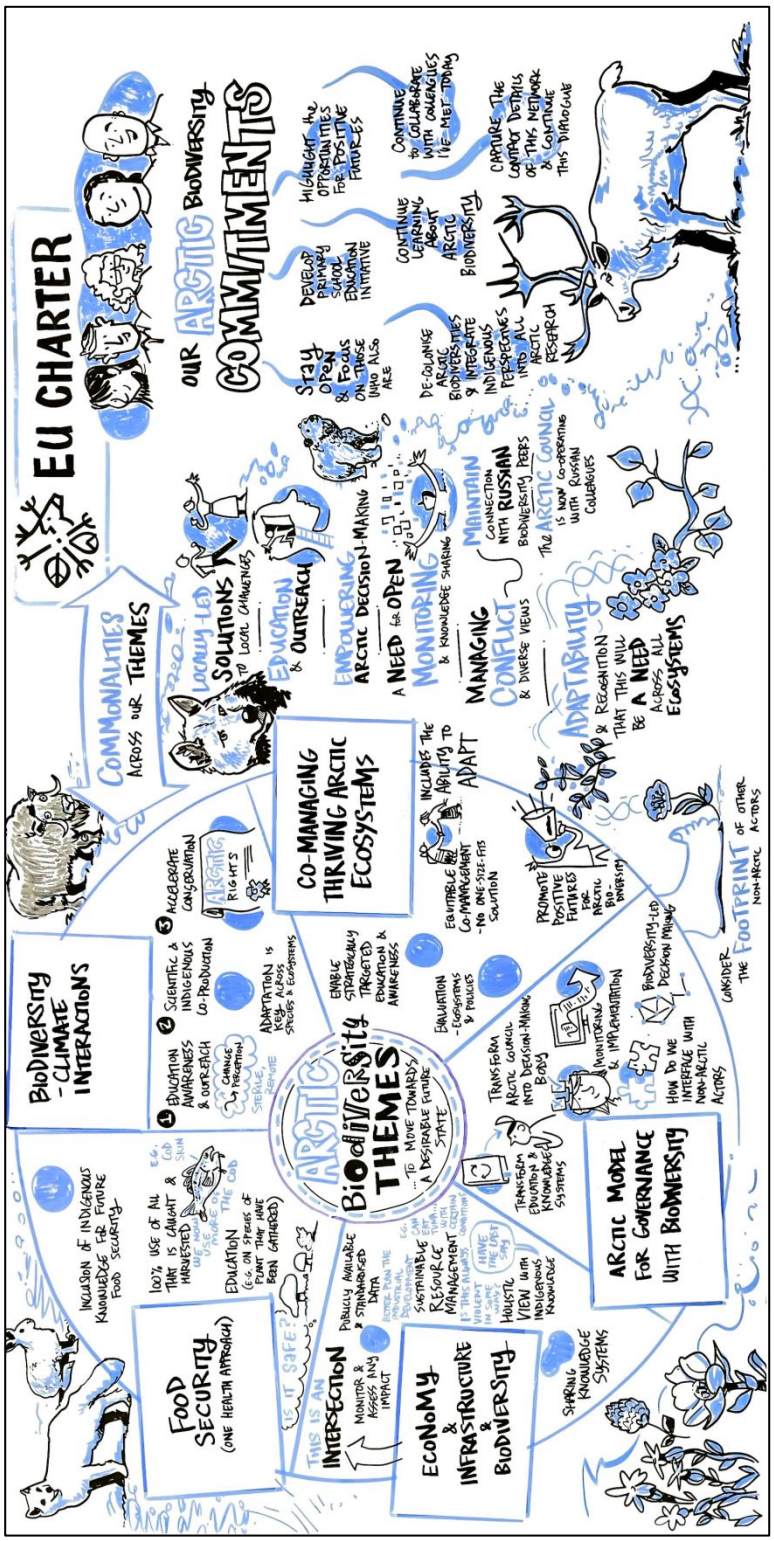

Figure 2: Workshop workflow and outcomes - Panel 2: Biodiversity themes and commitments. After the introduction and setting the scene (Figure 1), we identified five themes common to our visions (left) and defined actions that could help make our visions reality (centre). Inspired by the day, many of us made personal commitments (right). Artwork by Oliver Prothero.

Box 1: Overview on workshop design and method.

Motivation and background

The idea for the workshop originated in a team of natural scientists from the University of Zurich, Switzerland, within the context of the EU project CHARTER (https://www.charter-arctic.org) and evolved as a cross-sector collaboration with design thinking experts from Oliver Wyman (London, UK). Inspired by the development of the Nature Futures Framework (Kim et al., 2023), we were curious about the potential of desirable futures to stimulate positive change for Arctic biodiversity. We identified the World Biodiversity Forum 2024 as a venue for the workshop and, given limited time and resources, decided on a one-day format. The workshop was run on 16 June 2024 under the title "WS-15 (Workshop): Building pathways towards desirable futures for Arctic biodiversity – a design thinking workshop".

Design process, attendance and authorship

The workshop structure and prompts were designed by the workshop organisers (scientists from the University of Zurich) and facilitators (experts from Oliver Wyman) prior to the event and adapted during the workshop based on feedback from the participants. Everyone attending the workshop, including the participants (n = 20), facilitators (n = 6) and organisers (n = 2), was invited to join the manuscript as a co-author. This invitation was accepted by everyone except for one person (see acknowledgements).

Objectives

The workshop had three objectives: 1) enable participants to actively imagine desirable visions of the future, 2) co-identify important themes for developing nature-positive scenarios for Arctic biodiversity, and 3) sketch out high-level actions that could enable these. The workshop was announced on the conference website in November 2023, open for registration to everyone. In addition, the organising team reached out through their professional networks, inviting representatives of various groups by email for registration and participation .

Workshop structure

The workshop ran over eight hours, which were split into four sections with twelve sub-modules (Table S1). The first section (30 min) was designed to establish a welcoming atmosphere and a safe space, including an

icebreaker and a short presentation on housekeeping. Here, the participants, organisers and facilitators agreed on a code of conduct and the procedure for the use of the workshop outputs in this publication (Figure S1), including co-authorship.The second section (60 min) was designed to provide participants with the context for the day. This section started with a panel discussion introducing the theory and motivation behind desirable futures and concluded with a set of three “Arctic biodiversity” stories told by pre-briefed participants. During the introductory panel we noted that a degree of change is already “locked in” for Arctic systems, a consideration that participants were free to incorporate into subsequent discussions. The bulk of the day was reserved for the third section (5.5 hours), which was designed to achieve the core objectives of the workshop, including an individual exercise to develop personal visions (phone call from future) and two sets of group work (groups self-assigned) to identify common themes and potential actions (details below, prompts and examples in Tables S2-S11 and Figures S2-S11). Finally, the day was closed with a recap in the plenary, where each participant was asked to fill out a feedback survey and make a voluntary personal commitment for Arctic biodiversity. An experienced facilitator guided the participants through all activities and moderated discussions.

Imagining of personal visions

As the core exercise of the workshop and foundation for the subsequent discussions and backcasting, the participants imagined their personal vision of a positive future for Arctic biodiversity. To help make the task tangible, the participants were prompted to envision a phone call to a friend, family member or colleague made 10 years in the future (prompt: Figure S2). The participants were asked to imagine that they had just finished attending another instance of the World Biodiversity Forum conference and that things had shifted to the better for Arctic biodiversity – What would they tell the recipient of their phone call? Examples of the personal visions are provided in Figures S3-S6.

Identification of “biodiversity themes"

The participants then shared their visions in groups of five (prompt: Figure S7) and identified the top five themes that a) were common to their visions, and b) which the group believed would be important to discuss further (prompt: Figure S8, results: Table S2). The facilitation team and organisers collected the results and pre-grouped them into five umbrella themes, which we discussed and adjusted in the plenary (results: Figure 1).

Building out “biodiversity themes” and backcasting actions

The participants then built out the themes in structured small group discussions (prompt: Figure S9). Here, the aims were two-fold: 1) to identify the current state of knowledge as well as risks of not doing anything (results: Tables S3-S7), and 2) to identify potential actions to be taken that could make a positive future more likely using backcasting (results: Tables S8-S11). Please note that the term "backcasting" here does not refer to a specific type of structured methodology but to a general approach to aid the process of discovery (Dreborg, 1996). Participants self-selected which theme they would like to work on. After approximately 1 hour the groups temporarily split up to provide feedback to each other (prompt: Figure S10). One or two members of each group stayed back to report while all other group members chose a theme to visit and provide feedback on. Finally, the groups reported out their build-out themes and actions in the plenary (5 minutes per group).

Capture and synthesis of information

The content generated during the workshop was captured in writing and with photographs. Plenary discussions were recorded by a note taker and content from other activities were recorded in writing by participants and then photographed by the facilitation team. In addition, artist Oliver Prothero captured the activities and outputs in the form of live-drawn scribe panels (Figures 1 and 2). The workshop organisers and facilitation team summarised the content and synthesised the key messages, which we all reviewed and edited during the write up of this manuscript.

We identified five themes that were common to many of our individual visions (Figure 2, Table S2-S7): 1) governance of Arctic biodiversity; 2) understanding of biodiversity-climate interactions in the Arctic; 3) co-management to enable thriving ecosystems in the Arctic, 4) economy, infrastructure and Arctic biodiversity; and 5) food security and One Health in the Arctic. These themes are discussed as important issues in individual disciplines (for example, Akandil et al., 2024; Armitage et al., 2011; Barry et al., 2020; Ruscio et al., 2015; Schmidt et al., 2017), but addressing the associated challenges often requires cross-disciplinary and cross-societal approaches. While working across disciplines may seem daunting, there is strong potential for synergistic effects and co-benefits in the long-term (e.g., Two-Eyed Seeing). We also recognized the role of Indigenous knowledge for shaping resilient and inclusive strategies for Arctic biodiversity conservation (for example, Buschman and

Sudlovenick, 2023; Ksenofontov et al., 2019). In this context, the five themes provide a scaffold to develop more concrete visions in future workshops. Visioning exercises from other settings, such as the Korean Demilitarized Zone (Kim et al. 2026), illustrate how high-level themes can be operationalised into tangible biodiversity futures.

Despite the commonalities we also observed differences in our visions, often reflecting regional or disciplinary backgrounds (also Box 2). For example, some of our visions focussed on concrete and localised issues ("reindeer are thriving as traditional herding systems are maintained" and "lichen diversity is protected due to co-management of fires"), others on circum-Arctic and global aspects ("regions generating the majority of greenhouse gas emissions take responsibility for the damage they cause in the Arctic" and "the Arctic has become an important contribution for meeting global biodiversity targets"). These differences highlighted that pathways and solutions might not work everywhere or at all levels (one size does *not* fit all) and that it is important to coordinate across geographic regions and at - and across - all levels of societal organisation. We also observed a desire amongst us workshop attendants to co-create pathways towards desirable futures with representatives across disciplines (social sciences, natural sciences) and knowledge systems (academic, Indigenous). Our workshop, therefore, underlined the importance of recognizing the plurality of perspectives when it comes to the future of Arctic biodiversity, as only by doing so can we find actionable solutions that have broad support from all rights- and stakeholders.

Box 2: Despite commonalities amongst our visions, our perspectives on individual issues were diverse. Appreciating this plurality of perspectives will be critical when further developing visions and policies on Arctic biodiversity. In this box, some of us volunteered to share personal statements about their visions.

Recognizing the dual pressures of direct climate change impacts and the unintended consequences of mitigation efforts for Arctic Indigenous peoples such as the Sámi calls for an approach sometimes called knowledge coevolution. This involves creating adaptive, community-driven policies that not only preserve

biodiversity but also strengthen Indigenous knowledge and self-determination. By foregrounding Indigenous knowledge, fostering collaborative governance, and prioritizing localized, flexible solutions, these strategies can address both the ecological and socio-cultural challenges of a changing Arctic while ensuring the sustainability of Indigenous livelihoods.

Rauna Kuokkanen

80% of the world's biodiversity is found on Indigenous lands. Indigenous Peoples have been for millennia stewarding their lands and they are considered as the most effective stewards of biodiversity. Therefore, it is important to include Indigenous Knowledge in conservation efforts and policy-making processes.

Stanislav Ksenofontov

The Arctic is unique. It is full of vibrant, resilient life that is found nowhere else in the world. Many specialized species live here and we have a responsibility for their continued existence, which—in addition to intrinsic value—offer benefit, well-being and livelihood for those living in the Arctic. The Conservation of Arctic Flora and Fauna play an important role to address the conservation of Arctic biodiversity, and to communicate its findings to the governments and residents of the Arctic.

Inge Thaulow

The private sector has an important role to play in ensuring a healthy biodiversity in the Arctic. It matters to us all and will impact people and business if the biodiversity collapses.

Mads Qvist Frederiksen

New tools for monitoring of critical Arctic biodiversity are urgently needed as a fundamental tool in conservation. However, observation is no longer enough, given that there already is enough evidence for the identification of the underlying problem. The global society will need to reduce its environmental footprints; early education is (maybe the only) key to achieve understanding of this.

Kai Bischof

Working towards desirable futures at a systemic level requires that interdisciplinary work be a rigorous, primary directive rather than a nice-to-have supplement. The interstitial role of generalists and strategic translators can be built into long-term efforts, ensuring that insights (from workshops like this one!) are consistently woven back into ongoing workstreams or catalyse parallel, transformative interventions.

Irina Wang

Half of the terrestrial Arctic lies in Russia. The Russian invasion of Ukraine and its consequences has created a devastating gap in region-specific knowledge generation and transfer. Collaboration between Western and Russian researchers has almost collapsed and many Russian researchers opposing the war left Russia. I encourage studying the Russian Arctic by collaborating with researchers not supporting the invasion & using data and literature already available in Russian and other languages.

Vitalii Zemlianskii

Protecting Arctic Biodiversity, in all its complexity, means that we should not focus only on charismatic species, but on the entire tree of life. Aquatic fungi are pivotal for healthy aquatic ecosystems, but unfortunately highly overlooked. How many species of aquatic fungi are there in the Arctic? How many of them are threatened? All Biodiversity needs to be known, monitored and protected in desirable futures for the Arctic.

Isabel Fernandes

Solution-oriented research and policy decisions are pivotal to overcome the biodiversity and climate crisis, not only in relation to the Arctic. I believe that people need to be given hope that there is a solution, which only works if media and NGOs are not only showcasing the disasters and crises but also elaborate on the many good examples of possible solutions. Therefore, constructive reporting in the media and the solution-oriented work of NGOs is important to convince everybody to move into the environmentally positive direction.

Simon Jungblut

We determined three overarching actions that we believe would enable our desirable futures for Arctic biodiversity centred around the themes of education, decolonisation and governance (Figure 2, Tables S8-S11, no particular order): First, elevating the public perception of and fostering education efforts on Arctic biodiversity to raise awareness on its uniqueness and linkages to the global system (including feedbacks, long-distance impacts of consumption etc.). Second, recognising and amplifying voices of Indigenous rightsholders, as well as non-Indigenous Arctic residents, in all processes concerning the (co-)management of Arctic biodiversity - right from the beginning and across all organisational levels, to include knowledge and perspectives of all rights- and stakeholders. Third, rethinking the governance of Arctic biodiversity (structures, inclusivity, cross-disciplinarity) to recognise the importance

of localised solutions for a problem of global importance and responsibility. We think that enabling these actions could particularly benefit from input from educators, social sciences, rights- and stakeholders, policymakers and governance experts.

We identified two overarching actions that we believe would enable our desirable futures for Arctic biodiversity relating to the monitoring and understanding of ecosystems (Figure 1b, Tables S8-S11): First, the continued development of a scalable and comparable biodiversity monitoring programme across the Arctic to improve our ability to assess change and fill-in missing baselines. The Circumpolar Biodiversity Monitoring Programme (http://www.cbmp.is/) is well-established, but requires continued engagement and support from all parties involved, including funding commitments from nation states. Second, the structured assessment and re-evaluation of the effect and impact of policies, infrastructure development, and economic activities on Arctic biodiversity and livelihoods. Here, we suggest creating internationally comparable reporting and evaluation standards to enable better decision making for all activities with impact on Arctic biodiversity. We think that these actions will especially benefit from input from natural sciences, Indigenous Peoples, non-Indigenous Arctic residents, policymakers and business representatives.

Every small step counts on the path towards realising a desirable future for Arctic biodiversity. Many of the themes and actions that we identified are not new, but our workshop showed us that there is a need to increase their profile and couple them with transformative visions. By doing so, we believe that the relevant actors and decision makers (including us authors) can set the seeds needed to create those opportunities that will make our desirable futures reality. While the majority of us participating in the workshop felt pessimistic at the start of the workshop, many of us reported a change in attitude and felt empowered to make a personal commitment for positive action at the end of the day (Figure 2). We perceived co-creating visions for desirable futures as a group as particularly powerful and inspiring. We think that running similar workshops in a variety of contexts and with people not already involved in the

Arctic biodiversity discourse could broaden participation and increase the impact beyond the predominantly academic participants at the WBF2024 (Table S12), therefore reducing potential biases towards the abstract conceptualisation of the future that could have been created by the (self-) selection of our group. Future workshops would also benefit from including representatives from all backgrounds early in the workshop design. By sharing the method and outcomes from our workshop, we hope to inspire action and encourage people from all backgrounds, including the sciences, Indigenous Peoples, non-Indigenous Arctic residents, business and policymaking to come together, collaborate, envision and co-create a positive future for Arctic biodiversity.

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Author contributions

Jakob J. Assmann and Gabriela Schaepman-Strub conceptualised the workshop and manuscript. Jakob J. Assmann, Gabriela Schaepman-Strub, Anja H. Liski, Ann Chen, Cornelia Neumann designed the methodology for the workshop. Jakob J. Assmann, Gabriela Schaepman-Strub, Anja H. Liski, Ann Chen, Cornelia Neumann, Kai Bischof, Fiona Danks, Isabel Fernandes, Mads Qvist Frederiksen, Mariana García Criado, Ramona Heim, Malou Platou Johansen, Simon Jungblut, HyeJin Kim, Bjarni Kristófer Kristjánsson, Stanislav Ksenofontov, Rauna Kuokkanen, Niina Kuusanniemi-Abbotts, Hannah Mevenkamp, Julia Olsen, Karin Nutti Pilflykt, Divina Ryf, Irina Wang, Kevin White, Vitalii Zemlianskii contributed to the investigation. Jakob J. Assmann, Gabriela Schaepman-Strub, Anja H. Liski, Ann Chen, Cornelia Neumann, David M. Fischer, Malou Platou Johansen, Simon Jungblut, Lea Schaad,

Irina Wang contributed resources. Jakob J. Assmann, Anja H. Liski, David M. Fischer, Lea Schaad curated the data. Jakob J. Assmann wrote the original draft. All co-authors reviewed and edited the manuscript. Oliver Prothero visualised the outcomes. Gabriela Schaepman-Strub had the formal oversight for the project and provided mentorship to Jakob J. Assmann. Jakob J. Assmann, Anja H. Liski, Ann Chen contributed to the project administration. Gabriela Schaepman-Strub and Cornelia Neumann acquired funding.

Statement on inclusion

Our perspective piece brings together authors from many different countries, including authors based in the Arctic. While the idea for the workshop and manuscript, as well as the workshop design, were conceived by a sub-group of the authors, we ensured the workshop itself was advertised and open to anyone. We actively sent out invitations across the Arctic to ensure that a diverse set of perspectives was represented amongst the participants. We designed the workshop so that all participants were able to engage and could share their voices in a safe and open space. Additionally, we designed the workshop to incorporate flexibility to allow for adaptation of the planned activities based on input from the participants. All participants, organisers and facilitators were invited to contribute as co-authors to this manuscript. Whenever relevant, we cited literature by scientists from the region and ensured work from Indigenous scientists was represented.

Competing interests statement

This project received in-kind support in the form of services and materials from the Oliver Wyman Social Impact Programme. Cornelia Neuman, Anja H. Liski, Ann Chen, David M. Fisher, Oliver Prothero and Lea Schaad are employees of Oliver Wyman. All other authors have no conflict of interest to declare.

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Data availability statement

This manuscript does not report data.

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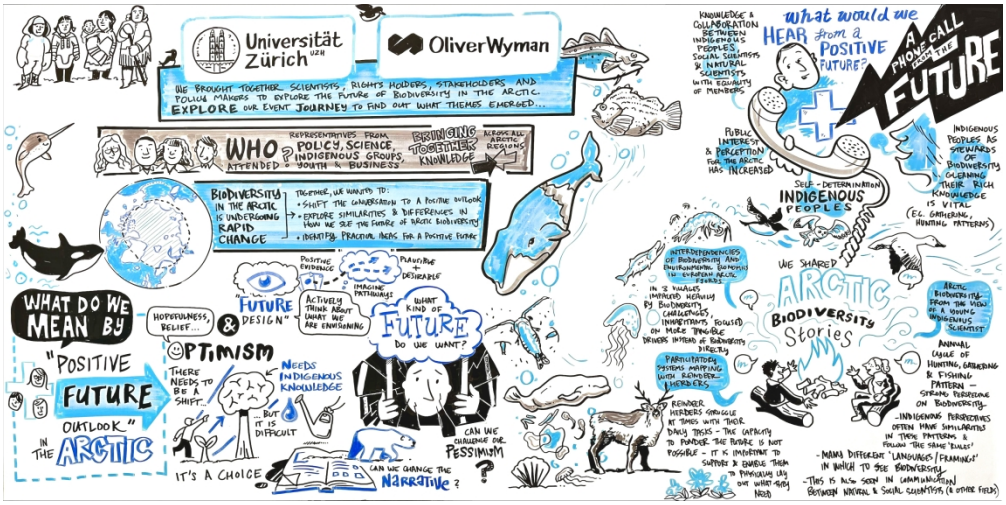

Workshop workflow and outcomes - Panel 1: Motivation and visioning. After introducing the motivation for visioning desirable futures for Arctic biodiversity (left), we set the scene with three "biodiversity stories" (bottom-right) and used an imaginary phone call made in the future to develop our individual visions (top-right). Artwork by Oliver Prothero.

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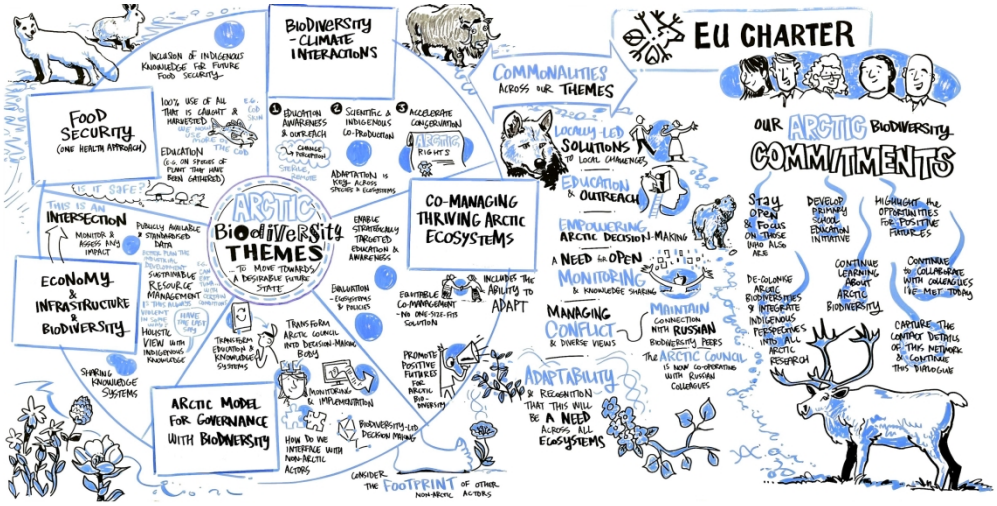

Workshop workflow and outcomes - Panel 2: Biodiversity themes and commitments. After the introduction and setting the scene (Figure 1), we identified five themes common to our visions (left) and defined actions that could help make our visions reality (centre). Inspired by the day, many of us made personal commitments (right). Artwork by Oliver Prothero.

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