



REPORT ON THE WORKSHOP 'FROM VISIONS TO SCENARIOS FOR NATURE AND NATURE'S CONTRIBUTIONS TO PEOPLE FOR THE 21ST CENTURY'

Led by the expert group and technical support unit on
Scenarios and Models of the Intergovernmental Science-Policy
Platform on Biodiversity and Ecosystem Services

March 2019, Vancouver, Canada



Netherlands Environmental
Assessment Agency

The Nippon Foundation
NEREUS PROGRAM
Predicting Future Oceans



PETER WALL
INSTITUTE FOR ADVANCED STUDIES
THE UNIVERSITY OF BRITISH COLUMBIA VANCOUVER

Report on the workshop 'From visions to scenarios for nature and nature's contributions to people for the 21st century'

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The Hague, 2019

PBL publication number: 3756

Corresponding author

Sana.Okayasu@pbl.nl

Authors

Sana Okayasu, Machteld Schoolenberg, Eefje den Belder, Laura Pereira, Garry Peterson, William Cheung, Carolyn Lundquist, Henrique Pereira, Sandra Verónica Acebey Quiroga, Ivon Cuadros, Kate Davies, Ana Paula Dutra de Aguiar, Tyler Eddy, Simon Ferrier, Karen Fisher, Maria Gasalla, Emily Giles, Zuzana Harmackova, Tim Hirsch, Sathyapalan Jyothis, Sylvia Karlsson-Vinkhuyzen, HyeJin Kim, Grygorii Kolomytsev, Jan Kuiper, Maria Gabriela Palomo, Ramon Pichs-Madruga, Osamu Saito, Theresa Satterfield, Bob Scholes, Fabrice Stephenson, Rashid Sumaila, Juan Jose Alava, Patricia Angkiriwang, Tayler Clarke, Hubert du Pontavice, Vicky Lam, Oai Li Chen, Ravi Maharaj, Muhammed Oyinlola, Juliano Palacios, Jennifer Rae Pierce, Tomoka Sweet, Colette Wabnitz

Contributors

Lilibeth Acosta, Rob Alkemade, Becky Chaplin-Kramer, Daniel Dunn, Shizuka Hashimoto, Justin Johnson, Alexander Popp, Roy Remme, Carlo Rondinini, Nadia Sitas, Esther Turnhout, Piero Visconti, Detlef van Vuuren, Simon Willcock

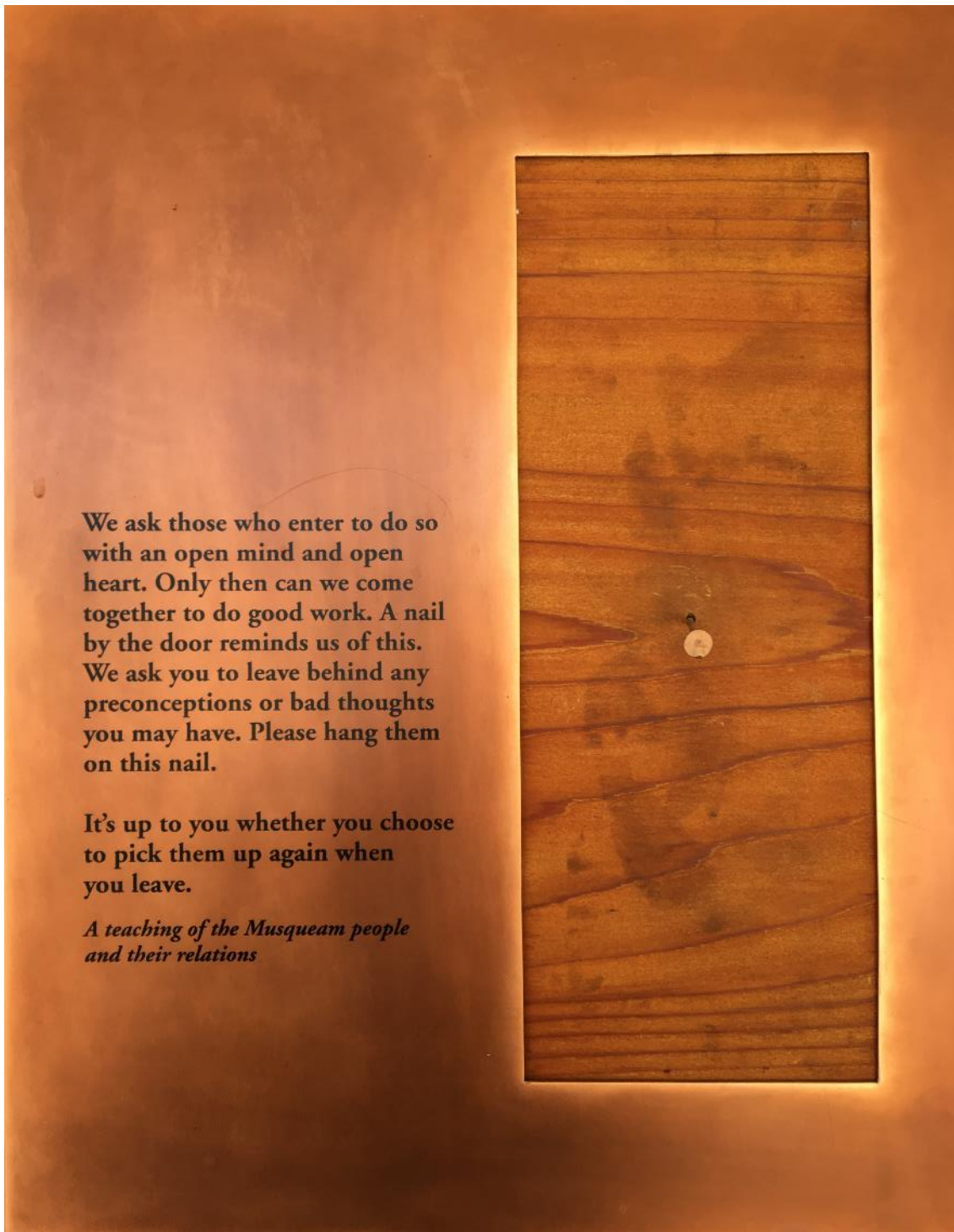
Acknowledgements

We would like to thank all experts who took part in this process, including those who contributed through the following roles.

Workshop organisation	Machteld Schoolenberg, Sana Okayasu, Eefje den Belder
Conceptual design and facilitation	Laura Pereira, Garry Peterson, Carolyn Lundquist, Henrique Pereira, Machteld Schoolenberg, Eefje den Belder, Sana Okayasu, HyeJin Kim, Jan Kuiper, Rob Alkemade
Logistical organisation	Sana Okayasu, Zhou Khabjane, Tomoka Sweet, Vicky Lam, Juan Jose Alava, William Cheung
Preparatory input	William Cheung, Juan Jose Alava, Tomoka Sweet
Writing - original draft	Sana Okayasu, Machteld Schoolenberg, Colette Wabnitz, Patricia Angkiriwang, Oai Li Chen, Tayler Clarke, Vicky Lam, Ravi Maharaj, Juliano Palacios
Writing - review & editing	Sana Okayasu, Machteld Schoolenberg, Eefje den Belder

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We ask those who enter to do so with an open mind and open heart. Only then can we come together to do good work. A nail by the door reminds us of this. We ask you to leave behind any preconceptions or bad thoughts you may have. Please hang them on this nail.

It's up to you whether you choose to pick them up again when you leave.

A teaching of the Musqueam people and their relations

Panel of the entrance of the cəsnaʔəm House at the University of British Columbia, Vancouver, Canada. Credit: Musqueam.

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Executive summary

The workshop entitled 'From visions to scenarios for nature and nature's contributions to people for the 21st century' was organized by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) expert group on scenarios and models and its technical support unit, and hosted by the NF-UBC Nereus Program, the Peter Wall Institute for Advanced Studies (PWIAS), and the University of British Columbia, Canada, from 25th to 27th March 2019 (and IPBES scenarios & models expert meeting on 28th & 29th of March). It aimed to build on the efforts supported by IPBES to develop a next generation of scenarios on positive futures for nature and people, incorporating potential synergies, trade-offs, and feedbacks between nature, nature's contributions to people, and human well-being. The workshop, attended by 43 participants, centred around the Nature Futures Framework that emerged from prior stakeholder consultations and explored the steps required for its further development.

The workshop allowed a familiarisation of the participants with the Nature Futures Framework and the three perspectives of *nature for nature*, *nature for society*, and *nature as culture*. The participants explored how each of these perspectives would shape the future, focusing on various cross-cutting issues, such as land and sea interactions, species diversity, indigenous and local knowledge, teleconnections, politics and power, or technology.

As a result, participants reached a shared understanding on how the Nature Futures Framework accommodates plurality in human-nature relationships, and makes explicit the value judgements that underlie the prioritisation of goals and the ways of addressing pressures, leading to synergies and trade-offs. Recurring topics of discussions were on:

- **Where the new generation of scenarios should focus within the Nature Futures Framework:** Participants debated on whether or not to prioritise the three perspectives of the Nature Futures Framework to build the narratives and conduct further modelling work, and whether these examples of futures would be useful to illustrate the range of possible options.
- **How to conceptualise the Nature Futures Framework and represent it visually:** Participants explored how to illustrate the concepts underlying the Nature Futures Framework in three different visual representations: i) a flow-chart of the drivers-pressures-responses-states relationships which lead to different future outcomes, ii) a tri-rectangular tetrahedron (one half of a cube split diagonally) visualising the three-dimensional state-space of the nature futures, where improvements can be made simultaneously along all three perspectives of the Nature Futures Framework, and iii) a spider diagram showing the different balances of priorities across the three perspectives. These three representations are complementary, each illustrating a different aspect of the Nature Futures Framework.
- **How to use the Nature Futures Framework:** Participants noted that there are various ways of using the Nature Futures Framework, either to identify the desired objectives, then the necessary actions, and finally the enabling conditions and policy options, or on the contrary, to back-cast from what pressures need to be addressed, what interventions are needed, then addressing the feedback loops and underlying issues.
- **Indicators and modelling of the scenarios:** Participants explored what kind of indicators would be important for each of the nature futures perspectives. They noted that some indicators would have a common desired trajectory for all perspectives, and suggested that common goals could serve as balancing guides for the trade-offs between the three approaches.

- **Drivers to consider in the scenarios:** Participants emphasised the importance of considering indirect drivers in this process of participatory scenario development, as it can lead to a new range of policies and responses that may otherwise not be visible.
- **Incorporating feedbacks into the scenarios:** Participants recognised a gap in assessments of how nature feeds back to the human world. They stressed the importance for the Nature Futures Framework to include key feedbacks from nature to policymaking and society, while considering diverse values and how these can create socio-ecological tipping points.
- **How the new scenarios could inform the post-2020 biodiversity agenda:** Participants suggested that different policy mixes and pathways would be a useful output of the scenarios. They emphasized the importance of having clearly identified and prioritised entry points for policy interventions when building a set of narratives.

The workshop concluded with a positive outlook on the future application and development of the Nature Futures Framework, with participants recognising the abundance of useful content which can be used for communication and policy support. Although the workshop did not reach consensus on where the new scenarios should be rooted within the Nature Futures Framework, participants appreciated the inclusive nature of the framework, which aims to cover many perspectives and ways of life, and which can be used as an inspiring tool. They recognized the challenge of bringing different perspectives together and integrating different disciplines into the nature futures scenarios in order to reflect the plurality of human-nature relationships. The workshop also served to identify important tasks for the next steps, including further clarifying the three nature futures perspectives, by clearly laying out what can be modelled and what needs to be explored further, and by complementing it with different policy interventions, key feedbacks, and quantitative and qualitative indicators at different time and spatial scales. Participants expressed hope that IPBES will promote participatory approaches that embrace plurality and understanding as a community of practice, and that it will support alignment with the Nature Futures Framework across its various lines of work.

The subsequent two-day meeting of the IPBES expert group on scenarios and models took stock of the workshop discussions and explored the way forward focusing on procedural matters. This served to clarify the processes for the continuation of the expert group's work under IPBES in the coming years, lay out the plans for upcoming workshops, and discuss potential funding sources.

Concrete outputs to be delivered by the experts

- A toolbox and template for the use of the Nature Futures Framework, consolidating the diverse values represented in the three perspectives, the visual representations of these perspectives, the participatory scenario-building process, and the metrics
 - A short paper introducing the Nature Futures Framework as a tool for understanding diverse values and participatory scenario-building
 - A paper on gaps and priorities in modelling, identifying what models already exist and what needs development for the modelling of nature futures
 - A long paper on the development process of the Nature Futures Framework and to elaborate on the methodologies used (as an elaboration of the short paper)
 - A paper on socioecological feedbacks to be incorporated into scenarios, including their conceptualisation and mobilisation of empirical evidence
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Introduction

Scenarios are powerful tools to envision how nature might respond to different pathways of future human development and policy choices. Most scenarios developed for global environmental assessments have explored impacts of society on nature, such as biodiversity loss, but have not included nature as a component of socioeconomic development. They ignore policy objectives related to nature protection and neglect nature's role in underpinning development and human well-being. This approach is becoming untenable because targets for human development are increasingly connected with targets for nature, such as in the United Nations Sustainable Development Goals.

This workshop, hosted by the NF-UBC Nereus Program, the Peter Wall Institute for Advanced Studies (PWIAS), and the University of British Columbia, on traditional, ancestral and unceded Musqueam territory, builds on the efforts supported by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) to develop a next generation of scenarios. These new scenarios are intended to incorporate alternative visions to reach the complex intertwined targets, including potential synergies and trade-offs between nature conservation and other development goals, as well as addressing feedbacks between nature, nature's contributions to people, and human well-being. We have used various participatory approaches since 2016 with stakeholders from relevant sectors and from the local to the global scale, to identify visions on the future of nature. From those exercises we have developed the so-called Nature Futures Framework, the centre of discussions during this workshop, for the further development of new scenario narratives. Ultimately, the new generation of scenarios are intended to support future assessments conducted by IPBES.

Background materials

1. Lundquist et al. (2017) Visions for nature and nature's contributions to people for the 21st century (report of the stakeholder workshop held in Auckland)¹
 2. PBL (2018) Next Steps in Developing Nature Futures (report of the expert group meeting held in The Hague)²
 3. Rosa et al. (2017) Multiscale scenarios for nature futures³
 4. Kim et al. (2018) A protocol for an intercomparison of biodiversity and ecosystem services models using harmonized land-use and climate scenarios⁴
 5. IPBES (2016) Summary for policymakers of the methodological assessment on scenarios and models of biodiversity and ecosystem services⁵
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¹ <https://www.niwa.co.nz/coasts-and-oceans/research-projects/ipbes-nature-futures-workshop>

² <https://www.pbl.nl/en/publications/report-on-the-workshop-next-steps-in-developing-nature-futures>

³ <https://www.nature.com/articles/s41559-017-0273-9>

⁴ <https://www.geosci-model-dev.net/11/4537/2018/>

⁵ <https://www.ipbes.net/assessment-reports/scenarios>

Aims and structure of the workshop

Aims

The overall aim of the workshop is to build on the Nature Futures Framework that emerged from stakeholder consultations, adding to the development of narratives for the next generation of scenarios from a nature perspective.

The expected outcomes of the workshop were:

- Reaching a shared understanding of the Nature Futures Framework and its potential uses
- Defining the next steps from storylines to modelling trajectories at different scales
- Exploring the important elements of the scenarios for existing and planned models and identifying important indicators and dynamics to consider
- Making connections with ongoing discussions on the post-2020 agenda of the United Nations Convention on Biological Diversity and the Sustainable Development Goals

Structure

The workshop consisted of two parts:

1) An expert workshop on the Nature Futures Framework

A three-day workshop bringing together the members of the IPBES expert group on scenarios and models and a range of stakeholders both from the modelling communities and other groups with experience in developing scenarios

2) A meeting of the IPBES expert group on scenarios and models

A two-day meeting for the expert group to take stock of the discussions and plan the way forward and identify specific tasks that lie ahead

A total of 43 experts attended the three-day workshop. The group was of a balanced gender composition, and of diverse geographical backgrounds: 42% from the Americas, 28% from Asia and the Pacific, 23% from Europe and Central Asia, and 7% from Africa.

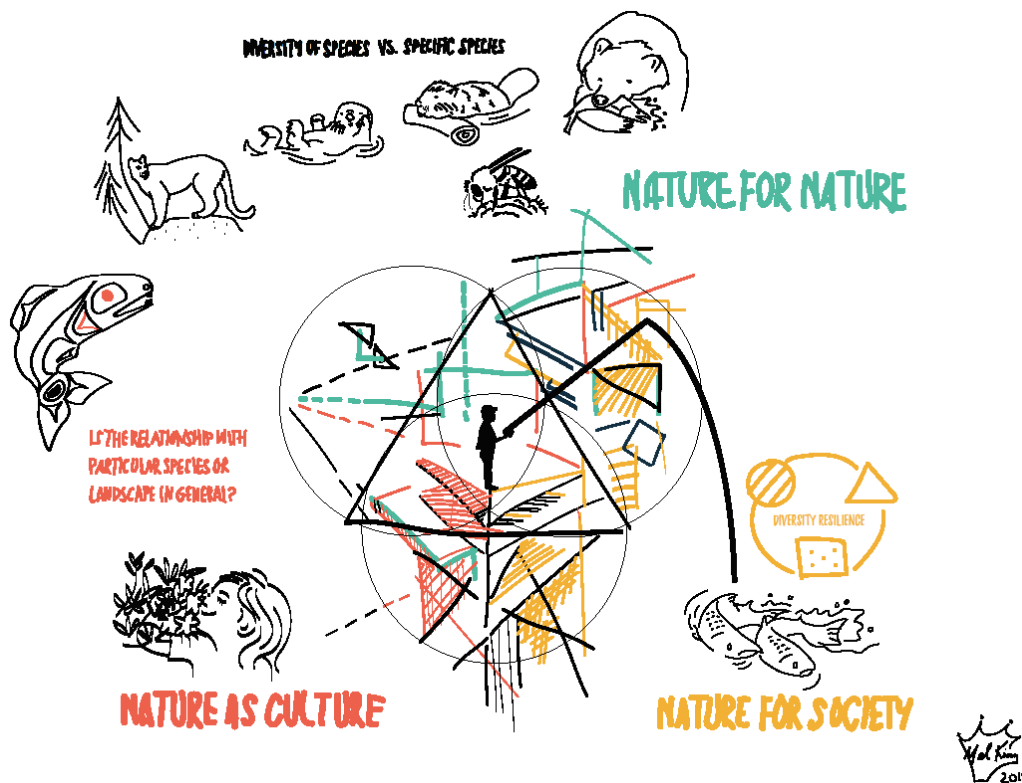
Keywords used in the workshop

“Seeds” are innovative initiatives, practices and ideas that are present in the world today, but are not currently widespread or dominant (Bennett et al., 2016⁶; Lundquist et al., 2017¹).

“Visions” are built on the different seed initiatives from which inspirational stories of sustainable, equitable futures can inspire us to move toward the values and ideals of a “good Anthropocene” (Bennett et al., 2016, Preiser et al., 2017⁷).

“Storylines” are qualitative narratives which provide the descriptive framework from which quantitative exploratory scenarios can be formulated (IPBES glossary⁸).

“Scenarios” are representations of possible futures for drivers of change in nature and nature’s contributions to people (IPBES, 2016⁹), combining storylines with model projections and expert analysis.



⁶ Bennett, E.M., Solan, M., Biggs, R., McPhearson, T., Norström, A.V., Olsson, P., Pereira, L., Peterson, G.D., Raudsepp-Hearne, C., Biermann, F. (2016) Bright spots: seeds of a good Anthropocene. *Frontiers in Ecology and the Environment*, 14(8): 441–448.

⁷ Preiser, R., L. M. Pereira, and R. Biggs. 2017. Navigating alternative framings of human-environment interactions: variations on the theme of ‘Finding Nemo.’ *Anthropocene* 20:83-87. <http://dx.doi.org/10.1016/j.ancene.2017.10.003>

⁸ Accessible from: <https://www.ipbes.net/glossary>

⁹ IPBES (2016): The methodological assessment report on scenarios and models of biodiversity and ecosystem services. S. Ferrier, K. N. Ninan, P. Leadley, R. Alkemade, L. A. Acosta, H. R. Akçakaya, L. Brotons, W. W. L. Cheung, V. Christensen, K. A. Harhash, J. Kabubo-Mariara, C. Lundquist, M. Obersteiner, H. M. Pereira, G. Peterson, R. Pichs-Madruga, N. Ravindranath, C. Rondinini and B. A. Wintle (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 348 pages. Available from: <https://www.ipbes.net/assessment-reports/scenarios>

Daily workshop report

Report from DAY 1 (Monday 25th March)

Opening remarks from the workshop host

William Cheung welcomed the participants and thanked the NF-UBC Nereus Program, the Peter Wall Institute for Advanced Studies (PWIAS), and UBC for hosting the workshop. Acknowledgement was made for the location of the workshop which was held on the traditional, ancestral, and unceded territory of the Musqueam people. Participants were requested to follow the Chatham House rule assuring the anonymity of statements made during the discussions. Dissemination of the event on social media was welcomed, provided participants use the hashtag #NatureFutures.

Welcome remarks from the expert group co-chairs

On behalf of both co-chairs, Henrique Pereira welcomed all participants and introduced the history of the IPBES expert group on scenarios and models and its participatory scenario building process which aims to develop a novel scenario for biodiversity and ecosystem services, or what is referred to as 'nature futures'. This process started in 2016 with a workshop hosted by iDiv, followed by the development of 7 nature futures visions in the Auckland workshop in 2017, subsequent stakeholder consultations, the development of the Nature Futures Framework at the 2018 expert group meeting in the Hague, and further stakeholder consultations in 2018. Alongside this scenario building exercise, the expert group has also contributed work for the IPBES global assessment, which is due for publication after the 7th meeting of the IPBES Plenary this year. The work of this expert group has also impacted academia, with publication of papers on scenarios and models and new research funding opportunities (e.g. BiodivERsA call linking to nature futures objectives). The challenge from here is to identify how to use our experience to define a set of scenarios to be delivered to modelling experts. This will also require the identification of key elements that need to be included in those scenarios (indicators, targets, drivers and feedbacks) as well as key challenges for biodiversity and ecosystem services. As existing biodiversity modelling at local and global levels may not encompass the diverse aspects covered in the nature futures, this work will also be of importance to the post-2020 framework of the Convention on Biological Diversity.

Introduction to IPBES

A brief introduction on IPBES was given to participants by Eefje den Belder of the IPBES technical support unit on scenarios and models, who explained that IPBES is for biodiversity what IPCC is for climate change. IPBES' main outputs are assessments on specific themes relevant to biodiversity and ecosystem services, and the primary audience is composed of governments and decision makers. The assessments are peer-reviewed by scientists, governments, and stakeholders, and the operating principle is to have an inclusive process to ensure credibility and relevance. Within the scenarios and modelling work conducted by IPBES, it is also important that end users can recognize themselves in the values of these new scenarios.

Speed talks

As part of the preparation for this workshop, participants were requested to consider two questions related to the reading material, and to present their answers in a short speed talk. The aim was to collect from all participants their understanding of the Nature Futures Framework and their opinion on what new scenarios should address. The questions were:

- Based on your understanding of the Nature Futures Framework, what new nature futures scenarios are needed? (thinking especially of the ecosystem or area where you work, if applicable)
- What are the most important dynamics, variables, processes, feedbacks or drivers that should be included in the next generation of scenarios, but are not well represented in existing scenarios?

In their responses, participants pointed to the need for scenarios that cover the impact of large collective actions on biodiversity change, identify targets on indirect drivers that countries can act upon, and show the cost of implementing policy interventions. This would allow decision makers to understand and tap into the potential to bend the curve on biodiversity and climate change. Many participants agreed that the new scenarios should accommodate diversity and plurality, taking into account differences among regions, ways of thinking and living, and types of dependence on nature. They emphasised that new scenarios should illustrate how the three perspectives of the Nature Futures Framework affect the role of biodiversity and ecosystem services for socio-economic development and human wellbeing. They agreed that scenarios should include diverse types of motivations for behaviours and policies, and highlight the role of biodiversity in maintaining ecosystem services. They should cover not only sustainability transitions but also transformations across domains such as politics and technology, and incorporate these in socioeconomic terms. Participants expressed hope that the new scenarios could incorporate complex dynamics and cross cutting issues such as gender, intersectionality, and other socio-ecological drivers.

In terms of overall approach, participants noted that scenarios should allow for positive options and uplift examples of positive influence of humans on nature. They also pointed out that the scenarios should explicitly address a degrowth paradigm which includes both conservative (cultural-historic identity, heritage, value - native biodiversity) and progressive approaches (dynamism, emergence, reorganization).

The importance of ensuring that the scenarios are inclusive of diverse knowledge systems and integrate indigenous and local knowledge with scientific knowledge was also repeatedly mentioned. They also emphasised that the scenarios should incorporate the impact of knowledge, including the loss and revival of traditional knowledge, biodiversity literacy, citizen science, awareness-raising, and mainstreaming, as well as the effects of a culture of data- and information-sharing that can lead to improved science to inform policies. In order to ensure that new scenarios respect and illustrate diverse ways of relating to nature and biocultural diversity, some cautioned against excessive focus on quantitative reporting.

Ensuring a broad sectoral coverage was also mentioned as an important element of new scenarios, including engagement with business and industry interests to ground the scenarios in practice, and to illustrate how to integrate nature conservation goals and sectoral development strategies (especially agriculture and food). Education and technological development were also repeatedly mentioned as important sectors for improvement and investment, in particular the role of education in people's experience of nature and how this changes over time.

Various ecosystem types were given emphasis by participants, especially oceans, due to the prevalence of marine scientists in the room. Some also mentioned freshwater biodiversity as an area requiring further work, as it is not sufficiently addressed in global scenarios, while others pointed to rural areas with abundant cultural and natural heritages, or to cities as areas reshaping how people interact with nature and shape global and regional dynamics.

Of particular interest was the issue of values underlying people's relationships with nature. Many hope that this scenario-building process would lead to scenarios which explicitly address the linkages between peoples' relationship with nature, how they value nature, and outcomes in land-use, consumption patterns, and other interactions with nature. The expectation is that by making explicit the values underpinning decision-making processes, the current disconnect between people's daily actions and the environment could be overcome. A balance would need to be struck between seeking to quantify many aspects of the scenarios, and ensuring that they are as inclusive as possible of diverse values. Stronger linkages with the values-related considerations across other IPBES processes is needed.

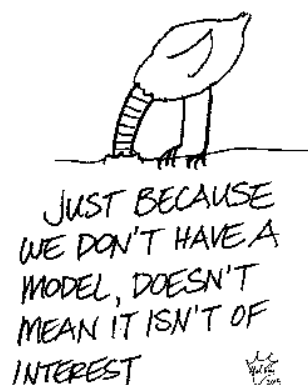
Another recurring topic was on the need for scenarios that bridge different scales, both physically and temporally. Scenarios would need to incorporate key global economic trends such as trade, finance, investments, cultural shifts, and illustrate their implications for nature at regional and local scales. Many modellers recognised the need to imagine nature futures for different landscapes and the implications at the global and national levels, for different sectors, and to link them to local biodiversity models, as models differ per scale. They suggested the use of Integrated Assessment Models at the global scale, but local ecosystem models and knowledge would need to be incorporated to determine local outcomes.

In terms of dynamics, variables, and processes to cover in the new scenarios, participants identified a long wish list centred around diverse human-nature interactions. Many mentioned interactions between people and oceans as an important element, manifesting through nutrient and material flows, land-sea interactions, changes in agricultural production and consumption patterns, trade, and governance. Urbanisation and rural-urban interactions were also emphasised. Changes in demographics such as depopulation, compacting of cities, and aging are also elements indirectly impacting nature and human wellbeing. Participants were also interested in including changes in governance and conservation strategies in the scenarios, particularly inequality in land ownership and how it shapes land use dynamics. They emphasised that new scenarios should explicitly address new business models, as they have a strong impact on public opinion, discourse, and trade, and in turn affect people's interactions with nature. Participants also hoped to include investment in and access to education, particularly environmental education, into the scenarios to indicate how people's experience of nature is impacted, as well as how activities in the space beyond cities (infrastructure, inland waterways, energy projects, recreation, industry) shape biodiversity. Others were interested in incorporating societal shifts, such as gender and inequality, social inclusiveness, rise of populism and nationalism, xenophobia, lack of trust in authorities, violations of human rights, and relationships with technology.

Some negative drivers of change were frequently mentioned as key elements to include in the new scenarios, namely climate change, pollution, and invasive alien species. On climate change, participants referred to the interaction of climate change and ocean dynamics, and to the combined impact of climate change and biodiversity through biophysical and atmospheric effects on societies, and through the impact of climate mitigation and adaptation measures on biodiversity. On pollution, they emphasized the impacts of agrochemicals on biodiversity (i.e., life in soil, water, natural pest control, and pollination), and on invasive alien species, they mentioned the need to cover the socioecological impacts.

Strong emphasis was placed on the inclusion of diverse feedback loops in the new scenarios. These included feedbacks of environmental health on human wellbeing with examples of links between mental health and experience of greenspaces, and physical health and nutrition, feedback of people's values on specific species or issues affecting their outcome, feedback of people's experience of nature on how they value nature, feedback of biodiversity on ecosystem function, and cumulative effects of combined feedbacks.

Throughout these speed-talks, participants recognized the technical challenges accompanying their ambitions. Many related to the challenge of modelling non-quantitative social and cultural ecosystem services, the diverse values which underlie them, and the perceptions of people on what constitutes nature and "wilderness" as components of novel Anthropocene ecosystems. Another major challenge is in reconciling scale mismatches, across governance and biophysical regimes, across physical and temporal scales, and across domains (land/sea). Modellers recognized the challenge of linking different systems of models to account for cross-scale dynamics of impacts, and socio-ecological responses to cumulative impacts, in order to better inform policy decisions. Others also recognized the challenge of ensuring plurality in a context where scenarios and models are biased towards 'decisions', and of engaging people who think differently about the world in the process.



Last but not least, participants recognized the importance of linking this scenario-building process to policy impact, and explored possible channels such as GBO5 and the CBD discussions on the post-2020 agenda. Overall, the nature futures discussions were recognised as responding well to the conclusions of the SBSTTA 21 recommendation 21/1¹⁰ on scenarios for the 2050 vision, welcomed in COP14 decision 14/2¹¹. Participants were also interested in how the nature futures scenarios align with the new generation of scenarios led by other global research initiatives such as The World in 2050 (TWI2050), representing integrated pathways to the SDGs and beyond.

Presentation of the Nature Futures Framework

After the coffee break, Carolyn Lundquist gave a comprehensive presentation on the Nature Futures Framework on behalf of the co-chairs and the expert group. The rationale for launching this participatory scenario building exercise was the recognition that despite scenarios being useful tools for policy support, existing frameworks were limited mostly to assessing the impact of drivers on biodiversity ecosystem services, and typically lacked participation of broader stakeholders. The nature futures exercise has thus far produced 7 Visions for nature and nature's contributions to people for the 21st century, with a focus on the desirable futures and positive visions instead of negative ones. These explore societal ecosystem interactions - for policy and decision making - considering that these interactions are different based on context, experiences, locality. The consideration on what differentiates these led to the formulation of the Nature Futures Framework which highlights the three perspectives which underlie the visions.

¹⁰ <https://www.cbd.int/doc/recommendations/sbstta-21/sbstta-21-rec-01-en.pdf>

¹¹ <https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-02-en.pdf>

Following the presentation, participants were given time for informal discussions to digest and reflect on the concept of the Nature Futures Framework. This was subsequently complemented with a Q&A and discussion session in plenary. Through the discussions, important observations were made for the future communication of the Nature Futures Framework:

- Although the Nature Futures Framework is represented as a triangle, it encompasses more than the three perspectives of the corners since they are not mutually exclusive, and the full richness of the framework flows through its translation into diverse future visions.
- There is a strong affinity with the work done for the conceptualisation of diverse values of nature under the IPBES expert group on Values.
- It needs to be made very clear that the *nature for society* perspective also assumes a positive, sustainable scenario, and is not supposed to be interpreted as the negative opposite of the *nature as culture* and *nature for nature* perspectives, nor as the business-as-usual scenario.
- The Nature Futures Framework could bridge global and local scenarios, and modelling communities working at the different scales can help with that.

Participants also raised critical questions on the way forward:

- *How do we go from the existing visions to new scenarios?*
A vision can be seen as the goal, and scenarios need to also encompass how to move towards that goal. We live in a diverse world, with different relationships with nature, so we need to try to capture this diversity within the pathways towards the visions. Some policy instruments or options might fit best under specific perspectives. Thinking about what differences might exist across the different perspectives helps to recognize that there is a wide spectrum of possible approaches in moving towards a positive vision. Scenarios will not represent a single perspective or vision, but will have a different balance of the three perspectives.
- *Where in the Nature Futures Framework should scenarios be developed?*
One approach could be to have three scenarios, each representing the extreme perspective at the corners of the nature futures triangle, and a central one which represents a less extreme blend of the three perspectives. For example, by thinking of what urban or agroforestry systems could look like in each of the three extreme perspectives could illustrate the plurality of world views. Another approach could be to focus on the lines between the extreme perspectives. The following days of the workshop will serve to discuss what would be the most useful scenarios to have.

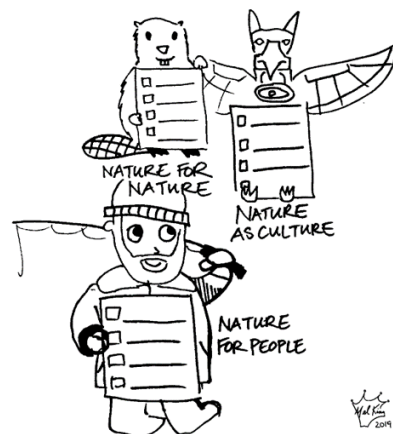
Breakout group discussions

The afternoon session of the workshop consisted of breakout group discussions. Participants were requested to consider where within the Nature Futures Framework the scenarios should be developed, and to discuss the following key questions:

- Are the existing visions capturing the most important issues? If not, what is missing?
- What are the key variables, dynamics, drivers that need to be captured? Are they already covered in the SSPs? Are there others that should be considered?

Participants were distributed across six groups focusing on cross-cutting themes emerging from the discussions and existing visions. The key points were shared in plenary:

- Group 1. Seascapes/landscapes including food production, rewilding, land-water interactions: The group focused on land and sea interactions around food production, and broke down its components into agricultural land, wetlands, fisheries, population (including lifestyle and culture), governance institutions, technology, and trade. Climate change, population, and governance institutions were identified as the key elements influencing the interactions between land and sea. Aquaculture was categorised as a sub-element of the sea, which links to the wider oceans, for example, through harvesting of feed for aquaculture. The group recognised that the different components of the land-sea interactions would have different futures depending on the nature futures perspective we choose to prioritise. Other participants noted that the definition of culture would change depending on which perspective we consider it from.
- Group 2. Species diversity, regional outcomes, multiple levels of engagement, invasive species, sectoral SDGs: The group discussed how conservation of species diversity would be perceived differently within the Nature Futures Framework, based on the flow chart of drivers, pressures, responses, and states. In the *nature for nature* perspective, the conservation of overall species diversity and of individual species of particular concern would be prioritised. In the *nature for society* perspective, focus would be on service-providing species, and species diversity for maintaining ecosystem services. In the *nature as culture* perspective, culturally important species would be valued. Regardless of the perspective, the same pressures such as habitat transformation and climate change exist, but the difference would lie in where they are addressed, as well as in the type of species targeted. Other participants noted that cultural key stone species may be an interesting indicator to consider in models. The differences in the management of pressures across the Nature Futures Framework would also need to be more explicit, and ecosystem service indicators would need to be included. They also commented that perception towards species conservation could be rooted in cultural differences rather than in the species (such as attitude towards conservation of predators like wolves).



- Group 3. Extreme Zones (mountains, deep seas, etc.), indigenous and local knowledge, forests, cultural landscapes, inequality of access: The group defined extreme zones as little known places with high fragility, isolation, and remoteness. This includes not only the environment but also peoples, and would encompass the deep sea and high seas, the amazon rain forests, and deserts. The group made a matrix of how these extreme zones would be managed across the three nature futures perspectives. In the *nature for nature* perspective, these zones would be closed off, have unique and diverse species, and support ecosystem function. Isolated indigenous peoples would also be protected. Discussions also touched upon how much restoration would be required and how to deal with trade-offs such as displacement of peoples. In the *nature for society* perspective, many of the management approaches are already being implemented, and responsible use through “limit setting” is a crucial tool. In the *nature as culture* perspective, the group noted that cultural heritage and spiritual connection with extreme zones need to

be sustained, requiring big changes in current society. Others noted that human displacement may not be appropriate to include in a positive nature futures scenario, and recognised the need to consider trade-offs resulting from some of the positive visions.

- Group 4. Pole to Pole - teleconnections and flows, industry and economic interests, material/nutrient flows, politics, power: The group considered teleconnections and flows between people and nature, which are not well thought-through in existing scenarios, and discussed the priority issues for each of the nature futures perspectives. For the *nature for nature* perspective, biogeography would be important, with species migrations connecting different places, and climate and ecosystem disturbances affecting species richness. Modelling these shifts would be important for the scenarios, as well as including ecosystem functions and services underpinning the stability of the earth system. For the *nature as culture* perspective, ethnoecology would be essential as species play an important role in certain cultures. Livelihoods that connect with nature, and the linkages between human wellbeing and experiences of nature would also be highly relevant. For the *nature for society* perspective, wealth and equality related to ownership of landscapes and seascapes would be important to consider. The group mapped how to adapt existing models and develop new ones to respond to these needs. Others remarked that aspects like land ownership would matter for all nature futures perspectives, while some issues are more specific to a perspective.
- Group 5. City, urban-rural dynamics, plurality, emotions and values, psychological wellbeing and health, green spaces, dynamics of cities: The group discussed cities, rural-urban flows, and their pressures and indirect drivers. Regarding indirect drivers, they focused on what makes people desire, strive for, and value nature, and how that value forms. They recognised that in some countries or cultures, environmental protection can have a negative connotation whereas in others it is perceived as trendy, and questioned where these differences originate. They identified knowledge as an important factor creating different dynamics within education, media, and popular culture. The group also discussed the factors leading to rural-urban and urban-rural migration. In particular for the *nature as culture* perspective, the group emphasised the importance of considering indirect, underlying drivers in participatory scenario development, as it can lead to a completely different range of policies and responses that may otherwise not be visible.
- Group 6. Hybrid Natures, role of technology, de-growth, systemic risk, gender: The group focused on techno-nature / techno-garden futures to explore how technology could be interpreted through the Nature Futures Framework. There would be one scenario on techno-natures but with different implications for each of the perspectives. When considering the middle ground across the three perspectives, the group imagined a future with cyborgs, social natures, and universal utilitarian ways of meeting society's needs. Notions of reciprocal stewardship, and of risks and uncertainties were also discussed. In the *nature for nature* perspective, importance would be placed on giving a voice to nature and living with nature. Comparing across perspectives, responses to events such as floods would vary widely, from letting nature run its course, to actively managing it. Geoengineering would also be a part of this scenario, especially in the *nature for society* perspective. The group noted that a lot of these ideas could have either positive or negative impacts depending on how they are implemented. They also identified virtual reality and gaming as possible seeds to incorporate into the scenarios.

Report from DAY 2 (Tuesday 26th March)

Opening of Day 2

The second day of the workshop was opened by William Cheung with a brief introduction to the schedule, an announcement of a public event hosted by the PWIAS in the evening with panellists from among the workshop participants, and an introduction to the graphic artist who will make visual representations of the discussions held throughout the day.

Feedback from the online discussion session

In parallel to the workshop, an online discussion session was held with remote participants (modellers and other stakeholders who could not be physically present at the workshop). Jan Kuiper and HyeJin Kim facilitated these discussions every morning prior to the start of the main workshop sessions, and presented the key points back to plenary. For the session of Day 2, the remote participants discussed the desired nature futures based on the breakout groups held on the previous day. They noted that the analytical diagram of indirect drivers, direct drivers, responses, and state of nature resonate well with people that work with policy makers. The group also discussed which models are already available, which are needed, which need to be modified, and which need to be newly developed. They suggested mapping out the landscape of the existing models and the desired models, as a starting point to connect with the modelling communities. Another idea was to share a template to ask modellers about relevant processes and to map existing models. The group also underlined the importance of considering the audience of the scenarios – i.e., for policy makers? for researchers to better understand options? – This matters for how we develop the narratives, especially in terms of how much we highlight trade-offs (particularly regarding policy makers for whom trade-offs are a particularly sensitive issue).

Breakout group discussions

The brief morning plenary was followed by a breakout group discussion session covering the following four topics. Participants self-selected their topic of interest and addressed the key question allocated to their group.

- Group 1: Indirect drivers, pressures, state of nature: "What trends and dynamics are moving the world towards each of the extreme nature futures?"
- Group 2: Socio-ecological feedbacks: "What feedbacks reinforce each of the nature futures?"
- Group 3: Seascapes / Landscapes: "How do different ecosystems and their connections vary among the three nature futures?"
- Group 4: Look at edges of the triangle: "What trade-offs and synergies might exist between the three pairs of nature futures?"

All groups were requested to spend the rest of the morning on the discussions and to report back to plenary on the following points:

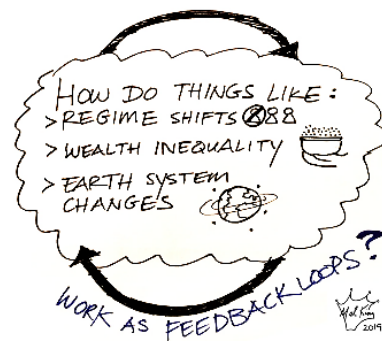
- Key issues and key factors for each nature future (or pair) (factors shared across NF);
- How do we go about doing this: Graphical summary and conceptual figure of your discussion
- How do you operationalize this NFF framework: what are existing datasets / models etc.... Think about which people to involve and how? Think about built-in pluralism and diversity and 'hooks' for people. Think of applicable scales.

Reporting back from groups

In the afternoon all groups gathered back in plenary to report on the progress of discussions.

- Group 1: The group focused on the extremes of the three nature futures perspectives to distil the various indirect and direct drivers and responses. They unpacked five categories of indirect drivers, namely Institutional, technological, social, cultural, and environmental drivers. They identified that these drivers could be both positive and negative depending on the context and the approaches employed. The group then organised the drivers into clusters and recognized the need to discuss specific policy options under these indirect driver categories. The emerging clusters were around the themes of sustainable technology, renewable energy, and production. The next step was to identify which cluster was more important and to identify their importance relative to each of the nature futures perspectives. The group identified the following to-dos for the rest of the day: 1) develop a matrix for each driver with the three different scenarios of the extremes of the nature futures perspectives, 2) look at the feedback loops, and 3) consider what kind of interventions would reduce the impact of the drivers.

- Group 2: The group started by discussing feedbacks within human-nature connections, and recognized that although there has been a focus on the human impacts on nature, there is a gap in assessments of how nature then feeds back to the human world, or how this leads to human-to-human or nature-to-nature feedbacks. The group also discussed regime shifts, power, wealth inequality, local vs. earth system changes, among others, and recognized that the feedbacks were not consistent across the nature futures perspectives, with many more feedbacks identified within *nature for society* and *nature as culture*, but not as much in *nature for nature*. This may have been due to lower representation of conservationists within the group. For the *nature for society* perspective, the group covered tipping points in ecological and social systems, associated economic feedbacks, bio-economic feedbacks and related ideas. Some aspects are already included in models of economic growth and expansion relevant to land systems research. They also discussed the possible triggers of change, such as investment in intensification leading to land abandonment, or ecosystem engineers structuring the feedbacks of nature to itself. For the *nature for nature* perspective, the group discussed tipping points between urbanization and rewilding, and ecosystem engineering. They noted that the coupling of nature's feedback onto itself and between its abiotic and biotic components are largely missing in current modelling work. For the *nature as culture* perspective, the group discussed feedbacks related to cultural keystone species, biocultural ways of living, livelihoods promoting stewardship through learning, and rights for nature bridging concepts for legal systems. They also covered *nature as culture* in engineered societies and non-indigenous bio-culture (e.g. Dutch water management, cultural landscapes, nature-based solutions, anthropogenic landscapes reinforcing institutional landscapes). The group recognized the important role of trust and spiritual values and how the experience of these values can be reinforced. Finally, they explored the aspect of scales, both in space (close, far) and time (now, distant future), and mapped some issues onto these axes. They noted that decision-making is easier when considering closer spaces within the current time, whereas it is more difficult when far into the future and in space, as it is harder to have sufficient insight or interest. They thus concluded that we need to focus on the medium term and distance. This mapping of issues could be useful for an inventory of what is already modelled and what is not.



- **Group 3:** The group considered how to make connections between different systems of seascapes and landscapes, and explored what kind of indicators across the IPBES conceptual framework would be important for each of the nature futures perspectives. They started with the marine environment which was the main expertise of the group, and then identified a similar list of indicators relevant to terrestrial areas. As hundreds of indicators exist, the group attempted to narrow them down by envisioning each of the nature futures first, and then identifying indicators relevant to each of them, rather than starting from the full list of possible indicators. They identified common goals and indicators with the same desired trajectory for all nature futures. For example, with fish stocks and species numbers declining in all systems, people's diet needs to change in all perspectives. Some differences were also identified, for instance the importance placed on marine protected areas for species protection in the *nature for nature* perspective, for CO2 sequestration in the *nature for society* perspective, and for community-based management in the *nature as culture* perspective. The group discussed the prioritization of indicators for each of these perspectives. They noted that common goals across scenarios would serve as balancing guides for deciding on the trade-offs between the three approaches. There were also discussions of cross-cutting issues that need to be addressed in the scenario narratives, such as time scales and baselines.
- **Group 4:** The group discussed possible trade-offs and synergies between the three nature futures perspectives, which would be particularly important in communicating effectively to policy makers. They noted two ways of using the Nature Futures Framework, either through the drivers-pressures-responses-states diagram, or through the relationships between the outcomes of the states. They focused on the latter to think of real-life examples of policy interventions to test the framework. They illustrated the differentiation between the three perspectives using the example of how marine protected area implementation would be measured differently across the perspectives. In the *nature as culture* perspective, the number of culturally important fish species or of viable local fishermen would be important measures of success, and in the *nature for nature* perspective, this would be measured by the proportion of species not threatened with extinction, whereas in the *nature for society* perspective, it would be measured by the percentage of GDP generated from fisheries. The group also explored similar examples such as the management of quotas from fishing and the conservation of the Amazon forest. These illustrated how the Nature Futures Framework makes explicit the value judgments made on specific interventions. The group mapped these on a spider diagram and compared them to discuss trade-offs and synergies. This led to discussions on the contrast between the pursuit of a reciprocal stewardship for nature versus nature-based technologies for society, and between perceptions on livelihoods for economic benefits versus the sense of identity and pride that it provides. Indicators that highlight the economic aspect as well as the cultural identification dimension would be needed. The drivers-pressures-responses-states diagram can be used in two ways, either to identify the desired objectives, then the necessary actions, and finally the enabling conditions, or on the contrary, to back-cast from pressures that need to be addressed, the interventions needed, then to address the feedback loops and underlying issues.

Plenary discussion

Based on the reports from the breakout groups, the rest of the afternoon was spent in plenary with discussions around definitions of targets, goals, priorities, and indicators, and around the interpretation and the uses of the Nature Futures Framework and its visual representation as a two-dimensional triangle as well as a three-dimensional space.

The first discussion point revolved around clarifying the differences between goals and indicators, as some participants noted that from the breakout group discussions, the indicators identified seemed to represent the priority issues rather than the metrics, resulting in trade-offs between the nature futures perspectives. Similar issues had been raised in many breakout groups, but there was a general recognition that indicators are a status measure, as we need to measure the outcomes of interventions. The exchange in plenary underlined that 'goals' should be the general direction that is being aimed for. 'Indicators' are rather a measure of how far we move in that direction. We therefore need to think about goals, then indicators, and then we can set 'targets', which are the specific points we aim to reach along a specific indicator. The trade-offs therefore occur not between different indicators, but rather between the desired balance of achievements across the overall set of indicators.

The participants then considered how to represent the above concepts and the Nature Futures Framework in a visual manner. Suggestions were made to move from a two-dimensional triangle representation of the three nature futures perspectives with gradients between the three corners, into a three-dimensional representation with three axes of the nature futures perspectives forming a tri-rectangular tetrahedron (one half of a cube split diagonally) in which the possible nature futures could be mapped as dots within the space of the tetrahedron. Using this representation, improvements can be made along all three dimensions of the nature futures perspectives. Some pointed out that if there is a strong push towards one of the dimensions then there would be a certain level of explicit trade-offs, and that it is important to remember that relationships are not necessarily linear along these axes. The participants appreciated the three-dimensional representation which they agreed better illustrates the plurality of the Nature Futures Framework, but still grappled with how to visually illustrate the trade-offs as well as the feedbacks and pressures within this state-space representation. They continued to discuss what would be the result of a specific intervention as opposed to a mix of different interventions across all nature futures perspectives, and how it would affect the feedbacks and drivers. They recognized that the spider diagram representations and the three-dimensional representation are complementary, each illustrating a different aspect of the Nature Futures Framework. Each spider diagram would then be a more detailed representation of the state of a single dot within the three-dimensional space. The participants also pointed out that we need to think not only about where we want to be in the nature futures, but the framework should contribute more to identifying what changes need to be made to progress towards it. So rather than showing a measuring scale in this three-dimensional figure, the mapping of the state-space needs to be interpreted as the location of the state relative to each other, and indicate whether we are investing sufficiently in nature or not. Therefore, in view of the scenarios development, we have to think about how to represent time in this space and about the levers that allow a shift from one position to another. Participants noted that this exercise is comparable to building on the SSP1 scenario, with a sustainable baseline (thus, positive scenario) that is additionally complemented with various nature perspectives. Others also suggested the idea of setting a threshold for certain indicators when optimizing differently for different scenarios, as a means to remain within a positive scenario.

After deepening their understanding of the framework, participants discussed how to move forward in the development of scenarios, and what instructions can be relayed to modelling groups. The discussions centred around the two subjects:

- How to tackle multiscale coordination in developing the new scenarios
- Where in the Nature Futures Framework the new scenarios should be focused

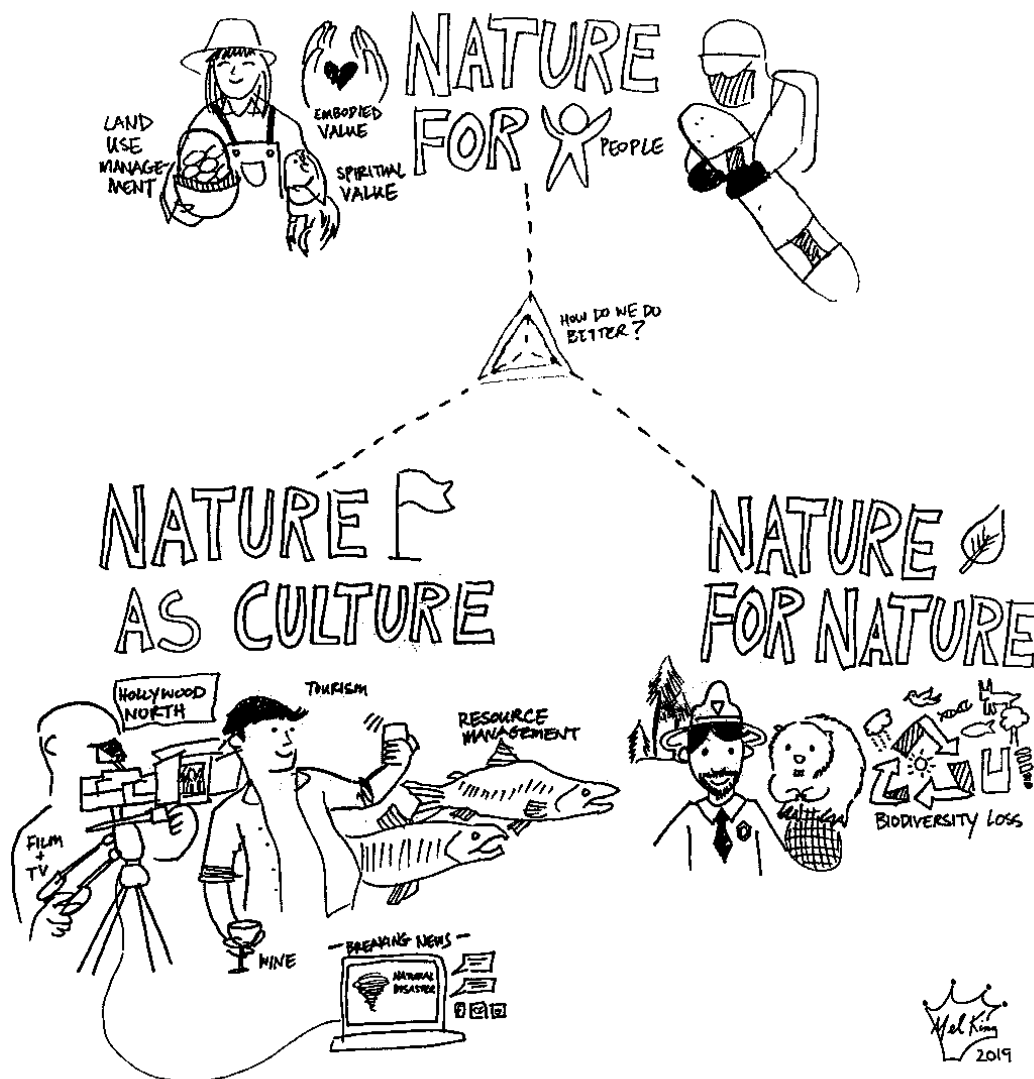
Participants recognized the need to approach the multiscale linkages differently to ensure sub-global representation, rather than only working in a top-down manner. A suggestion for addressing this was to first start generating global drivers, then to scale those down to sub-global scales and develop local indicators at a finer scale than the IPBES regions, then finally, to re-upscale them to produce global scenarios. Past exercises have followed steps 1 and 2, but have not gone as far as to re-upscale to the global level to ensure representation. Participants reflected back onto the process followed at the Auckland workshop, where visions were generated in a participatory manner, mainly at the global scale but also with local links. Participants agreed that to understand the diverse value systems and what happens at the local scale, the approach of downscaling then upscaling drivers would be interesting provided that there is a good spread of scenarios within the space of the nature futures perspectives (not necessarily in the extremes). Others agreed that although the SSPs provide large stories about the world, it may be worth breaking them down to three or more for different scales.

The discussions were followed by a further debate on which perspectives of the Nature Futures Framework the new scenarios should focus on, and whether or not there is benefit in rooting the scenarios in the three perspectives of the Nature Futures Framework. There was a dichotomy between opinions expressed among the participants. Given that the diverse visions from the Auckland workshop led to the emergence of the triangle Nature Futures Framework, some argued that having three extreme scenarios based on the three values will not be useful. They stressed that it is more important to think about representing pluralism in the new scenarios since the goal of IPBES scenarios is not only to link with modelling work but with broader stakeholders, including indigenous peoples and local communities. On the other hand, others stressed that although the scenarios would represent extreme futures if they are built for each of the three nature futures perspectives, they would still be useful to capture the different drivers and build the narratives further. They pointed to the benefit of understanding the differences between the perspectives, as long as the extremes are not to an extent where they create drastic trade-offs or oppose each other. Some suggested that the group may need to think of using the Nature Futures Framework triangle, not as a space in which to map the scenarios, but rather as a mechanism for understanding the underlying motives and the resulting outcomes. They noted that there is considerable material from this and previous meetings which could be used to make a synthesis, with as starting point to visualize the main drivers for the three main visions in a table, in order to gather concretely the content for the future narratives.

In conjunction with the consideration on where to build the scenarios, the participants also discussed how to move forward in identifying indicators. They acknowledged that we currently have good indicators in some of the nature futures perspectives, but not in others. Some hoped that by exploring which indicators are associated with each of the nature futures perspectives and how similar or different they are, modellers would be able to then consider how much can be integrated into their work. Others noted that there may be a risk to move onto identifying indicators too soon in the process, as it may limit the discussions to which indicators are the best measures (with focus on 'how do we measure this?'), rather than what should be represented using indicators (with focus on 'what should be measured'). However, many recognized that there is value in thinking of indicators that are meaningful and useful in this context (rather than sticking with commonly used metrics that may not be informative in the context of this exercise). They acknowledged that discussing indicators allowed them to characterize what was meant by the nature futures perspectives. Another important realization was that existing indicators only work in parts of the Nature Futures Framework, which shows that we are currently limited in the ways in which we measure nature and these interactions.

Finally, participants revisited what the scenarios should be useful for and how they would best be able to fulfil their purpose. They noted that there is value in visualizing the three nature futures perspectives, but risks in them being misunderstood as the goals of the framework. They recognized the need to make clear that the idea of having scenarios in the extremes of the nature futures perspectives is to illustrate the range of diverse options. They stressed that the goal of the scenarios is to illustrate consequences and values and what can be achieved with different options, to show the range of options for policymakers to choose the appropriate mix of options, rather than to show a realistic future. Thus, if the scenarios are taken too far to an extreme of the nature futures perspectives, trade-offs with the realization of other perspectives would occur. However the future will always be a mix and trade-off between different options, so the consequences of the scenarios would depend on which policy questions we are trying to address. Finally, the participants discussed that the Nature Futures Framework can achieve more ambitious results if it serves as a policy tool that works at every scale, although it may not need to go as far as connecting to different indicators. They suggested that through outreach other than workshops, such as webinars and online training, we can connect with a much broader range of stakeholders to communicate this concept to different actors.

The workshop closed at 15:00, and was followed by the public panel discussion event hosted by PWIAS.



Report from DAY 3 (Wednesday 27th March)

Opening of Day 3

The third day of the workshop was opened by Carolyn Lundquist announcing the programme of the day and confirming support by the graphic artist who will make rounds of different groups to capture the content of discussions.

Feedback from the online discussion session

HyeJin Kim and Jan Kuiper provided another summary of the morning remote discussion session. The participants revisited the diagram of the drivers, pressures, responses and states, and discussed whether to back cast from the desired states to build the scenarios, or to dynamically model the pressures. This was based on some uncertainty on whether to interpret the top row of the diagram (the states of nature) as a representation of goals, or of indicators, and whether modellers were expected to disentangle the states, pressures and drivers. The response was that the diagram illustrates the underlying mechanism that needs to be considered when discussing possible scenarios, but there is no predetermined approach dictated by this visual representation. The participants recognized from this exchange that the diagram needs to be complemented with some explanation to avoid misinterpretation.

Breakout group discussions

Following the brief morning plenary, participants considered how to address the open-ended questions emerging from the workshop and the remote discussion sessions. They agreed that the Nature Futures Framework needs to include key feedbacks from natural systems back to the human system, as well as feedbacks within individual systems. They stressed the importance of considering values and value frameworks, and how these can create socio-ecological tipping points. The concept of inclusive green growth was also highlighted as an important aspect to include in the futures we consider. A research agenda is needed to pinpoint the key feedbacks, and to link to ongoing modelling work on economic feedbacks, climate change impacts on land use and agriculture, and their consequences for labour and food systems. Distinguishing between research questions and assessment questions would be important to disentangle the questions emerging from the workshop. We also need to clearly lay out what we need to know, what we are certain of now, and what needs to be explored further. If there is an urgent need for policy advice or support, results should be presented using a clear uncertainty statement even if research is still underway. Based on these discussions, participants reiterated the key objectives of this meeting:

- Identifying the key elements that are currently lacking, but need to be incorporated into biodiversity modelling: e.g., socio ecological feedbacks, value preferences
- Establishing a common understanding on the criteria on which to build new scenarios and the concrete steps forward

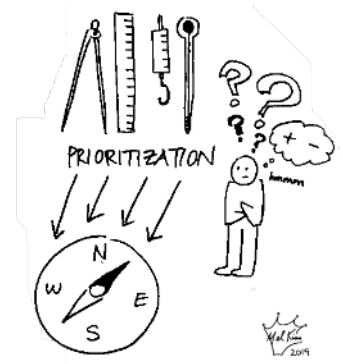
For the rest of the morning session, participants split up into the following groups:

- Group A: *Metrics across the three nature futures*
Subgroup 1: *Mapping metrics onto the nature futures*
Subgroup 2: *Identifying urban environment metrics*
- Group B: *Feedback loops across the three nature futures*
Subgroup 1: *Feedbacks in a nature for nature future*
Subgroup 2: *Feedbacks in a nature as culture future*
Subgroup 3: *Feedbacks in a nature for society future*

Reporting back from groups

All groups gathered in plenary before lunch to report on progress of discussions.

Group A: This group focused on what metrics would apply across the three nature futures perspectives and explored potential ways of prioritizing them for particular themes across each of the perspectives, which may result in a priority metric. They also reached an important discussion around baselines and explored how the nature futures could inform the implementation of the post-2020 biodiversity agenda. Different policy mixes and pathways would be a useful output of the scenarios which could feed into the ongoing IPBES assessments, GBO 5 and 6, and the broader SDGs. They also discussed the differences that would arise depending on the scales, and how to bring different groups together by borrowing each other's methods, and by considering what the gaps, alignments and mismatches are. A follow-up with the modelling community would be needed for their feedback on the scenarios. Clearly identified and prioritised entry points for policy interventions (leverage points that are transformational) would be needed for scenario processes to be taken seriously by policymakers. The group further subdivided into two groups, one focusing on how various metrics would map across the three nature futures perspectives, and another on specific metrics for the urban context.



- Group A1: The sub-group built on the metrics identified on the previous day, and mapped them into the Nature Futures Framework to disentangle the metrics of the states, responses, and pressures. They took the example of livelihoods to understand how different states of livelihood would be measured from different nature futures perspectives. From the *nature for society* perspective, the focus would be on jobs generated from natural capital, such as forestry or fisheries. From the *nature as culture* perspective, the sense of identity or pride rooted in these occupations and the social cohesion fostered by this would be important. From the *nature for nature* perspective, livelihood generation would be excluded from natural areas. Another example was on how to assess the state of habitats and the landscape. From the *nature for nature* perspective, importance would be placed on maximizing the levels of intact habitat, while from the *nature as culture* perspective, it would be on minimizing change in landscapes and habitat over time, and from the *nature for society* perspective, it would be on the performance of the land, such as soil erosion, carbon sequestration, biomass, etc. Finally the subgroup also examined how species would be measured differently across the three perspectives. From the *nature for nature* perspective, this would be the number of endangered species and genetic diversity, while from the *nature as culture* perspective, it would be cultural key stone species or culturally important species, and from the *nature for society* perspective, focus would be on ecosystem service providers such as pollinators. They concluded that different management interventions could be toggled to achieve the different states. There can be a zero value for a given intervention, depending on the perspective (e.g. livelihoods in a *nature for nature* future).
- Group A2: The subgroup focused on the identification of indicators for the nature futures perspectives, specific to the urban context. They used a similar approach to the previous day, categorizing the metrics according to whether they characterized human wellbeing, environmental health, or ecosystem services. The metrics of human well-being included air and water quality, urban gardening, green roofs and spaces, species richness, cultural keystone species, density and size of cities, urban versus rural populations, accessibility to green areas, hours and mode of commute, measures of equity, mode of energy

supply, hours of education on nature, etc. The metrics of the environment included overall species richness, threatened species, culturally valued species, etc. For each of these indicators, the group considered which one would be prioritised under each nature futures perspective. For the *nature for nature* perspective, the group imagined that priority would be given to dense cities with high human population, giving space to nature elsewhere. For the *nature for society* perspective, priority would be on air and water quality, and functioning green spaces. For the *nature as culture* perspective, accessibility to green areas and community gardens would be a priority. The subgroup acknowledged that these results may have been rooted in a western worldview.

Group B: The group on feedbacks split into three subgroups corresponding to the three nature futures perspectives, and discussed the associated drivers and feedback mechanisms.

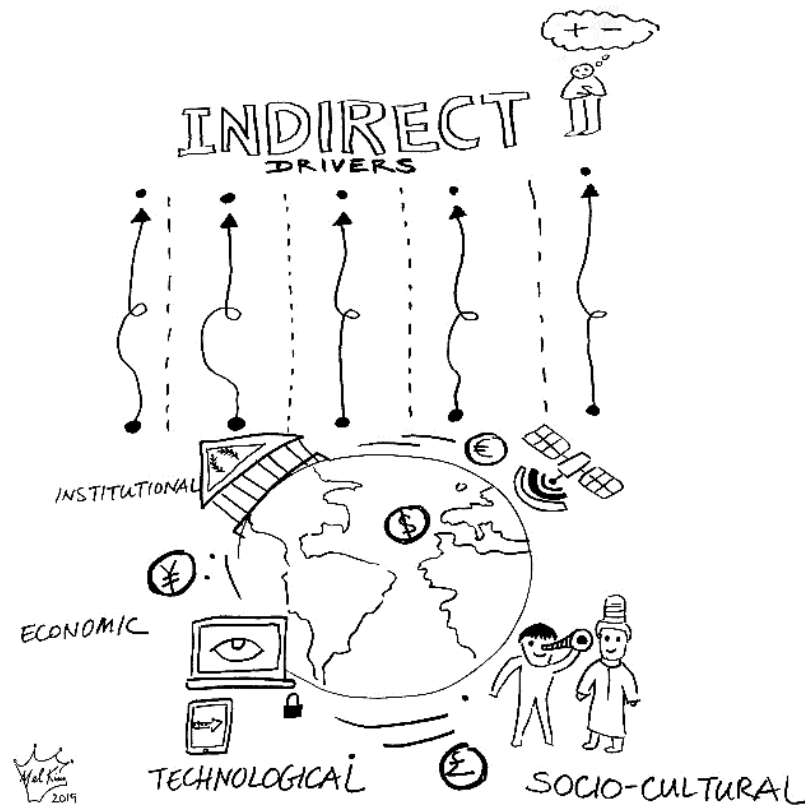
- Group B1: The subgroup focused on a future that prioritises the *nature for nature* perspective. This future assumed the ability of nature to support itself and the existence of a feedback of people enabling this dynamic. The subgroup identified a list of key dynamics that they would want to communicate through this scenario, and what is meant by 'nature' in this future. They highlighted functional diversity, response dynamics, role of species as ecosystem engineers, top-down dynamics, role of keystone species, geographic diversity and connection, cyclical dynamics, and the role of disturbance. They also identified a wide range of drivers that would lead to a *nature for nature* type of world:
 - o technology, reduced footprint of society on nature, people functioning more like nature (eco-efficiency, nature-based solutions, room for the river, etc.)
 - o policies taking into account cumulative impacts and planning according to different timescales
 - o education on and legal rights for nature
 - o nature-based planning or a green new deal linking nature to economic development and social equity
 - o urbanization giving space to nature, and rewilding linked to human wellbeing
 - o reduced wealth inequality, people having control over their local areas, and living with nature in different ways in different places

The subgroup also produced a diagram to understand the mechanisms of these feedbacks by mapping the drivers onto a spatial and temporal scale ranging from local to global, and from fast to slow. The emerging clusters were urban-rural connections, local ecological restoration (long term, small scale), global markets, climate change (long term, global), and consumerism, media, and urbanisation (medium term, regional).

- Group B2: The subgroup discussed the feedbacks that would occur in a future where the *nature as culture* perspective is prioritised. People's relationship with nature would need to change, and society would need to uphold cultures that have nature at their core. The subgroup identified technology, economics, demographics, institutional influence, and social culture as spaces in which to explore feedbacks. They considered that the largest influence would come from the economy, with reduction in consumption rate and increased natural capital accounting as examples of positive drivers. Other influential drivers included social culture (with a positive relational perspective on nature, and recognition of the importance of nature as part of culture), environmental institutions (with more concern for nature and pro-environmental regulations), demography (with migration, and resulting change in dominant culture), and technology (with development of virtual nature, sustainable technologies, etc.). The subgroup imagined how these

feedbacks would play out, and noted that many drivers overlap across the nature futures perspectives. Policy interventions need to be identified as the next step, as well as the sensitivity of the different feedback mechanisms to the interventions.

- Group B3: The subgroup discussed a future prioritizing the *nature for society* perspective, based on drivers and feedbacks identified on the previous day. For indirect drivers, they focused on society and people's awareness, and specifically on feedbacks from nature to policymaking. They explored how changes in nature would cause pressures on people, and how that in turn would influence decision-making on issues of health, economy, and resources. They hoped to identify a mechanism that works on different scales of time and space to produce the various states. Taking the economic dimension as an example, they illustrated how the global economy could encourage the production of export crops, causing change in land use (such as deforestation, exploitation of soil and water, biodiversity loss), with, in turn, an adverse economic, social, and environmental effects. The subgroup suggested that if we are to build positive scenarios, then policy measures to minimise adverse effects need to be identified. The next to-do's include re-clustering of feedbacks around the main ideas, and connecting feedbacks and drivers for each of the scenarios.



Plenary discussion

The breakout groups were followed by a brief discussion in plenary. The conclusions from the different groups underlined the importance of incorporating leverage points that are transformational when building the narratives. Many groups cautioned that if the scenarios fail to do this, policymakers would not find use in them. They also suggested that rather than having a long list of what can be done, it would be more useful to indicate in relative terms which actions would be better than others. Participants also highlighted that the added value of these new scenarios should be to incorporate new entry points as lessons from IPBES work. They agreed that exploring feedbacks to identify leverage points is a way forward.

Presentations on important processes

After lunch, participants reconvened in plenary to explore the uses of the new scenarios. Presentations were given by Tim Hirsch, Eefje den Belder, and Henrique Pereira on important processes to which scenarios can contribute.

- The Fifth Global Biodiversity Outlook: Tim Hirsch introduced the participants to the CBD timelines for the production of the GBO-5 and the post-2020 biodiversity framework. The SBSTTA meetings scheduled in November 2019 and July 2020 will produce the final set of documents to be considered in October 2020 at the COP15 in China. He explained that the zero draft of GBO-5 is due by September, when the window for input will close. He gave an overview of the key elements of the GBO-5, including the outlook on the level of attainment of the Aichi Biodiversity Targets, a framework for looking ahead, and the transformations required. The draft will likely include a target-by-target review informed by the IPBES global and regional assessments, and national reports to the CBD, and will also make links between biodiversity and the SDGs. It will touch upon the long term vision of the CBD and the transitions needed for achieving it. He highlighted possible entry points for some of the nature futures work discussed at the current workshop.
- Ongoing and upcoming IPBES assessments: Eefje den Belder highlighted some of the relevant IPBES work conducted thus far, as well as the upcoming assessment themes such as food and health, business and biodiversity, and determinants of transformative change in 2020, as well as the next global assessment which is due in 2025. She introduced the work contributed by the scenarios and models expert group to the regional assessments and the archetype approach used for harmonization and comparison across regions where data and knowledge differ widely. She highlighted the scenarios work conducted for the land degradation assessment as well as the ongoing methodological assessment on values which also has a scenarios chapter. She emphasized the importance of ensuring cross-pollination between the various efforts implemented under IPBES.
- IPBES Global Assessment: Henrique Pereira also briefly introduced the work conducted in collaboration with various modelling groups on producing biodiversity projections under historical trends and scenarios for the future across various combinations of SSPs and RCPs. He also pointed participants towards some of the outputs, now published as O'Neill et al. (2017) and Kim et al. (2018).

Breakout group discussions

Following the plenary presentations, the participants were invited to break out into four random groups to discuss the following key questions:

- What set of scenarios would be most useful for you and IPBES? How would they be useful, what would the key features be, and how would they relate to existing scenarios?
- What is the scenario timeframe?
- What is the scenario's long term goals and products?
- How can they input into the post-2020 CBD discussions and other immediate needs?
- What is required to produce the scenarios? What new elements are required?

Reporting back from groups

- Group 1: The group had a large number of people with experience in IAMs, which allowed discussions on what materials are already available for use in modelling, what the experts are trying to build on, and what is, or is not feasible with existing models. They discussed quantitative and qualitative metrics, and how to bridge them using terms from social sciences such as constructed metrics. Discussions also touched upon how to use the Nature Futures Framework for building scenarios and to work with partners who will be developing the models. The participants noted that in the current discussions on the nature futures scenarios, there is an entanglement between what can be modelled and what cannot, and therefore we need to distinguish the two and identify the areas of particular interest. The group also discussed how to use the SSPs in the nature futures process, and proposed to represent the nature futures perspectives as 'SSP-NFX' at the global level and at other scales. Scenarios would then be the combination of SSP-NFX and a suite of policies. They agreed that the real value of the Nature Futures Framework is in fostering a participatory process and not only in generating new scenarios.
- Group 2: The group noted that identifying conflicts and synergies between the nature futures perspectives would be an important way forward. They noted that as there may be many synergies and tensions between the three perspectives and underlying values, it would be useful to see how outcomes would differ according to whether the actions are globally orchestrated or fragmented. They also expressed interest in seeing the variations between low ambition and high ambition actions within the three-dimensional interpretation of the Nature Futures Framework. They hoped to see how the framework could incorporate bottom-up scenarios and connect to global ones, as well as to more complex models. The group found that the *nature as culture* perspective may be the most challenging to build on, but suggested it could be addressed by nested approaches to indicators. The group also expressed interest in incorporating the role of business, law, and finance, and exploring how to include more radical aspects of the world (such as CRISPR, AI, etc.) and their role in scenarios.
- Group 3: The group did not reach a consensus around where the new scenarios should be rooted in the Nature Futures Framework, and discussed what is useful about the framework. They explored the possibility of placing elements along an axis of ease of implementation over time, and recognized that there is a lot of useful content from the workshop and past work on the nature futures that do not require incorporation into scenarios and models to be communicated to the world. These included the diverse values framework, the multilevel participatory scenario-building process which could be tested in different locations around the globe, the identification of the three perspectives ("corners" of the triangle) which provide insight into underlying assumptions about how the world works, the representation of these perspectives in the form of radar charts, which could be useful in mapping out policy interventions, and the development of new metrics emerging from the discussions. They suggested that these could be consolidated into a toolbox, which also illustrates the gaps and feedbacks for dissemination to a wider community.
- Group 4: The group discussed how the nature futures scenarios could be useful in their own local scales, city, and country. They noted that time scales for certain spatial scales may differ, with city planning considering time scales of up to around 5 years, national planning exercises considering 5 to 20 years, and global scale exercises considering 10 to 30 years, and even longer, as seen in climate targets. They pointed out that if the nature futures scenarios are to be useful, they need to be useful at these temporal and spatial scales. The group recognized that the end of the scenario-building exercise would not signify the end of the nature futures process, as iterations will be required. They discussed that the Nature Futures Framework would need to show different pathways

with mixes of different sustainability policy options, key feedbacks, leverage points, and quantitative and qualitative indicators. The outputs of the scenario process would be reports, models, raw data, and other forms of outputs. They emphasized the importance of linking to SSPs and ensure that existing work is not repeated, and also expressed a strong hope to ensure the representation of the *nature as culture* perspective which has been lacking in much of the Aichi Biodiversity Targets.

Plenary discussion

In response to the discussions held throughout the day, Zuzana Harmackova, member of the IPBES values assessment author group, gave a short presentation to promote alignment between the development of the values assessment report and the Nature Futures Framework. She explained the 3-year process of the assessment, split across 6 chapters aiming to provide a comprehensive assessment of values and the diversity of thinking around values of nature, and how this translates into valuation and decision-making processes. Also as a relevant and useful background material, she recommended the recently published paper on the scenarios developed for the Europe and Central Asia regional assessment, and another in review on the use of archetypes across regional assessments. Based on her insights on the development of the values assessment, Zuzana suggested producing joint publications with the values assessment authors as a way to foster cross-fertilization between the two lines of work, and to communicate to the world that the two values frameworks are in alignment. Participants exchanged thoughts on how the various nature-related values frameworks map into each other, and discussed the importance of ensuring plurality in IPBES assessments. They explored the benefits and trade-offs of having multiple IPBES frameworks, acknowledging the confusion caused by constantly changing terminology, but also the risk of imposing a biased worldview by sticking with a fixed approach.

Final round of the table and closing of the meeting

As a final exchange of the workshop, the participants were invited to share their takeaways from the discussions, and any hopes they may have for future activities under IPBES.

Participants noted that the workshop had helped them gain a better understanding of the nature futures process and how to apply it, and recognized its usefulness in the steps needed to reach the SDGs. Although many viewed the nature futures process as complex and full of new questions, they expressed excitement for its further development. They found that the Nature Futures Framework is becoming an inclusive framework which aims to cover many perspectives and ways of life, which can be used as a communication tool to inspire people, and to which everyone, not just decision-makers, can contribute. They recognized the usefulness of shifting focus from the outcomes of human actions, to the underlying reasons, in order to target change at the root. They also emphasized the value of being able to progress on all three axes of the nature futures perspectives simultaneously, rather than having a divisive framework focused on trade-offs. Many appreciated the relationship established among the participants which stimulated new ideas, and expressed hope that it would grow into a community of practice. They also reflected on how to incorporate the Nature Futures Framework into their individual work and research. Some were also inspired to organize outreach and case studies in their home countries based on the discussions.

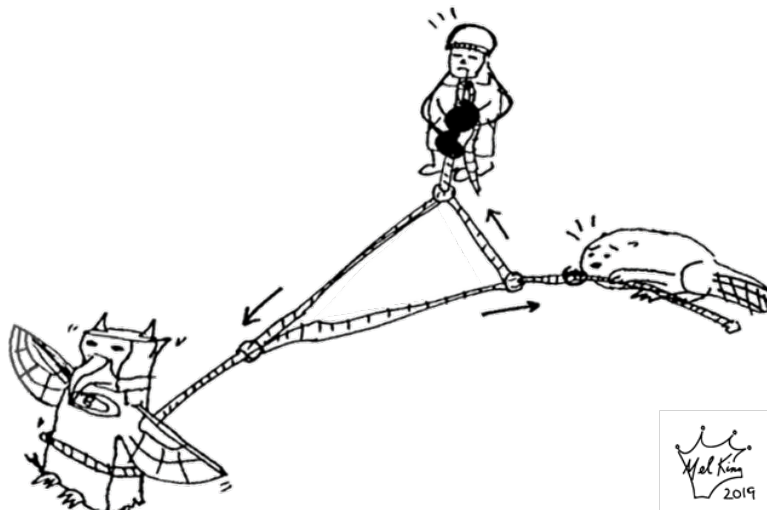
Overall there was a strong interest among participants on the further development of the Nature Futures Framework. Some suggestions were made for the next steps. For example participants felt the need to further clarify the three nature futures perspectives, including trade-offs and policy interventions involved, and in particular to have a better conceptualization of the *nature as culture* perspective to ensure pluralism. Participants also

hoped for further exploration on bridging different scales in order to provide a global understanding that can then be linked to local solutions. They also found that it would be helpful to have more graphs and visualisations of the three nature futures perspectives which would be understandable to a broader range of stakeholders. They suggested producing written materials on the possible scenarios to have something tangible 'to show' to stakeholders. Others encouraged further communication of the framework with different stakeholders to reflect it onto the real world and explore how it could translate into a liveable future, since the framework itself could have a much broader reach in terms of communication and policy support than solely to structure the scenarios and modelling process. They advised to both continue to develop the intricacies of the Nature Futures Framework for the scenarios and modelling work, but also to maintain a level of communicability of the concept for the stakeholders outside of the academic bubble.

From the discussions, participants recognized the challenge of bringing different perspectives together (especially bridging modelling experts and experts in participatory processes) and integrating various indicators from different disciplines into the nature futures scenarios in order to reflect the plurality of human-nature relationships. Many participants agreed that the next steps would consist in clarifying and organizing materials that are available to date, as well as identifying research and development challenges for years to come (i.e. modelling processes, interactions, feedbacks required to elaborate on the nature futures scenarios). Although many recognized that a daunting task still lies ahead, they appreciated the value of this pioneering work and how far this community has come.

In terms of expectations from IPBES, the participants stressed the need for an effective process management to harmonise frameworks and terminologies, and to promote participatory approaches to bring in more diversity, allowing for plurality and understanding as a community of practice. They hoped for further efforts towards interdisciplinary collaboration, to incorporate qualitative or non-quantifiable measures, socio-cultural factors, as well as marine features into modelling work, and also to add case studies as a concrete step towards thinking on different scales and building capacity. The participants also emphasized the importance for IPBES to translate the scientific work into realistic, actionable options, not only for policy makers but all stakeholders, and to encourage real-world application of its findings.

In closing, the co-chairs of the expert group thanked the host, organisers, and all participants for their valuable inputs. The TSU also added a special thanks to co-chairs and the organizing team and facilitators as this was the final official meeting of the IPBES expert group of the first work programme.



Expert group meeting report

Report from DAY 4 and DAY 5
(Thursday 28th - Friday 29th March)

Aims of the expert meeting

Following the workshop, the IPBES scenarios and models expert group met with the aim to:

1. Revise the roadmap for the four working groups based on outcomes of the workshop
2. Identify funding opportunities and resources to support roadmap implementation
3. Identify the way forward for the development of nature futures scenarios (including the link with relevant non-IPBES processes, such as CBD, IPCC)
4. Start drafting the planned papers.

The following is a non-chronological report of the discussions and outcomes of the meeting.

Discussions to identify the way forward for developing nature futures scenarios

Drivers: Having an overview of the different driver variables incorporated in existing models would allow us to look into how models align with the different drivers in the narratives, and clarify which aspects cannot be modelled yet. For several existing modelling initiatives, data tables of input variables exist, e.g. Fish-MIP. Input variables can be compared and narrowed down to a common set. However, there are no exact plans on modelling indirect drivers. We may need to explore first how to modify existing drivers and their projections, to incorporate nature futures perspectives into them, and allow time for a new generation of drivers to be modelled. Perhaps by testing SSPs incorporating nature futures perspectives. The work of ecosystem services (ES) modellers could continue to look at SSPs.

Socio-ecological feedbacks: There is a need for a research agenda on key socio-ecological feedbacks (see papers). There is also a need to map out processes of how nature underpins social dynamics: which data and models we have, which processes are not covered by these, and which skills we have in our networks. A template is useful to gather an overview of what this modelling community and the expert group covers. A way forward may be to jointly make a wish list of variables, policy responses, drivers etc. that would be relevant for the narratives. This would include a list of key socio-ecological feedbacks. The modelling community could reflect on what is already covered and what could be developed.

The Nature Futures Framework and how to use it: Different ways of using the framework were also considered. Although there is no consensus on a single way is to use the Nature Futures Framework (NFF), experts agree that it is important to represent different perspectives on nature, that there are key gaps in modelling approaches, and the need to trigger model development (socio-ecological feedbacks, certain drivers etc). If there are not enough indicators for *nature as culture* for instance, these need to be developed. The NFF could serve as a heuristic framework for developing scenarios: modelling communities could use the NFF perspectives as SSP-variations to illustrate how this framework could work. If we are however to follow the initial vision of developing entirely

new scenarios, the challenge would be to get the modelling communities to work on the same things, in the absence of a common scenario set like the SSPs.

Thus, the issue to consider is whether the narratives illustrate the corners or the centre of the Nature Futures Framework. The global average would be around the centre of the triangle, whereas specific locations might fit in different corners. Consistent narratives for corners might help to move forward, but may give the impression that we only consider extreme scenarios.

Narrative development: The challenge is to develop a set of narratives to kickstart the process of illustrating different parts of the triangle. Discussions resulted in two strategies of moving forward with narrative development:

- 1) Narrative-driven: develop scenarios first, identify key socio-ecological feedbacks, and task modelling teams to work with these narratives and test what can be quantified.
- 2) Model-driven: build scenarios only to a certain level in this first iteration. Identify and list the important variables of the narratives for the modelling community to consider (drivers, interactions), then have them consider which scenario they can/want to test run (e.g. SSPs modification with nature futures resulting in SSP-NFs. Test these in Biodiversity + ES models). The results would serve as input to developing final narratives with a broader stakeholder community. Modelling communities traditionally work in this way.

Regardless of the strategy, the most important role of the narrative is to help think about variables and relationships, which is a first step in developing the scenarios. Having well-defined narratives first is therefore crucial for the modellers' work. Also, the articulation between the qualitative and quantitative parts of the scenarios is crucial.

Illustrations and a modelling exercise: Apart from our final goal of creating these scenarios, we can already work with what we have so far. Hiring a designer to make beautiful illustrations and visions for the corners could improve our explanation of what the value perspectives of the NFF represent.

What we have to explore is how to move from today to a better world with different levels of ambition, taking into account the three perspectives, and considering trade-offs. It could be useful to speak of three possible visions of human-nature relationships, and illustrate what the levers leading us there could be, using examples from models. There are already good materials for this from The Hague workshop. The matrix on drivers, states, responses for the three corners produced by the breakout groups also illustrates how the framework could play out (see papers). It is useful to conceptualise these across scales using what we have now, even before delving into future projections. Further into the future we must look at indirect drivers, deeper lifestyle changes, links to SSPs, etc. Maybe we can already make projections for 2035 and explore the possibilities and trade-offs across the three dimensions.

We could have a cloud of different places in the triangle (viewed as a tetrahedron), and run simple scenarios to show what could change on different scales (considering drivers, states, responses for each future vision, on different scales and times: present day, 2035, 2050). Building on the matrix, a few case studies could be identified at different scales to make a similar inventory, and to illustrate the potential applications of the NFF for scenario modelling (see papers) and encourage people to work with us. The difficulty is indicating progress on the axes, but a relative comparison of progress would still be possible by considering vectors rather than magnitude. Vectors of real-world interventions could help illustrate the NFF qualitatively.

Discussions on the production of papers

List of planned papers

1. Short paper to introduce the NFF as framework for values and for building scenarios (to be submitted immediately after this workshop; Carolyn et al., *Science policy forum*).
2. The 'roadmap' paper: revised to cover gaps and priorities in modelling: critical variables on state/driver/pressures; list of needs, what exists, what needs model development. This paper will serve as an introduction to the short-term modelling exercise paper. (Henrique et al. // Kim et al., *Nature Sustainability/Ecology and Society*).
3. Nature Futures Framework methodology paper, serving as a longer version of the short science policy paper, to elaborate on the methodologies of how the NFF was developed (Laura et al., *People and Nature/Sustainability Science*, 8000 words).
4. Scenarios and socioecological feedbacks paper: will address what key socio-ecological feedbacks are needed in the scenarios. Covering conceptual elaboration and mobilization of empirical evidence (Garry et al., - *Frontiers, EE*).

Use of visualizations of the NFF: When producing papers, the visualizations of the NFF need to be coordinated for consistency and to avoid excessive duplication. The short paper for the Science policy forum will include a brief description of the corners with illustrations and supplementary materials. This should include descriptions of the values represented in the framework, and can also be further elaborated in the longer NFF methodology paper.

Progress on the Roadmap paper: Discussions were held on the author list and figures (including the three-dimensional 'spaghetti cube'), on how to define indicators for the corners, on how to consider trade-offs and synergies, and on what kind of values are represented in this 3D space. The group suggested to split the ideas into two papers: one paper on the important variables and currently available models (to be drafted by the modellers' workshop in June 2019); and another paper on a short-term modelling exercise, aiming for results before the next SBSTTA. The short-term exercise would identify case studies from different scales to make an inventory illustrating how to apply the NFF for scenario modelling.

Progress on the NFF methodology paper: We will focus on journals that allow a longer paper on our consultation process, and edit existing materials into one storyline. Rough conceptual sketches of figures have been made. The journal has specific requirements for authorship, so the proposed list is: 1) facilitators of the Auckland workshop; 2) facilitators/organizers of the Hague workshop and other events; 3) the Hague workshop participants who review the manuscript; 4) those who worked on NatCap/IPBES-6. The plan is to submit by the end of April 2019.

Progress on the Socioecological feedbacks paper: A research agenda on key socio-ecological feedbacks is needed. Publishing a paper that builds on this workshop, and expands on how to use the NFF to develop scenarios at different scales, could contribute to this. The paper would cover key feedbacks per NF perspective, illustrated with some real life examples. Due to gaps in research, there may be a concern for accuracy, which can be addressed by making explicit the confidence levels of statements as is often done in assessments. The plan is to have a draft ready before the modellers meeting at PBL in June 2019.

Authorship: We need to remain flexible on authorship, and assign backup authors to avoid the work being impeded by conflicting priorities among senior lead authors.

- For the modelling roadmap paper, Henrique will be backed by HyeJin. HyeJin will take the lead in writing. Some remote participants of the workshop will be authors.
- For the NFF methodology paper, Laura will be backed by Sana and Machteld.
- For the socioecological feedbacks paper, Garry could be backed by Gabriela and Jan.

Members of the expert group that were not at this workshop will be updated on these papers, and contributions invited where relevant.

Working Group 1 updates, discussions and plans

Updates: Almost all experts are members of working group 1, which handles the drafting of papers as well as linking across other working groups. The first product of this working group is the short paper drafted for submission to Science's Policy Forum. It was discussed to update the Nature Futures Framework figure with the one used at the CBD COP14, which has been widely shared on twitter already. The paper includes developments beyond The Hague workshop (June 2018), but is not trying to resolve how to encapsulate the Nature Futures Framework. In parallel to the short paper, the methodology paper has been drafted to cover the Auckland workshop and the stakeholder consultations since.

Regarding the development of the framework, we will discuss narrative development building on this workshop. Further illustration of the diversity of relationships with nature is to be included in a workshop organized in Wageningen in May 2019. There is also a need to translate the Nature Futures Framework and make concrete linkages with the IPBES Values assessment. We also need to ensure more cross-fertilization between narrative development and modelling (as the Auckland workshop had very few modellers, and the SSP exercise involved very few non-modellers).

Working group 1's action list is to develop an overall roadmap for the work ahead, to identify further funding sources, and to synthesise reflection on completed workshops and consultations.

Discussions: In reaction to the update from working group 1, experts underlined the need for a common understanding on the Nature Futures Framework, as it is sometimes referred to as the underlying values framework, and at other times as the structure of the entire nature futures conceptualization process. Discussions addressed whether the three-dimensional figure should already be used in upcoming papers.

Other experts shared plans and opportunities to link discussions on indicators across working groups, and also with the CBD. The need to realign some of the work in the timeline of activities was recognized. It would be useful to consolidate the materials emerging from all activities up to now, including post-Auckland consultations.

There was some unresolved debate on whether or not work with the modellers could begin before having some draft scenario narratives.

Short term plans: see papers.

Working Group 2 updates, discussions and plans

Updates: Working group 2, supported by the TSU, has been focusing on disseminating and testing the Nature Futures Framework through stakeholder consultations. These included, among others, a survey and exhibition booth engaging delegates at the 6th Plenary of IPBES (March 2018), a workshop at the Natural Capital Forum (March 2018), side events at CBD SBSTTA (July 2018), and CBD COP14 (November 2018). This workshop in Vancouver is a cross-cutting activity of working groups 1, 2, and 3. Both experts and TSU members have given presentations on the NFF at conferences, workshops, universities, and IPBES events.

Other initiatives could also benefit from the nature futures work: the IPBES assessment on the sustainable use of wild species is keen to work with the expert group and may have funding for this through WWF; the African Futures programme as well as the Global Environmental Outlook could also be opportunities. There are also relevant opportunities beyond the IPBES community (e.g. related to food), and more linkages should be created with the business sector. Draft narratives would be needed to communicate our work and to move forward. Joining events of other sectors such as the Eat Forum or the World Business Council for Sustainable Development could be useful, as having the private sector join IPBES meetings is difficult. We need to join forces across similar processes led by different entities, as they often involve the same experts. Examples include modelling work by institutions such as PBL and IIASA, as well as other cross-IPBES links such as capacity-building workshops.

Discussions: Consultations with stakeholders need to work two-ways, with the IPBES expert team consulting the modelling community and other disciplines, but also contributing to their processes. Such interactions would give insights, e.g. on how they incorporate biodiversity in climate, agriculture, land use discussions. They would welcome input from the biodiversity community, so we should consider their scenarios work. An interesting example is SESYNC, working on geoengineering scenarios with science fiction writers and modellers, similarly to how we worked in Auckland.

Several funding proposals have been submitted, most without success. Submission of abstracts and proposals should be streamlined to avoid competing with each other. We have produced workshop reports, abstracts for conferences, several NFF presentations, and image material from Auckland (posters, flyers etc.). The WG-4 toolbox would be crucial for compiling these.

Short term plans: The next steps for WG-2 are to discuss what kind of consultations are needed, and how to fill existing gaps in our visions. To progress from visions and the Nature Futures Framework to scenarios, a stakeholder workshop will be organised in late 2019/early 2020 (6 months to prep; to be held before IPBES-8). WG-2 will need to plan the organisation and extent of stakeholder engagement. WG-2 will also connect this participatory process with WG-3 and the modelling community, as well as with different lines of IPBES work and other scenario communities. There is also a need for outreach products other than reports and papers (to be produced with WG-4).

Working Group 3 updates, discussions and plans

Update: Collaborative modelling work has been successful, resulting in contributions to the IPBES global assessment. However, the modelling of nature futures has yet to be initiated. This work needs to consider indirect drivers, direct drivers, and biodiversity and ecosystem services. This will include adjustment of SSPs for nature futures scenarios, modelling of key socio-ecological systems, and incorporation of policy interventions in the models. WG-3 also needs to consider additional ways of securing funding for this work.

A workshop led by WG-3 is planned for June 2019, where the outcomes of this Vancouver meeting will be taken on board. Several WG-3 members met at the Scenarios forum in Denver (March 11-13) and discussed the possibility of involving a wider modelling community through virtual connections. The remote sessions of this workshop provide lessons for this.

WG-3 also connects with the Fish-MIP community, and has introduced the nature futures framework at their last meeting. However, the timing of the Fish-MIP scenario modelling and the nature futures development may be difficult to match. The terrestrial BES modelling community is already quite engaged with this IPBES work.

Discussions: [most discussions on WG-3 linked with general debates on how to develop scenario narratives from the NFF. These have been covered in the first section of this expert meeting report]

One of the objectives of this meeting was to brainstorm on the mapping of what models can do against what we would like them to do. This would constitute a distinct exercise from the scenarios and socio-ecological feedbacks work. The proposed quick-study on important variables and modelling priorities could be led by William and Carlo.

Short term plans: by end of semester 1, 2019, we need the short paper on the NFF to be submitted (see papers). Then a trial can be organised with modelling teams on the short term exercise (in the June 2019 workshop; and iDiv can fund another workshop later in 2019). Another paper would be on the short term modelling exercise including the longer roadmap.

Working Group 4 updates, discussions and plans

Update: Working group 4 task leaders have started drafting a template for conducting case studies using the Nature Futures Framework, but progress has been slow, as the design needs to fit different audiences and consider language barriers. The expert group recognizes that having a clear framework and approach at global level is key in bringing the nature futures to local levels. The Chinese government is implementing a national scenario-building exercise, for which a workshop was held in early 2019, inviting some of the expert group members to introduce the nature futures. The workshop involved young experts from China and served to discuss scenarios in different sectors. A grant proposal has been submitted to the Stockholm Environment Institute's strategic collaborative fund to support the implementation of an Indian case study around water resources. There have been no concrete developments in the other potential case studies we identified (i.e. South Africa or Sub-Saharan Africa, and Brazil).

Several experts are working on setting up a database of local and regional scenarios, which could create bottom-up tractability for the nature futures and provide case studies for working group 4.

Discussion: The template needs to be set-up as soon as possible, so we can compile a ready-to-use toolbox including materials for future presentations, workshops and consultations by the expert group. One of the lessons from the China workshop was a need for such a toolbox to include a set of practical tools and materials to present the Nature Futures Framework, considering possible language barriers, as well as examples of consultation exercises of different lengths (e.g. the MEP exercise, Oct. 2018).

For the WG-4 case studies, it is important to have more control over who conducts them and how. This depends on funding but we should consider how useful each opportunity is, as we have limited resources. Examples are the workshop in China and summer school in Brazil, where the type of participants and overall programme design was out of our hands: both because of limitations by the organizers but also due to late mobilisation among ourselves.

Short term plans: For future engagement of stakeholders it is important to create publicly available outputs. The next 2 years plan would thus include the production of a toolbox (visioning, seeds, etc.), and identification of funding opportunities.

Final considerations

End of the expert group's mandate & a new task force: This workshop was officially the last meeting of the current expert group. Eefje den Belder, on behalf of the TSU, thanked William Cheung, his team, and the University of British Columbia for hosting a successful workshop, and Garry Peterson and Laura Pereira for leading the workshop preparation. A big round of applause and thanks were given to Carolyn Lundquist and Henrique Pereira for their excellent job as inspiring co-chairs.

IPBES-7 may approve the establishment of a task force on scenarios and models (permanent version of expert group), in which case there will be a call for new members and a TSU. Current experts will have to re-apply, but fellows will continue for the coming 2,5 years. The size of the new task force is still unclear. It is useful to consider our short term and long-term activities: what can we do this year, what will we continue or start later? Officially we can still set certain agendas and need to leave a clear heritage for the new task force to build on. Thus, this is the time to deliver outputs (e.g. papers, website, toolbox), as a new task force may not pick it up and plans may be up for discussion again. A workshop will be organised, likely in the latter half of 2019, to have the new task force meet and discuss existing and new plans for the nature futures development.

Discussion on timelines: We need to consider the timeline of CBD's process leading up to 2020 and our moments of influence. Not only through IPBES INF documents but also by publishing papers in time. For now, the NFF is in line with the CBD's timeline, and they can be informed already on the framework. Thinking about indicators and the key socio-ecological feedbacks that need to be modelled should be our priority, as this attracts attention within the CBD and would be greatly useful for them.

Workshop report: The workshop report is to be ready by the IPBES-7 plenary: an informative, descriptive workshop report will be prepared by the TSU and experts will focus on papers. Authors for this workshop report will be all participants, the organising team, and the main note takers, and will include a table with people's contributions. Remote participants will be named as contributors.

Fellows: Fellows can play a role in finalizing the planned papers and linking with the ongoing assessments. The TSU will introduce them to the expert team as soon as they are officially selected, and will plan their mentorship and division of tasks. There will also be a fellows' workshop in Morocco, where all of the scenarios & models fellows will be able to meet with fellows of other deliverables. One of our fellows will be invited to join the workshop in Brazil of the TSU Capacity Building and perhaps the summer school on scenarios & modelling in the same location as well. Also, the fellows allocated to be working on WG-3 will be invited to participate in the regional modelling meeting in June 2019 at PBL in the Netherlands.

Links to other taskforces and assessments: To stay linked to the other ongoing work by IPBES, such as the task forces and the assessments, the TSU and/or experts will be liaisons:

- 1) The TSU serves as contact between the IPBES secretariat and other TSUs.
- 2) The TSU will be connected to the taskforces on Indigenous and Local Knowledge, Knowledge and Data, Capacity Building, and Policy Support Tools, to consider collaborations and involve experts where relevant.
- 3) For the scenario chapters of the ongoing (and future) assessments
 - a) For the Values assessment: Zuzana Harmackova, Nadia Sitas, Becky Chaplin-Kramer, Patty Balvanera are in our list of liaisons to our group, and Eefje den Belder (TSU) will be the contact from our side.
 - b) For the Invasive alien species assessment: to be determined
 - c) For the Sustainable Use of Wild species: Laura Pereira from our group and Christo Fabricius from their group will serve as liaisons.

There is a need to connect and stay in regular contact with other IPBES efforts, both informally and formally to make our work build on each other. Also, we need to remain well connected to the scenarios and models MEP members, and will have regular calls with them, the co-chairs, and the TSU. Due to time constraints, there is a preference for more digital meetings (e.g. remote presentation), rather than organising more meeting to connect to them.

Other: It would be great to have a flexible, easy way of collaborating online within the expert group. Google drive, Asana, Slack, share space are all mentioned but none of these are universally appreciated. The TSU will think about what might work, once the period of the upcoming nomination process for TSU and experts is over.



Outcomes of the workshop

- The workshop allowed a familiarisation of the participants with the Nature Futures Framework and the three perspectives of *nature for nature*, *nature for society*, and *nature as culture*.
- The participants reached a shared understanding on how the Nature Futures Framework accommodates plurality in human-nature relationships, and makes explicit the value judgements that underlie the prioritisation of goals and the ways of addressing pressures, leading to different synergies and trade-offs.
- The participants identified three different visual representations of the Nature Futures Framework that complement each other by illustrating different concepts:
 - i) a flow-chart of the drivers-pressures-responses-states relationships which lead to different future outcomes,
 - ii) a tri-rectangular tetrahedron (one half of a cube split diagonally) visualising the three-dimensional state-space of the nature futures, where improvements can be made simultaneously along all three perspectives of the Nature Futures Framework, and
 - iii) a spider diagram showing the different balances of priorities across the three perspectives.
- The meeting of the expert group members clarified the processes for the continuation of the expert group's work under IPBES in the coming years, and identified important outputs to be delivered in the next steps:
 - o A toolbox and template for the use of the Nature Futures Framework, consolidating the diverse values represented in the three perspectives, the visual representations of these perspectives, the participatory scenario-building process, and the metrics
 - o A short paper introducing the Nature Futures Framework as a tool for understanding diverse values and participatory scenario-building
 - o A paper on gaps and priorities in modelling, identifying what models already exist and what needs development for the modelling of nature futures
 - o A long paper on the development process of the Nature Futures Framework and to elaborate on the methodologies used (as an elaboration of the short paper)
 - o A paper on socioecological feedbacks to be incorporated into scenarios, including their conceptualisation and mobilisation of empirical evidence

Conclusions

- The workshop concluded with a positive outlook on the future application and development of the Nature Futures Framework:
 - o The Nature Futures Framework is evolving into an inclusive framework which aims to cover many perspectives and ways of life, and which can be used in various ways to discuss future visions and targets.
 - o The development of the nature futures scenarios will be an ambitious process which seeks to integrate different disciplines to reflect the plurality of human-nature relationships.
 - o There is an abundance of useful content developed to date on the Nature Futures Framework, which can be used as a communication tool to inspire people, and for policy support.
- The requirements for further elaboration of the three nature futures perspectives were also laid out:
 - o Extensive modelling work still needs to be carried out, which will first require a disentanglement of what can be modelled and what needs to be explored further.
 - o The narratives of the nature futures scenarios need to be developed with clearly identified and prioritised entry points for policy interventions.
 - o Indirect drivers need to be considered in this process of participatory scenario development, as it can lead to a new range of policies and responses that may otherwise not be visible.
 - o Key feedbacks from nature to policymaking and society need to be incorporated into the nature futures scenarios, including how diverse values can create socio-ecological tipping points.
 - o Quantitative and qualitative indicators need to be identified for different time and spatial scales that are relevant to policymaking.
 - o Trade-offs and synergies which may arise between the three nature futures perspectives need to be identified.
 - o The role of business, law, finance, politics, and radical shifts in society need to be considered in more depth in the elaboration of narratives.
 - o The nature as culture perspective needs to be better conceptualised to ensure that the plurality of relational values of nature is well represented.
- Finally, the workshop highlighted the importance for IPBES to translate scientific work into realistic, actionable options, while promoting participatory approaches that embrace plurality and understanding as a community of practice, and encouraging alignment of various lines of work with the Nature Futures Framework.

ANNEXES

Annex 1. List of participants

Sandra Verónica Acebey Quiroga

JG & Asociados
IPBES Scenarios & Models expert group
sacebey@outlook.es

William Cheung

The University of British Columbia
Institute for the Oceans and Fisheries
IPBES Scenarios & Models expert group
w.cheung@oceans.ubc.ca

Ivon Cuadros

Sapienza University of Rome
Department of Biology and Biotechnology
ivon.cuadros@uniroma1.it

Kate Davies

NIWA Social Science and Economics
Kate.Davies@niwa.co.nz

Ana Paula Dutra de Aguiar

Stockholm University
Stockholm Resilience Centre
anapaula.aguiar@su.se

Tyler Eddy

University of South Carolina
Institute for Coastal & Marine Sciences
tyler.eddy@sc.edu

Simon Ferrier

CSIRO Land and Water
IPBES Scenarios & Models expert group
simon.ferrier@csiro.au

Karen Fisher

University of Auckland
School of Environment
k.fisher@auckland.ac.nz

Maria Gasalla

University of Sao Paulo
Oceanographic Institute
mgasalla@usp.br

Emily Giles

WWF Canada
Science, Research, and Innovation
egiles@wwfcanada.org

Zuzana Harmackova

Stockholm Resilience Centre
zuzana.harmackova@su.se

Tim Hirsch

Global Biodiversity Information Facility (GBIF)
Secretariat
thirsch@gbif.org

Sathyapalan Jyothis

National Institute of Rural Development
Centre for wage employment
IPBES Scenarios & Models expert group
jyothis.nird@gov.in

Sylvia Karlsson-Vinkhuyzen

Wageningen University
Public Administration and Policy
IPBES Scenarios & Models expert group
sylvia.karlsson-vinkhuyzen@wur.nl

HyeJin Kim

iDiv German Centre for Integrative Biodiversity
Research
Biodiversity Conservation
hyejin.kim@idiv.de

Grygorii Kolomytsev

I.I. Schmalhausen Institute of Zoology NAS of
Ukraine
Animal monitoring and protection
IPBES Scenarios & Models expert group
g.kolomytsev@gmail.com

Jan Kuiper

Stockholm University
Stockholm Resilience Centre
jan.kuiper@su.se

Carolyn Lundquist

NIWA and the University of Auckland
Institute of Marine Science
IPBES Scenarios & Models expert group
carolyn.lundquist@niwa.co.nz

Maria Gabriela Palomo

Natural History Museum Argentina
Marine Ecology Lab
IPBES Scenarios & Models expert group
mariagapalomo@gmail.com

Henrique Pereira

iDiv
MLU
IPBES Scenarios & Models expert group
hpereira@idiv.de

Laura Pereira

City University of London
Center for Food Policy
IPBES Scenarios & Models expert group
pereira.laura18@gmail.com

Garry Peterson

Stockholm University
Stockholm Resilience Centre
IPBES Scenarios & Models expert group
garry.peterson@su.se

Ramon Pichs-Madruga

Center for World Economy Studies (CIEM)
Direction
IPBES Scenarios & Models expert group
rpichs@yahoo.com.mx

Osamu Saito

United Nations University
Institute for the Advanced Study of
Sustainability
saito@unu.edu

Theresa Satterfield

University of British Columbia
Institute for Resources, Environment and
Sustainability
terre.satterfield@ires.ubc.ca

Bob Scholes

University of the Witwatersrand
Global Change Institute
bob.scholes@wits.ac.za

Fabrice Stephenson

NIWA
Centre for Coasts and Oceans
Fabrice.Stephenson@niwa.co.nz

Rashid Sumaila

The University of British Columbia
Institute for the Oceans and Fisheries/
School of Public Policy and Global Affairs
r.sumaila@oceans.ubc.ca

Eefje den Belder

PBL Netherlands Environmental Assessment
Agency
IPBES TSU Scenarios & Models
eefje.denbelder@pbl.nl

Sana Okayasu

PBL Netherlands Environmental Assessment
Agency
IPBES TSU Scenarios & Models
sana.okayasu@pbl.nl

Machteld Schoolenberg

PBL Netherlands Environmental Assessment
Agency
IPBES TSU Scenarios & Models
machteld.schoolenberg@pbl.nl

Juan Jose Alava

University of British Columbia
Institute for the Oceans and Fisheries
j.alava@oceans.ubc.ca

Patricia Angkiriwang

University of British Columbia
Institute for the Oceans and Fisheries
p.angkiriwang@oceans.ubc.ca

Taylor Clarke

University of British Columbia
Institute for the Oceans and Fisheries
t.clarke@oceans.ubc.ca

Hubert du Pontavice

Agrocampus Ouest/University of British
Columbia
Institute for the Oceans and Fisheries

Vicky Lam

University of British Columbia
Institute for the Oceans and Fisheries
v.lam@oceans.ubc.ca

Oai Li Chen

University of British Columbia
Institute for the Oceans and Fisheries,
o.li@oceans.ubc.ca

Ravi Maharaj

University of British Columbia
Institute for the Oceans and Fisheries
r.maharaj@oceans.ubc.ca

Muhammed Oyinlola

University of British Columbia
Institute for the Oceans and Fisheries
m.oyinlola@oceans.ubc.ca

Juliano Palacios

University of British Columbia
Institute for the Oceans and Fisheries
j.palacios@oceans.ubc.ca

Jennifer Rae Pierce

University of British Columbia/Yale University
Urban Biodiversity Hub
piercestudio@gmail.com

Tomoka Sweet

University of British Columbia
Institute for the Oceans and Fisheries
t.sweet@oceans.ubc.ca

Colette Wabnitz

University of British Columbia
Institute for the Oceans and Fisheries
c.wabnitz@oceans.ubc.ca

Annex 2. Final programme of the workshop

MONDAY (25 March)		
<i>Get on the same page on Nature Futures Framework and how best to generate scenarios useful to IPBES. Emphasise the urban, land-water and marine interactions.</i>		
7h00 - 8h00	Remote session	Online discussions with remote participants
8h00 - 8h45	Breakfast	Breakfast at the venue (PWIAS) for all
8h00 - 9h00	Registration	
9h00 - 9h15	Welcome	Welcome by host and co-chairs Welcome to UBC & land acknowledgement
9h15 - 9h30	Introduction to IPBES	Introduction to IPBES, assessments and our Scenario & model expert group mandate (Eefje den Belder)
9h30 - 10h45	Introductions	Speed talks (2 mins per person) - see template slides <ul style="list-style-type: none"> Based on your understanding of the NFF, what new nature futures scenarios are needed for the system in which you work? What are the most important dynamics, variables, processes, feedbacks or drivers that should be included in the next generation of scenarios, but are not well represented in existing scenarios?
10h45 - 11h00	Coffee	
11h00 - 12h30	Plenary presentations	Presentation on the Nature Futures Framework (Carolyn Lundquist) Q&A
12h30 - 14h00	Lunch	Change of venue to Aquatic Ecosystems Research Laboratory
14h00 - 16h30	Breakout groups <i>Coffee on the go</i>	Key questions for all groups: <ul style="list-style-type: none"> Are these existing visions capturing issues - if not what is missing? What are the key variables, dynamics, drivers - are they already in these SSPs? Or are there other ones and if so, which ones are the important ones? Group 1: <i>Seascapes/landscapes including food production, rewilding, land-water interactions</i> Group 2: <i>Species diversity, regional outcomes, multiple levels of engagement, invasive species, sectoral SDGs</i> Group 3: <i>Extreme Zones (mountains, deep seas etc.), indigenous and local knowledge, forests, cultural landscapes, inequality of access</i> Group 4: <i>Pole to Pole - teleconnections and flows, industry and economic interests, material/nutrient flows, politics, power</i> Group 5: <i>City, urban-rural dynamics, plurality, emotions and values, psychological wellbeing and health, green spaces, dynamics of cities</i> Group 6: <i>Hybrid Natures, role of technology, de-growth, systemic risk, gender</i>
16h30 - 17h30	Plenary presentations	Report back from groups
17h30	Meeting adjourned	
18h00		Optional walk to the beach (guided by UBC's team)

TUESDAY (26 March)		
<i>Link to models; how does modelling community need to work together and shift away from singular IAM perspective to include legitimacy, equity, plurality.</i>		
7h00 - 8h00	Remote session	Online discussions with remote participants
8h00 - 8h45	Breakfast	Breakfast at the venue (PWIAS) for all
9h00 - 10h00	Welcome and recap	Recap on progress made on Day 1 and feedback from the remote session
10h00 - 12h30	Breakout groups <i>Coffee on the go</i>	<p>Key tasks for all groups:</p> <ul style="list-style-type: none"> • Identify the key issues and key factors shared across the nature futures • Produce a graphical summary and conceptual figure of your discussions • Consider how to operationalize this Nature Futures Framework <p>Group 1: <i>Indirect drivers, pressures, state of nature: "What trends and dynamics are moving the world towards each of the extreme nature futures?"</i></p> <p>Group 2: <i>Socio-ecological feedbacks: "What feedbacks reinforce each of the nature futures?"</i></p> <p>Group 3: <i>Seascapes / Landscapes: "How do different ecosystems and their connections vary among the three nature futures?"</i></p> <p>Group 4: <i>Look at edges of the triangle: "What trade-offs and synergies might exist between the three pairs of nature futures?"</i></p>
12h30 - 13h30	Lunch	
13h30 - 14h30	Plenary presentations	Report back from groups
14h30 - 15h00	Plenary discussions	
15h00	Meeting adjourned	
15h00 - 16h00	<i>Leave the room</i>	<i>Preparations of venue for Public Event</i>
16h00 - 18h00	Public Event	At PWIAS
18h00	Cheese & Wine	

WEDNESDAY (27 March)		
<i>How to be useful to the policy cycle (strengths and opportunities for use of the scenarios and models): what can we do now and what gaps must research fill? How does this link to CBD, SDG, indicator discussions?</i>		
7h00 - 8h00	Remote session	Online discussions with remote participants
8h00 - 8h45	Breakfast	Breakfast at the venue (PWIAS) for all
9h00 - 9h45	Welcome and recap	Recap on progress made on Day 2, feedback from the remote session, and discussion on key objectives of the day
9h45 - 11h30	Breakout groups <i>Coffee on the go</i>	Key question for all groups: <ul style="list-style-type: none"> What are the key elements that we need to bring in to model biodiversity that we do not do now? e.g., socio ecological feedbacks, value preferences Group A: <i>Metrics across the three nature futures</i> Subgroup 1: <i>Mapping metrics onto the nature futures</i> Subgroup 2: <i>Identifying urban environment metrics</i> Group B: <i>Feedback loops across the three nature futures</i> Subgroup 1: <i>Feedbacks in a nature for nature future</i> Subgroup 2: <i>Feedbacks in a nature as culture future</i> Subgroup 3: <i>Feedbacks in a nature for society future</i>
11h30 - 12h30	Plenary presentations	Report back from groups
12h30 - 13h00	Plenary discussions	
13h00 - 14h00	Lunch	
14h00 - 15h00	Plenary presentations	Short talks on processes to which scenarios can contribute: <ul style="list-style-type: none"> Updates on the GBO5 process (Tim Hirsch) Ongoing and upcoming IPBES assessments (Eefje den Belder) Contributions of the modelling group to the IPBES global assessment (Henrique Pereira)
15h00 - 16h15	Breakout groups <i>Coffee on the go</i>	Key question for all groups: <ul style="list-style-type: none"> What set of scenarios would be most useful for you and IPBES? How would they be useful, what would the key features be, and how would they relate to existing scenarios? What is the scenario timeframe? What is the scenario's long term goals and products? How can they input into the post-2020 CBD discussions and other immediate needs? What is required to produce the scenarios? What new elements are required? Groups 1-4 selected randomly
16h15 - 17h00	Plenary presentations	Report back from groups
17h00 - 17h30	Final round of the table	Brief speech from all participants on their takeaways from the workshop
17h30	Meeting adjourned	Closing words from the co-chairs and thanks

THURSDAY (28 March) Expert group meeting		
8h00 - 8h45	Breakfast	Breakfast at the venue for all
9h00 - 9h30	Intro to expert days	Review by WG leads of key tasks; assigning Expert Group to WG breakouts
9h30 - 11h00	Plenary presentations	Update of activities per WG: key tasks, timelines, people <ul style="list-style-type: none"> • WG 1 (Carolyn Lundquist) • WG 2 (Laura Pereira) • WG 3 (William Cheung) • WG 4 (Jyothis Sathyapalan) Plenary discussions
11h00 - 11h30	Coffee	
11h30 - 13h00	Breakout groups	Key questions for all groups: <ul style="list-style-type: none"> • What did this WG take from these 2 days and how do you see the next 1½ to 2 years? • What needs to be done as we move forward to engage with stakeholders and to have the multiscale scenarios? • How do you see a report for this workshop emerging? Group A: <i>The stakeholder consultation process, development of narratives, and compilation of a toolbox</i> (WG 2 & WG 4) Group B: <i>Way forward for the modelling work</i> (WG 3)
13h00 - 14h00	Lunch	
14h00 - 14h30	Plenary presentations	Report back from groups
14h30 - 15h30	Plenary discussions	Discussions on scheduled outputs and timeline of production
15h30 - 17:00	Breakout groups <i>Coffee on the go</i>	Paper drafting groups: Group 1: <i>Participatory scenario building process (Auckland-COP14 period) paper</i> Group 2: <i>Socio-ecological feedbacks paper</i> Group 3: <i>Modelling paper</i>
17h00 - 17h30	Plenary discussions	Report back from groups on progress and confirmation of plans for the last half-day
17:30	Meeting adjourned	Closing words from the TSU with thanks to the hosts, WG 2 co-leads, and co-chairs of the expert group
19h00 - 21h00	Group dinner	

FRIDAY (29 March) Expert group meeting		
8h00 - 8h45	Breakfast	Breakfast at the venue for all
9h00 - 11h00	Breakout groups	Paper drafting groups: Group 1: <i>Participatory scenario building process (Auckland-COP14 period) paper</i> Group 2: <i>Socio-ecological feedbacks paper</i> Group 3: <i>Modelling paper</i>
11h00 - 11h30	Coffee	
11h30 - 13h00	Plenary discussions	Report back from groups on progress and discussion on authorship Discussion on other relevant topics for the work of the expert group: <ul style="list-style-type: none"> • Timeline of activities • Engagement of Fellows • Linkages with other IPBES assessments • Organisation of future meetings
13h00 - 14h00	Lunch	Conclusion and goodbyes

Breakout Groups of the week

Day 1

- Speed-talks: Garry Peterson (facilitator)
- Group 1 (Seascapes/landscapes interactions): Henrique Pereira (facilitator), William Cheung, Eefje den Belder, Tyler Eddy, Colette Wabnitz, Sana Okayasu
- Group 2 (Species diversity): Carolyn Lundquist (facilitator), Simon Ferrier, Grygorii Kolomytsev, Ivon Cuadros, HyeJin Kim, Juliano Palacios, Tayler Clarke
- Group 3 (Extreme Zones): Kate Davies (facilitator), Sandra Acebey Quiroga, Rashid Sumaila, Ana Paula Dutra de Aguiar, Muhammed Oyinlola, Juan Jose Alava
- Group 4 (Pole to Pole – teleconnections): Garry Peterson (facilitator), Maria Gasalla, Gabriela Palomo, Ramon Pichs, Vicky Lam, Oai Li Chen
- Group 5 (City, urban-rural dynamics): Sylvia Karlsson-Vinkhuyzen (facilitator), Machteld Schoonenberg, Zuzana Harmackova, Jennifer Rae Pierce, Emily Giles, Tim Hirsch, Patricia Angkiriwang
- Group 6 (Hybrid Natures): Laura Pereira (facilitator), Karen Fisher, Osamu Saito, Fabrice Stephenson, Hubert du Pontavice, Jan Kuiper, Terre Satterfield

Day 2

- Group 1 (Indirect drivers, pressures, state of nature): Sylvia Karlsson-Vinkhuyzen (facilitator) Juliano Palacios, Ramón Pichs, Ivon Cuadros, Fabrice Stephenson, Zuzana Harmackova, Emily Gills, Jan Kuiper, Carolyn Lundquist, Juan José Alva
- Group 2 (Socio-ecological feedbacks): Garry Peterson (facilitator), Bob Scholes, Jennifer Rae Pierce, Vicky Lam, Maria Gasalla, Muhammed Oyinlola, Oai Li Chen,
- Group 3 (Seascapes/landscapes interactions): Henrique Pereira (facilitator), Colette Wabnitz, Tyler Eddy, Gabriela Palomo, Kate Davies, Eefje den Belder, William Cheung
- Group 4 (Trade-offs and synergies in the triangle): Laura Pereira (facilitator) Grygorii Kolomytsev, Ana Paula Dutra de Aguiar, Simon Ferrier, Karen Fisher, Jyothis Sathyapalan, HyeJin Kim, Tim Hirsch, Tayler Clarke, Sana Okayasu

Day 3 (only facilitators listed)

- Group A (Metrics across the nature futures): Henrique Pereira, Laura Pereira
 - Subgroup 1 (Mapping metrics onto the nature futures): Kate Davies
 - Subgroup 2 (Identifying urban environment metrics): Henrique Pereira
- Group B (Feedback loops across the nature futures): Garry Peterson, Sylvia Karlsson-Vinkhuyzen
 - Subgroup 1 (Feedbacks in a nature for nature future): Garry Peterson
 - Subgroup 2 (Feedbacks in a nature as culture future): Jennifer Rae Pierce
 - Subgroup 3 (Feedbacks in a nature for society future): Zuzana Harmackova, Ramon Pichs
- Groups 1-4 of the afternoon session: split randomly

Days 4 & 5

- Group A: Stakeholder consultation, narrative development, toolbox compilation (WGs 2 & 4)
- Group B: Way forward for the modelling work (WG 3)
- Group 1: Participatory scenario building process (Auckland-COP14 period) paper
- Group 2: Socio-ecological feedbacks paper
- Group 3: Modelling paper