Pole Position-NL 3.0

Strategy for the Netherlands Polar Programme 2021–2025

Cover: Adélie penguin. Photo: **Marck Smit**, NIOZ.

Pole Position-NL 3.0

Strategy for the Netherlands Polar Programme 2021–2025

Contents

Prologue

The polar regions are changing rapidly and only science can inform us about the changes that may lie ahead, affecting both the polar regions but certainly also the Netherlands. Due to climate change, the regions pose increasingly urgent and fascinating questions for both scientists and policymakers.

This is the 2021–2025 strategy for the Netherlands Polar Programme (NPP), aimed at addressing the most urgent questions for the polar science community in the Netherlands. The NPP is operated by the Dutch Research Council (NWO) and financed together with the Dutch government. The strategy document will guide the future of the NPP and is intended for anyone who is interested in our key themes and key research questions, in what we are trying to accomplish, how we want to achieve it and who should take action.

Many thanks are in place for the work done by the strategy committee, especially by its chair Martine van den Heuvel-Greve. They all shared their valuable insights and contributed to creating this document. We would also like to thank those in our polar community who took the time to respond to the committee's questionnaire. All of this input has made this a much better document.

This strategy builds further on the excellent international reputation of our polar sciences, which we can all be proud of. It has proven to be of high quality and will provide a sound baseline for future work.

Five ambitions are identified in the strategy, providing excellent challenges for further developments, with associated specific actions. This strategy invites the NPP Programme Committee, the funding ministerial departments and, last but not least, the polar researchers themselves to take action. The bar has been raised high for all of them for the next five years.

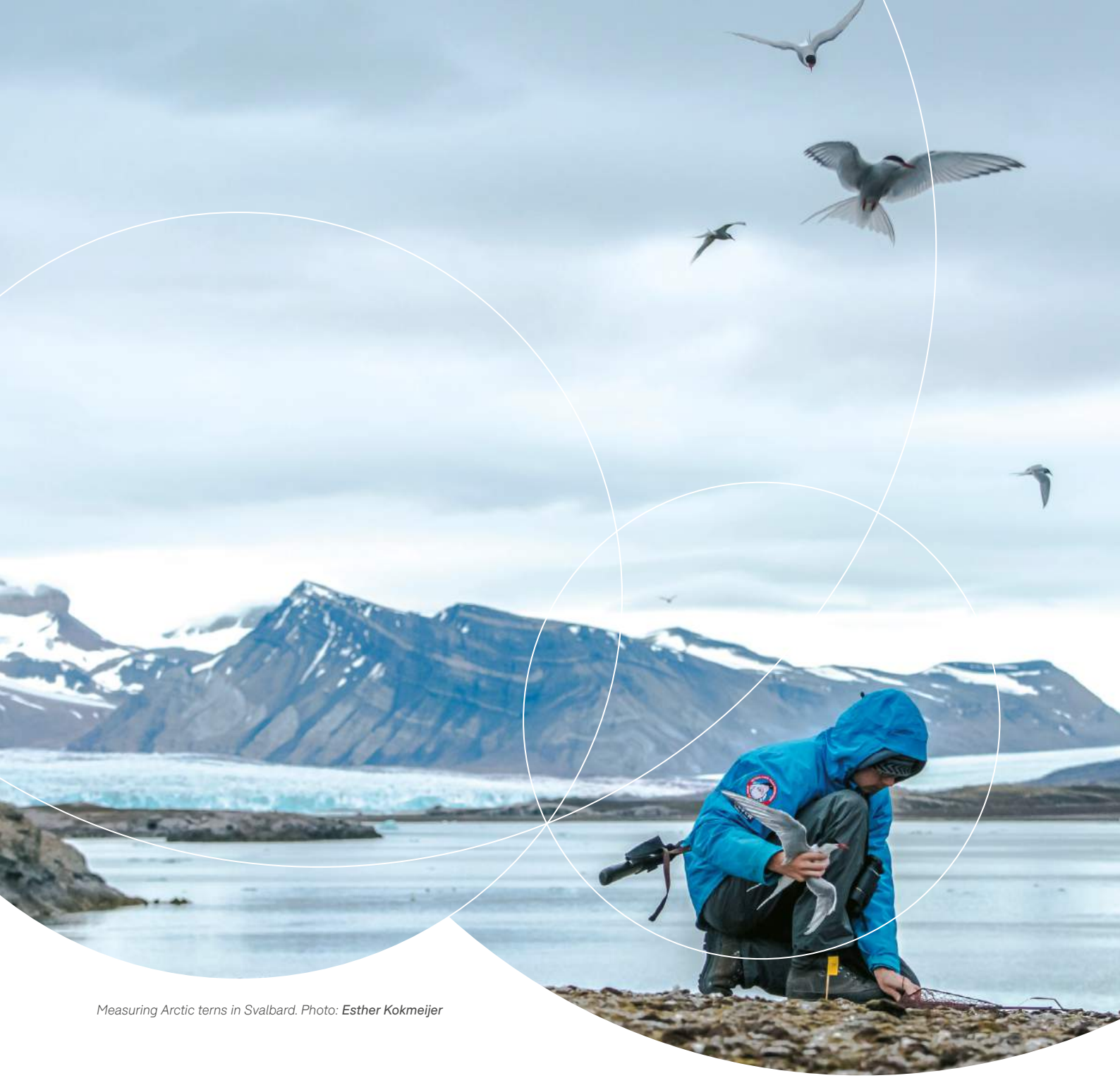
This newly conceived strategy provides tools for a 'focus and mass' approach on four key themes and six key questions. The strategy indicates further necessary strategic selection by targeting available funding on topical, location-driven or strategic calls. It also directs the scope of our international collaborations and prepares the ground for a taskforce to dive deeper into the feasibility of establishing a Netherlands Polar Centre in the second year of this strategy. Such a centre could mean a landmark development in the future of polar sciences in the Netherlands, especially for its coordination and support. A future in which the polar regions are certain to make the headlines in ever greater number and gravity.

There is an undisputable increase in strength and capacity to be gained from (inter)national collaboration, which can (further) enlarge our return on investment. This is crucial for the NPP's success. Apart from some strategic partnerships, we do not oversee any large self-sustaining polar logistics capacity or infrastructure. This creates strength through flexibility, but it also creates dependency on others. Multipliers, strategic collaborations and smart synergetic approaches will be required to enable us to address our ambitions successfully. Not everything is possible everywhere at the same time. Thus, this strategy is designed to guide the actors in polar research into making the best possible choices and to get as far ahead in polar research as possible.

It requires everyone's efforts and support.

Dick van der Kroef
Director of the Netherlands Polar Programme

The Hague, May 2021



Measuring Arctic terns in Svalbard. Photo: ***Esther Kokmeijer***

Summary of Pole Position-NL 3.0

Ambitions and actions

The aim of the Netherlands Polar Programme (NPP) is to stimulate and support the development and execution of high-quality research in the Arctic and Antarctic. It is a special programme operated by the Dutch Research Council (NWO), financed and commissioned by the Dutch government. The Netherlands has been committed to scientific polar research since it obtained Consultative Party status in the Antarctic Treaty in 1990, and Observer status in the Arctic Council in 1998. This Pole Position-NL 3.0 describes the third integrated polar research strategy (2021–2025). It is complementary to the Netherlands' Polar Strategy 2021–2025, titled Prepared for Change, published by the government of the Netherlands. The research strategy was developed with the aid of a strategy committee under the auspices of the NPP Programme Committee.

The purpose of Pole Position-NL 3.0 is to:

1 Advise the Dutch government and NWO on how the Netherlands Polar Programme can best invest its resources
2 Provide an overview of the strongholds of Dutch polar expertise and know-how, and disclose opportunities for collaboration

International collaboration

International collaboration is of high importance for conducting Antarctic and Arctic research. Although the Netherlands cooperates with many international partners, the two most important ones are the British Antarctic Survey (BAS) in the UK and the Alfred Wegener Polar Institute (AWI) in Germany. The NPP maintains Memoranda of Understanding (MoUs) with both to support and stimulate collaboration and facilitate access to their polar infrastructure.

To stay up to date and make it possible to influence international polar developments and agendas, the NPP nominates and supports the Dutch representation in international polar committees. The current portfolio for membership and participation via NPP consists of coordinating bodies for research – e.g. the Scientific Committee on Antarctic Research (SCAR), the International Arctic Science Committee (IASC) and the European Polar Board (EPB) – hosted by NWO in The Hague since 2015. The NPP is also indirectly involved in the Dutch contribution to Arctic Council Working Groups. In addition, two coordination bodies for **science support**, e.g. the Council of Managers of National Antarctic Programs (COMNAP) and the Forum of Arctic Research Operators (FARO), seek to coordinate international research facilities.

Research themes

Pole Position-NL 3.0 developed four themes that provide an overview of the strongholds of Dutch polar scientific expertise and knowledge, with special attention to urgent issues. These consist of:

I **Climate change:** Covering the current state and (anticipated) changes in Earth, ocean, atmosphere, cryosphere and their dynamics
II **Ecosystem dynamics:** Covering the state and changes in biology, ecology, stressors and permafrost
III **Social sciences and humanities:** Covering legal, social, economic, political, historical and cultural knowledge
IV **Sustainable development:** Covering integrated impact analyses, innovations and cold region technology

The key theme questions for the NPP

1 How do the various components of the ice-ocean-atmosphere system precisely interact and how will this change the future? (theme I)
2 How do polar ecosystems function, interact and respond to stressors? (theme II)
3 How does permafrost thaw impact climate, landscape and environmental systems? (theme II)
4 How can Arctic and Antarctic organisations address, prevent and respond to the negative impacts of (non-indigenous) human presence in the polar regions? (theme III)
5 How have people in the Arctic interacted with their environment during the Anthropocene? (theme III)
6 How can we improve sustainability of operations and minimise the negative impact of human activities in the polar regions? (theme IV)

These research questions correspond well with key issues for polar research as identified by SCAR and IASC, and the integrated European Polar Research Programme that was published by EU-PolarNet in autumn 2020.

Implementation

Since 2019, the Programme Committee of the NPP (PC NPP) has been advising NWO on NPP funding and strategic decisions. A secretariat helps the PC NPP to run the science programme. This includes a director for international representation.

The NPP is funded in a covenant with five ministerial departments and NWO. The introduction of a five-year rolling budget provides continuity of funding with long-term commitment. The covenant recognises three pathways for funding polar research and activities:

- A geographically and thematically balanced polar funding programme that also provides input for strategic opportunities and the international policy support of the entire NPP. This Pole Position-NL 3.0 is the strategy for this main body of polar research funding, with a budget of €3.4 million per year, from 2021 until at least 2025.
- A contribution to polar research of €500,000 per year by NWO is earmarked as a minimum amount for funding polar projects via NWO's other funding instruments.
- The Polar Activities Programme (PAP), at €270,000 per year, administered by and at the direct disposal of the ministries. The PAP operates outside of NWO and while it does not organise calls, it does subsidise topical and applied research projects.

The criteria for funding all NPP projects include scientific excellence, a link to the polar regions and relevance to Dutch polar policy. These are assessed by both scientific and policy experts. The NPP budget will be used to enhance the impact and visibility of Dutch polar science, optimise the use of our investments and engage with opportunities that will appear on the (inter)national polar roadmap. Calls from the NPP will be initiated from three perspectives: they must be topical, location-driven and/or strategic opportunities.

The Dutch policy, reflected in the Netherlands' Polar Strategy **Prepared for Change** 2021–2025, is to leave as small a footprint in the polar regions as possible. Our strategy, therefore, is to maximise the use of existing polar research infrastructures via collaboration and strategic partnerships. Most important is the collaboration with BAS and AWI.

The NPP has traditionally facilitated interactions between NWO-NPP, researchers and polar research governance through the successful annual Netherlands Polar Symposium, yet there is a need for more regular interaction between the research field, funders and other stakeholders. Outreach to the general public is needed to foster the democratic basis for (polar) scientific research and evidence-based policymaking. The NPP has contributed to this awareness via the funding of targeted projects, policy briefs, visible polar jackets for branding the national research programme, a webcast and the Dutch SEES.nl expeditions to Edgeøya, Svalbard (2015 and 2022).

Governance and funding opportunities

The governance of the NPP consists of a Programme Committee (PC NPP) that advises NWO on funding and strategy decisions. Five Ministries – Education, Culture and Science; Infrastructure and Water Management; Foreign Affairs; Agriculture, Nature and Food Quality; and Economic Affairs and Climate Policy – contribute to the funding of the NPP, along with NWO. Opportunities to enlarge the polar programme can be found in additional funding instruments, facilities, infrastructure and instruments.

Step forward: a Netherlands Polar Centre

The decentralised geography of polar research in the Netherlands can strongly benefit from the initiation of a Netherlands Polar Centre. A taskforce will seek opportunities, benefits, tasks and challenges for such a centre. The centre will hopefully assist in building a stronger, vital and more successful polar research community by taking up tasks that can otherwise not be addressed effectively, including the management of facilities, outreach and communication.

Ambitions and actions

The strategy development process resulted in the following five key ambitions for the next five years. They are paired with identified key actions that could effectively contribute to its realisation. Three main actors are indicated who are most suited to take ownership of these required actions. The government, e.g. the ministerial departments (listed below as 'M'), the NPP Programme Committee ('P'), and the polar research field ('F'). Most actions require a collaborative effort from all actors; only a few are only relevant for one or two actors.

1 | High-quality polar research with impact

a Invest in policy-relevant calls based on key research theme questions. (chapter 3) [M,P]
b Guarantee a high level of scientific quality through peer review and optimise the approach to guarantee a high level of policy relevance and involvement of relevant stakeholders. (chapter 4) [M,P]
c Aim to fund mid-sized research proposals for focus and mass, preferably developed by multidisciplinary, multi-institution research teams and relevant stakeholders. (chapter 4) [M,P]
d Increase impact through the acquisition of additional funding via multipliers. (§ 6.1) [M,P,F]
e Enlarge the visibility of Dutch Polar Research and policy-relevant results with communication, education, outreach and policy briefs. (§ 4.2) [M,P,F]

2 | Strong strategic international collaboration

a Continue the long-term partnerships with BAS and AWI. (§ 2.3 and 4.1) [P]
b Ensure NL participation in key high-impact scientific consortia and expeditions. (chapter 2) [M,P,F]
c Active national participation through NPP, with suitable delegates, in international discussions to create and support collaborative opportunities. (§ 2.4 and 4.2) [M,P,F]
d Enhance NL representation in international platforms with a clear task description for national delegates and knowledge exchange with the NPP governance bodies. (§ 2.4 and 4.2) [M,P,F]

3 | Optimised polar facilities and infrastructure

a Balance the budget over three types of calls-for-proposals: topical, location-defined and strategic opportunities. (chapter 4) [P]
b Optimise access to and use of Dutch facilities in the polar regions. (§ 4.1) [M,P]
c Support relevant international shared polar facility initiatives. (chapter 2 and § 2.4) [M,P]

4 | Strong national cooperation and support of Dutch polar research

a Stimulate the development of an independent national home base for polar sciences e.g. a Netherlands Polar Centre. (chapter 7) [M,P,F]
b Appoint a taskforce to draft a decision document in preparation of founding a Netherlands Polar Centre addressing mission, tasks, Terms of Reference, involvement and commitments of stakeholders, and more. (chapter 7) [P]
c Improve (inter)national connections – Nexus of science to science, science to policy, and science to society. (§ 4.2) [M,P,F]
d Provide the Dutch government with evidence-based and innovative knowledge for policy development. (§ 4.1) [P,F]

5 | Strategic observations and infrastructure

a Identify important long-term Dutch monitoring programmes that provide information on key indicators for climate change and ecosystem health. (chapter 4) [P,F]
b Secure uninterrupted development and use of state-of-the-art models of the polar system or parts of it. (§ 6.2) [P,F]

Ursus maritimus *on the Arctic Ocean. Photo:* ***Ronald JW Visser***

Chapter 1
The Dutch polar landscape

The Dutch government's Polar Strategy Prepared for Change *(Beslagen ten IJs*, 2021–2025) identifies scientific research as one of its core values, along with international cooperation and sustainability in the polar regions. The Netherlands has a reputation for doing excellent, innovative polar research with high impact on key focus areas. This strength forms the basis for this Pole Position-NL 3.0 research strategy.

Polar research is conducted in collaboration with national and international partners. Our scientific research and its results support polar political organisations in evidence-based policy and decisions. The primary locations of these decisions are the Antarctic Treaty Consultative Meetings (ATCM), the Arctic Council, Brussels and the 'home base' in The Hague. Both research and policymaking are team efforts that draw on extensive cooperation with partners, both nationally and internationally.

The Netherlands has committed itself to scientific polar research with its status as Consultative Party in the Antarctic Treaty, obtained in 1990, and Observer status in the Arctic Council since 1998. The Netherlands has backed several polar policy initiatives, such as the introduction of the International Maritime Organization's Polar Code (2018), the Arctic heavy fuel ban (expected 2021) and the Arctic Science Ministerial meetings (bi-annually, since 2016), as well as the Central Arctic Ocean Fishing Agreement (2018) that was signed by the EU on behalf of all member states. The full accession to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in 2019 underlines the Dutch government's commitment to international collaboration and protection of the Southern Ocean.

The Dutch polar science community includes scientists from approximately fifteen universities and public research institutes (see the map on page 28). They work in close collaboration with foreign partners in every aspect of their research. The international perspective is illustrated by the number of international co-authorships with Dutch presence, where Dutch polar researchers rank second in percentage of international polar publications, after Switzerland[1]. The specific expertise, knowledge and know-how of Dutch polar researchers have led to the formulation of four themes and six theme questions where our strong scientific assets meet the Netherlands' Polar Strategy.

[1] DW Aksnes, IA Osipov, O Moskaleva and L Kallerud (2016). Arctic Research Publication Trends: a Pilot Study. Rovaniemi: UArctic.

*Photo: Close-up of a Greenland ice core. © **Suzette Bousema**, Climate Archive.*

Rothera research station. Photo: ***Ronald J.W. Visser***

Chapter 2

International collaboration

This chapter details international partners, strategies and organisations

International collaboration is indispensable for conducting research in remote polar regions. Important reasons are the exchange of scientific and logistics expertise and capacities. Teaming up expertise is crucial (1) to be able to organise complex expeditions and the required programmes of tomorrow, (2) to create worldwide impact in science and policy by sharing knowledge, and (3) to organise shared facilities with (free) access for individual polar researchers to work together across borders. International coordination is required to exchange knowledge, technologies and resources to get the most impact. It is recommend for the NPP to ensure NL participation in key high-impact scientific consortia and expeditions (action 2b) and to support relevant international shared polar facilities initiatives (action 3c) as elaborated in this chapter.

2.1 | International scientific strategies

For Antarctica, the Antarctic and Southern Ocean Horizon Scan (SCAR 2014) identifies six crucial scientific priorities for up to 2035. Four of these priorities connect well with Dutch scientific work and are linked to the four Pole Position-NL 3.0 themes (chapter 4):

- Define the global reach of the Antarctic atmosphere and Southern Ocean (themes I, II)
- Understand how, where and why ice sheets lose mass (theme I)
- Reveal Antarctica's history [viz. paleoclimate] (theme I)
- Recognise and mitigate human influences (themes II, III, IV)

For the Arctic region, the International Conference on Arctic Research Planning (ICARP, by IASC 2015) identified three main research priorities:

- The role of the Arctic in the global system (themes I, II, III)
- Observing and predicting future climate dynamics and ecosystem responses (themes I, II)
- Understanding the vulnerability and resilience of Arctic environments and societies and supporting sustainable development (themes II, III, IV)

The State of Arctic Science report from IASC (2020) summarises crucial emerging research issues for the Arctic. There are a whole range: coupling of systems (see below), pollution, observing and predicting weather and climate, societally relevant Arctic research – including geopolitics, governance, infrastructure, economic and technological futures – and the overarching topic of sustainability. It concludes with a call for better channels to disseminate important results of Arctic research to the general public.

A recurrent theme in international strategies is the coupling of systems. (Tele)couplings are the interaction between different natural and social systems, via poorly understood interdependencies, cumulative effects and feedback loops.

Key examples, with their relevance to Pole Position-NL 3.0 in brackets, are:

- Relationships between atmospheric processes, ice and ocean – e.g. Polar Amplification (theme I)
- Coupling between the stratosphere and lower atmosphere (theme I)
- Terrestrial-atmosphere exchange processes (e.g. carbon, fires and hydrology) (themes I, II)
- Complex polar biological systems (theme II)
- One Health: focus on human, animal and environmental health, adopting an all-encompassing understanding of well-being (e.g. in tourism and the green economy) (themes II, III, IV)

On the European level, EU-PolarNet is an EU-funded consortium that published the integrated European Polar Research Programme (EPRP) in autumn 2020 as a research agenda. The following six urgent research priorities need to be addressed, using a multidisciplinary approach:

1 Better understanding of climate change in the polar regions (Pole Position-NL 3.0 theme I)
2 Informed weather and climate action (themes I, III, IV)
3 Resilient socio-ecological systems (themes II, III, IV)
4 Prospering communities in the Arctic (themes II, III)
5 Challenges and opportunities for polar operations (themes III, IV)
6 Inclusive creation, access and usage of knowledge (all themes)

This agenda will direct European policy and funding, by means of Horizon Europe and in European partnerships. The success of this consortium signals an improving European harmonisation of Antarctic and Arctic research. In 2020, NWO-NPP and 21 other European polar funders set up EU-PolarNet 2 – Coordinating and Co-designing the European Polar Research Area. NWO-NPP supports the **stakeholder guardian** who will ensure a transdisciplinary approach throughout the whole project.

EU-PolarNet may provide the basis for the scientific ambitions of the Integrated European Union policy for the Arctic, which will be formally updated in 2021. It is expected to highlight the importance of a safe, stable, and prosperous Arctic for the EU with science and research at the heart of policies and actions in the Arctic. The strategy rests on three pillars:

- Climate change (theme I) and safeguarding the Arctic environment (themes II-IV)
- Sustainable development in and around the Arctic (themes II, III, IV)
- International cooperation on Arctic issues (all themes)

In the funding programme Horizon Europe (€96 billion in the period 2021–2027), the EU is investing in five key **missions**: challenges to be solved before the end of the decade by 2030. Two missions have a strong potential for polar research:

- Mission II 'Adaptation to climate change including societal transformation'.
- Mission III 'Healthy oceans, seas, coastal and inland waters'.

Scientific excellence and multinational research consortia are essential to obtain funding in the EU. Funding allocation will be guided through the Green Deal, which is an integral part of the European Commission's answer to the UN 2030 Agenda and the Sustainable Development Goals. Between 2014 and 2021, approximately €200 million was invested in polar research by the EU,approximately €12 million of which was awarded to Dutch knowledge institutions. Finally, the All-Atlantic Ocean Research Alliance will be a guiding force for Horizon Europe's polar research funding.

Horizon Europe's thematic calls often require a matching budget via partnerships with national co-funders, such as ministries and NWO. The Dutch polar research community, government and NWO will need to closely monitor emerging opportunities for polar thematic calls in Europe. These can form strategic opportunities and worthwhile multipliers on top of the funding capacity of the NPP.

Arctic Science Ministerial

The Arctic Science Ministerial (ASM) is an international convention of science ministers committed to strong Arctic research. The first Ministerial meeting took place at the White House, Washington, D.C., USA in 2016 and the second in Berlin, Germany in 2018. The third was scheduled to take place in Tokyo, Japan in 2020 but has been postponed to 2021 due to the COVID-19 pandemic. The Dutch Minister of Culture, Education and Science attended all three meetings and signed the joint statements on Arctic research. The Ministerial meetings aim to advance our understanding of:

- arctic change,
- its impacts on other regions of the world, and
- our ability to respond.

One of the direct outcomes of the ASM is the establishment of an Arctic Science Funders Forum that was joined in 2020 by NWO (NPP) on behalf of the Netherlands. See 2.3 for more information.

2.2 | Dutch-international partnerships

Good and safe access to the poles and high-quality international collaborations are crucial for the success of our polar programme. Formal bilateral partnerships are an important mechanism for achieving this.

Over many years, excellent relationships have been maintained with two of our most important next-door European neighbours, e.g. the British Antarctic Survey (BAS) in the United Kingdom and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Germany. It is recommended to continue the long-term partnerships with BAS and AWI (action 2a).

These institutions operate large (expensive) infrastructures and have the capacity to provide sound and safe logistical support into remote and extreme polar regions. They meet, under peer review, high standards of excellence in research and welcome collaboration with our scientists on the condition that there is mutual added value. NPP maintains Memoranda of Understanding (MoUs) with both partner countries to access their polar infrastructure and to support and stimulate collaboration.

Good examples of added value achieved through these partnerships are to be found:

- In science: in special volumes of scientific publications[2]
- In shared facilities: the mobile Dirck Gerritsz Laboratory, participation in the MOSAiC expedition
- In policy: proposals for new Antarctic Specially Protected Areas[3]

[2] E.g. MP Meredith, J Stefels and M van Leeuwe (2017). Marine studies at the western Antarctic Peninsula: Priorities, progress and prognosis. *Deep-Sea Research Part II: Topical Studies in Oceanography*, Vol. 139(05).
[3] Netherlands' Polar Strategy 'Prepared for Change' 2021–2025.

The extension of bilateral partnerships, either via MoUs or Letters of Intent for new collaborations, should be pursued:

- To create new opportunities for fruitful collaboration
- To obtain wider, easier access for NL scientists to the polar regions
- To improve on risk management, by not relying on a single Antarctic and Arctic facility
- To achieve more flexibility and synergy in enabling the deployment of mobile labs at alternative coastal research stations (e.g. Dumont d'Urville, IPEV-FR in East Antarctica) and on research vessels

More details on research infrastructures and partnerships in chapter 4.2.

2.3 | Scientific committees and working groups

To stay up to date and in close connection with international polar policy and agendas, the NPP nominates and supports Dutch representatives in relevant international polar committees. Each of them is a well-established authority with a unique set of responsibilities. For each committee, national membership contributions are reserved to be able to participate and send delegates. It is essential that the NPP continues funding these contributions **and** supports its nominated delegates as it is the only funding source available in the Netherlands. Support is recommended for active national participation through NPP, with suitable delegates, in international discussions to create and support collaborative opportunities (action 2c). It is also recommended to enhance NL representation in international platforms with a clear task description for national delegates and knowledge *exchange with the NPP governance bodies* (action 2d).

The current and recommended portfolio for membership and participation via NPP consists of:

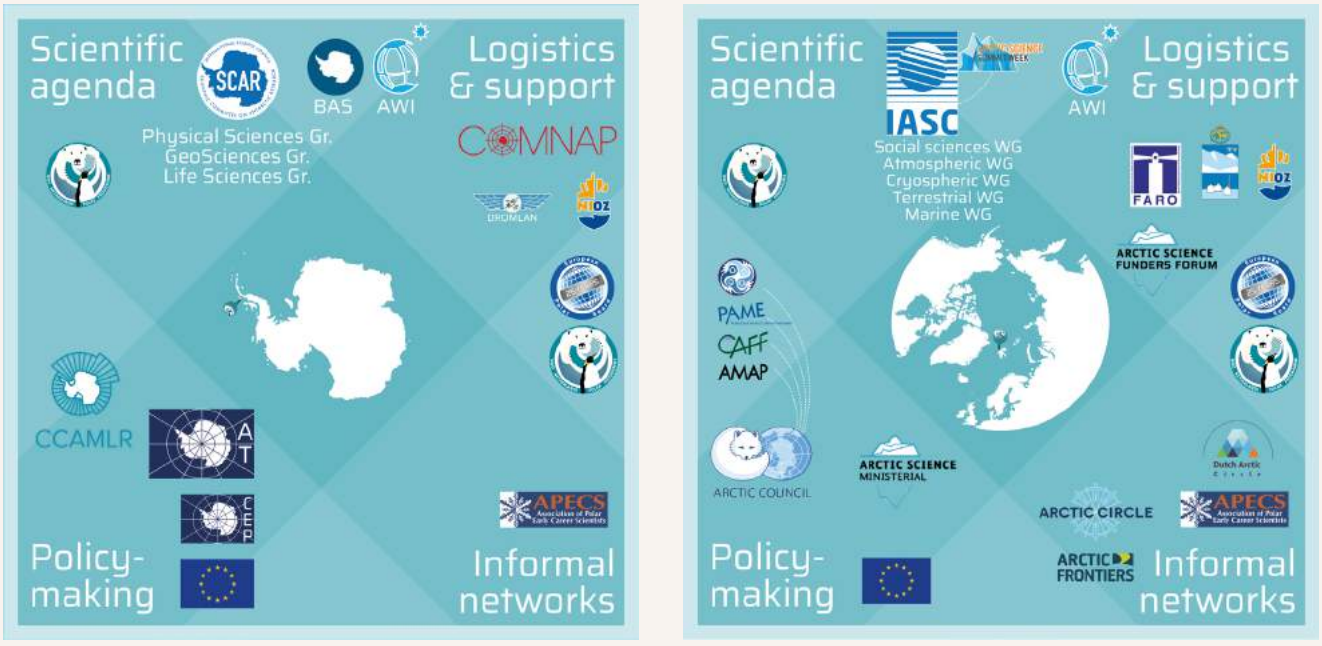
Science coordination: SCAR and IASC

The Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC)[4] are important to shape the international agenda for Antarctic and Arctic (collaborative) research and provide decision-makers with evidence-based advice. Participation in SCAR follows directly from the Antarctic Treaty.

European Polar Board

The European Polar Board (EPB) is a polar network organisation, for Arctic and Antarctica, for both science coordination and science support. The secretariat is hosted by NWO, as an independent organisation, under contract until 2025. It has a European perspective and strengthens the valuable European network for important initiatives and coordination purposes. It has become a central organisation in the coordination of European polar research, operations and funding. It has been at the helm of several international flagship projects with high impact and visibility. By hosting the European Polar Board's secretariat at NWO, the

[4] In SCAR, the Netherlands has scientific representation in the Life Sciences, GeoSciences and Physical Sciences groups. In IASC, these are the Social and Human, Atmosphere, Cryosphere, Terrestrial and Marine working groups. Working groups convene annually.



Overview of the spheres of international governance in which the NPP operates.

Photo: *Wil B. Geven*

Indigenous rights and inclusivity in the Arctic

There is increasing international recognition of the fundamental rights of indigenous peoples and local communities in the Arctic. There is a need for more knowledge and research on the societal challenges people in the Arctic are facing, their cultural and economic vulnerability, and adaptive capacity, as well as the interconnectivity with their rapidly changing natural environment. This is reflected in the European Polar Research Programme, the Arctic Research roadmap, the International Arctic Social Science Association (IASSA) and the Arctic Science Ministerials.

The Netherlands stresses the recognition of indigenous rights and the inclusion of indigenous and local stakeholders in Arctic research, which will require attention in those projects where this bears relevance.

Netherlands demonstrates its willingness to play its part in important international research infrastructures and organisations.

Arctic Council working groups

These provide informative links between knowledge institutes and policymakers. Delegates are nominated and funded via the Interdepartmental Polar Committee (IPO). Since the Netherlands obtained observership to the Arctic Council in 1998, it has been active in the Arctic Monitoring and Assessment Programme (AMAP), Conservation of Arctic Flora and Fauna (CAFF) and Sustainable Development Working Group (SDWG). In 2019, the Protection of the Arctic Marine Environment (PAME) was added to this portfolio.

Science support coordination: COMNAP and FARO

The Council of Managers of National Antarctic Programs (COMNAP) and the Forum of Arctic Research Operators (FARO) streamline **science support** activities and facilities. Science is increasingly an international affair: Information exchange, harmonisation of activities and shared use of research facilities should be facilitated and coordinated via these dedicated expert organisations. Participation in COMNAP follows directly from the Antarctic Treaty, signed and ratified by the Netherlands. It is recommended to stay actively engaged in these organisations to be able to support relevant international shared polar facility initiatives (action 3c).

‘The ARC project reaffirmed that no one country has the wherewithal to simultaneously pursue all aspects of the highest-priority Antarctic science. Continuing and enhanced cooperation in the spirit of the Antarctic Treaty remains a high priority and an ever-increasing financial reality for national programmes.’

Antarctic Roadmap Challenges (COMNAP 2016)

Arctic Science Funders Forum

The Arctic Science Funders Forum (ASFF) was established in 2020 as a platform for the joint funding of Arctic polar research. It holds the potential for a better internationally coordinated funding of collaborative actions and initiatives and may provide a new promising platform for forging international multidisciplinary Arctic calls, perhaps akin to the (global) Belmont Forum.[5] The NPP will be its contact point in the Netherlands. The NPP will be constructively following the opportunities it creates and be in a position to contribute available funding to the Forum.

[5] Belmont Forum is a research funding forum for multi/transdisciplinary and international science on global, urgent topics. In 2018, it operated the second Collaborative Research Action for the Arctic, themed *Arctic Resilience*. Via NWO’s membership of the Belmont Forum, the NPP co-funded €432,000 to this call, which led to two projects with Dutch participation.

Selection of delegates

Most of the above-mentioned platforms have formal or semi-formal substructures based on polar (research) topics, scientific disciplines or geographic regions. Representatives are expected to exchange thoughts on new developments, based on regular interaction with their field and other stakeholders. They are required to report back on their activities to the community and contracting authority in return for their funding.

For a better connected and informed polar community, the NPP should create more frequent national meetings for interaction with various stakeholders. This will also maximise the value of the participation in these polar committees.

As a Contracting Party, a country '... demonstrates its interest in Antarctica by conducting substantial scientific research activity there, such as the establishment of a scientific station or the dispatch of a scientific expedition.'

Article IX.II of the Antarctic Treaty, which The Netherlands signed in 1967. The Netherlands obtained consultative status in 1990.

Permafrost research at Chokurdakh Scientific Tundra station.
Photo: ***Rúna Magnusson***

Chapter 3
Research themes

‘Dutch research enjoys an outstanding international reputation, is characterised by a high degree of international collaboration and contributes to a better understanding of the changes in the polar regions.’

(The Netherlands’ Polar Strategy 2021–2025, Prepared for Change).

Pole Position developed four themes that provide an overview of the strongholds of Dutch polar expertise and know-how, with special attention to urgent issues.

I Climate change
Covering the current state and (predicted) changes in ocean, geophysics, atmosphere and cryosphere functioning, and in dynamics

II Ecosystem dynamics
Covering the state and changes in biology, ecology, stressors and permafrost

III Social sciences and humanities
Covering legal, social, economic, political, historical and cultural knowledge

IV Sustainable development
Covering integrated impact analyses, innovations and cold region technology

As a focus of research topics recommended for funding, the NPP is advised to invest in policy-relevant calls based on key theme research questions as identified below (action 1a). These are regarded as relevant by the Dutch government’s Polar Strategy, which identified topics such as climate change, protection of the marine environment, migratory birds, pollution, tourism and sustainability as highly relevant. These key research questions also correspond well with the main topics on international research agendas (chapter 3).

The programme needs to maintain a practical balance between the polar regions (Arctic and Antarctic), between the four focus themes and theme questions, and between science and science support activities.

Theme I Climate change

*Antarctic glacier front. Photo: NWO | **Dick van der Kroef***

Theme question

How do the various components of the ice-ocean-atmosphere system precisely interact and how will this change in the future?

Dutch expertise

In the Netherlands, cryospheric research is well developed and has a first-rate international reputation. It builds on glaciological research and is benefitting from progress in remote sensing and improvements in climate modelling. Dutch researchers pioneered surface mass balance programmes in Greenland and developed detailed regional climate models dedicated to studying Greenland and Antarctica. In the mid-1990s, the first signs of mass loss of the ice sheets were observed, and meteorological field campaigns offered insight into the relation between the increased surface melt and meteorological conditions. Changes in the ice sheets are part of broader warming trends in the Arctic region and over the Southern Ocean, which connect the study of ice sheets to ocean observations and modelling of high-latitude climate and sea ice.

At present, research questions addressing the coupling of the various components of the climate system are most urgent. They will drive new research initiatives in the coming years. Questions relating to ice-ocean interaction are key. Also, questions relating to the alarming retreat of Arctic sea ice must be addressed from various perspectives, e.g. the implications for biogeochemistry and impact on atmospheric composition. Over time, measurements of ocean circulation and heat transport into the polar regions have been organised more and more through large consortia. Feedbacks between warming oceans and melting ice are nowadays studied with climate models and observations on scales from the fjords to the open ocean, in order to make accurate predictions of polar changes.

Research addressing coupled components is highly effective at examining sea level and storm changes. Uncertainties in the evolution of the Antarctic ice sheet are making it difficult to predict changes in sea-level rise in the long term.

Topics with strong Dutch research contributions are:

- Changes in polar ocean and atmosphere circulation
- Changes in sea ice in both hemispheres
- Changes in atmospheric composition (including ozone) and impact on climate
- Feedbacks, trends, variability and tipping points in the physical polar climate system
- Sea-level rise
- The surface mass balance and dynamics of glaciers and ice sheets
- Past changes in the geo(physical) system relevant for future evolution of the system

Links to international research focus areas

There is observational evidence that large physical changes are taking place in the polar regions, e.g. huge icebergs breaking off in Antarctica or new records in minimum Arctic sea ice extent. These are part of a major transition in system Earth. Also, the ocean is acidifying and warming, and polar and more distant weather patterns are shifting. The scientific community needs – in a collaborative effort – to focus on understanding the entire system and the complex interactions and resulting feedback mechanisms. It has to improve future projections and provide guidance in adaptation and mitigation discussions for policymaking. Model improvements typical for polar region physics/dynamics are required to more accurately predict future impacts, to understand complex interactions, to find and identify governing feedbacks in the system, and to quantify thresholds and tipping points in the polar climate system. Improved efforts in monitoring from space and in situ observations are needed given the still rather limited in situ observation facilities. These can validate and improve numerical models and detect changes in the system over longer time periods to distinguish climate change trends from the natural variability of the system.

Models and observations of the current climate in both polar regions and the changes in the physical and biogeochemical system are key in climate research and a specialty of Dutch theme I researchers. Remote sensing and field-based observations are instrumental to the monitoring of current changes in the polar regions. Observational data are critical for the validation of global and regional Earth system models that describe the present-day status and predict future evolution. These data include the physical impacts on global and regional sea levels, mass loss of ice sheets, decreases in the Arctic sea ice, changing ocean circulation, high-latitude biogeochemistry and associated changes in atmospheric composition, and consequences for weather patterns in the Netherlands.

Current challenges can be found in ocean/atmosphere ice sheet interactions (relevant for sea-level rise), the connection between Atlantic Ocean circulation and Arctic sea ice (relevant for mid-latitude climate), links between climate and biochemistry (relevant for the carbon cycle) and quantifying trends in climate variability/extremes, aerosols and clouds (relevant for impacts on society and eco-systems).

Theme II Ecosystem dynamics

Atlantic puffin. Photo: NWO | Renno Hokwerda

Theme questions

How do polar ecosystems function, interact and respond to stressors? How does permafrost thaw impact climate, landscape and environmental systems?

Dutch expertise

Dutch polar researchers have highly rated expertise when it comes to studies in algae, viruses and biochemistry as well as sea ice-connected systems, known as sympagic ecosystems, and terrestrial studies that focus on plants and fungi. Our studies are at the forefront of mapping and understanding the role of stressors, including climate change, non-indigenous species and pollutants on ecosystems. Special Dutch niches include migratory birds that are linked via flyways to the Netherlands, and the study of permafrost thaw, and its landscape-scale consequences for hydrology and biogeochemistry (e.g. greenhouse gas exchange). The Arctic and Antarctic environments are influenced by numerous human activities both **within** and **outside** the polar regions, adding to the complexity beyond climate change.

Links to international research focus areas

Theme II, Ecosystem dynamics, covers three areas: the polar biosphere, stressors, and landscape change. The polar regions are a natural laboratory for (rapid) environmental change at a large magnitude. They signal what is to be expected in more temperate parts of the world.

Polar biosphere

Polar ecosystems cover a wide variety of habitats and include terrestrial and aquatic systems, whether sea ice-connected or in (advancing) open water areas. These ecosystems have in common low temperatures, extreme seasonality, and the (seasonal) presence of snow and ice. Species at all levels are strongly connected in a food web and also between food webs through the coupling of systems and migration.

Polar bears on the tundra. Photo: ***Wil B. Geven***

Without the basic understanding of the natural variability, shifts in the ecosystems are impossible to measure and assess. For conservation purposes, e.g. the identification of relevant Marine Protected Areas, key questions need to be answered, such as: Which species and processes are most sensitive or important in the context of climate change? How will the communities change (in taxonomy, abundance)? And how will this affect fluxes of elements and energy transfer? We still know little about the natural variability and seasonality of polar ecosystems. Much important baseline information is still needed on biogeochemical cycling, community and food web structures, biodiversity and the biology of polar species at all levels of the food webs. The lack of data is highest in regions that are most difficult and costly to access.

Migratory birds depend on the habitat quality in both wintering and breeding areas, as well as food availability during their migration routes. Changes in these systems offset their timing of arrival both in the wintering areas and in their breeding locations. Several bird species that winter in the Netherlands have their breeding area in the Arctic, while other birds breed in the Netherlands and overwinter in the austral summer. For conservation purposes, accurate and detailed knowledge is needed on the migration routes, wintering and breeding grounds, and the effects of climatic changes.

Stressors

Polar ecosystems are affected by multiple stressors. Despite the lack of data, many changes in the polar biosphere are already documented, though their precise interrelatedness remains hard to understand. Changes related to climate include the timing and abundance of primary production, fluctuations in biomass and species composition, range extension of more temperate species into areas that were previously too cold, and changes due to extreme weather events and ocean acidification.

Other stressors are more directly linked to human activities, either local or from sources outside the polar regions. Local activities in the polar regions consist mainly of shipping,

fishing, tourism and research, resulting in noise pollution and the introduction of non-indigenous species, for instance. In both polar regions, the introduction of non-indigenous species has been observed, which can disrupt communities and food webs. Sources from much further away can transport stressors to the polar regions via ocean and air currents, for example chemical contaminants and marine litter. Information on the occurrence and the impacts of local-regional and global stressors on the polar ecosystems are of vital importance for the conservation of these areas.

Innovations are needed to collect information on multiple stressors at a faster pace than more traditional methods and in areas that are difficult to access. Examples are smart sensors, environmental DNA, drones, robotics and autonomous vehicles, and high-resolution satellite imagery. Geolocators and models are effective for obtaining additional detailed information on migratory bird behaviour and food availability. Biological indicators can be further developed and used to understand current and past changes in the polar regions. Cross-site comparisons are needed for a better understanding of natural variability in the polar ecosystems, forming an important basis for assessing changes due to climatic changes and other stressors. These comparisons can only be conducted in a proper way when standardised methods are applied in internationally aligned monitoring programmes.

Landscape change

Permafrost, permanently frozen ground, is widespread in the Arctic and in ice-free regions of the Antarctic. Arctic warming, as illustrated by record temperatures in Siberia (30°C in 2020), is warming and thawing permafrost on a global scale. Thaw manifests itself in various ways, ranging from landscape subsidence, shifts in hydrology or increasing coastal erosion. Degrading permafrost also leads to the decomposition of its large soil organic carbon stock, generating greenhouse gases that are emitted into the atmosphere. Thawing soils also deliver organic matter and nutrients into inland and coastal waters fuelling marine primary production and ocean acidification. In addition, over the course of a decade, large-scale wildfires have become a regular occurrence all around the Arctic, of which the long-term impacts on ecosystems, landscapes and other **Pole Position** theme topics are poorly understood.

Warming-related greening trends indicate widespread changes in Arctic vegetation, of which shrub **expansion** is the most prominent. Conversely, shrub decline may be under-detected due to the small-scale nature of disturbances of permafrost collapse. This lacuna is crucial given the projected permafrost degradation and widespread landscape collapse that will probably release disproportionate amounts of soil carbon. Greening and browning trends can be studied with remote sensing but interpreting satellite data is demanding and requires in situ validation. Therefore, both modelling and fieldwork are needed that integrate hydrology and biogeochemistry to advance this field.

Numerous feedbacks influence the potential impacts of permafrost thaw, for example the climate-driven increases in plants and shrubs which may have a calming effect on permafrost thaw. The vegetation insulates the soil surface and therefore helps to protect against further permafrost thaw and greenhouse gas release. Human activities disturbing the fragile permafrost system can therefore further trigger collapse and damage to infrastructure. These coupling feedback effects have so far lacked thorough analysis.

Theme III Social sciences and humanities

Football match in Greenland. Photo: ***Renno Hokwerda***

Theme questions

How can Arctic and Antarctic organisations address, prevent and respond to the negative impacts of (non-indigenous) human presence in the polar regions?

How do people in the Arctic interact with their environment during the Anthropocene?

Dutch expertise

Theme III includes legal, social, economic, political, historical and cultural knowledge. The Netherlands has been leading the way in Antarctic governance research, focusing on the conservation of wilderness and the management of natural resources, and their legal and geopolitical implications. Dutch archaeological expertise exists in the exploitation of natural resources by ancient Arctic communities and later in history by European entrepreneurs (for example, whaling and mining in Svalbard), while ethno-archaeologists are concerned with the impacts of changing climates and environments on Arctic communities. Polar tourism is studied from a variety of angles in the Netherlands. Present-day studies of economic activities have covered research into tourism regulation, benefit-sharing arrangements and fishery management.

Link to international research focus areas

Whereas in the Arctic there is a strong focus on sustainable and viable socio-ecological systems and the livelihood of its inhabitants, in Antarctica international social scientific research is directed towards protecting ecological, intrinsic, scientific and historic values.

Governance, adaptation and resilience in Antarctica

International decision-making regarding Antarctica and the implementation of existing regimes have been considered ineffective for keeping track of human developments and related threats to Antarctic ecological, intrinsic, scientific and historic values. Dutch social sciences and humanities research therefore need to focus on knowledge that supports the ATCM and CCAMLR in adopting a more proactive approach in Antarctic governance. This means gaining a better understanding of the pressures caused by human activities, the roles and positions of (potentially) involved states in the Antarctic Treaty System, potential regulatory instruments to limit the human footprint in Antarctica and approaches to strengthen compliance with regulations.

Relevant topical research questions include: What instruments could be developed to better address cumulative impacts on Antarctic wilderness? How can the processes of designating and governing protected areas in terrestrial and marine environments be improved? What novel activities may take place in Antarctica's future and how can these be regulated in the existing framework?

Governance, adaptation and resilience in the Arctic

The adequacy of the current governance regime of the Central Arctic Ocean and the role of the Arctic Council requires critical analysis. As an observer in the Arctic Council, the Netherlands has a special obligation to contribute with research supporting sustainable, viable and safe developments and operations in the Arctic region. This includes identifying governance regimes and regulatory measures to ensure these contributions.

Important governance questions relate to threats to Arctic biodiversity and the vulnerability and resilience of communities and economic activities in the face of climate change and new risks. Risks include climate change-induced shocks, such as extreme weather events, landslides or shifts in resource distribution. Different strategies have been adopted to respond to these disruptive direct and indirect environmental changes, from the introduction of new norms and standards, to environmental information services and warning systems, evacuation and migration plans. However, these measures can also be disruptive in their own right, or amplify societal inequalities.

Polar sustainability in the Anthropocene

There is an international need to better understand historical, current and potential future human activities and their impacts on sociocultural, economic and ecological systems in an integrated way. How can we develop a better knowledge base that allows us to tackle modern challenges – ranging from ecosystem services, cultural and linguistic diversity, heritage, identities and communities? The lens of the Anthropocene – the epoch of the human footprint – provides a lens to understand the complex interactions between humans and their environment, in the past and present, while looking ahead into the future.

Global interrelations

Transnational social and economic mobility of goods, food, water and energy security, tourism, travel, and telecommunications are increasingly connecting actors outside the polar regions with those within. This generates countless effects and implications. Through tourism, shipping and supply chains (e.g. oil, gas, minerals and fisheries), the polar regions are highly interconnected with our domestic lives in the Netherlands. Studies on geopolitics, sociocultural and economic values, and international governance and regulation are of vital importance to create a sustainable economy, by providing advice on preventative or adaptive measures. It is important to consider how these global interrelations affect local responsibility, accountability and transparency for sustainable and socially just outcomes.

Theme IV Sustainable development

*Taubanesentralen in Svalbard. Photo: NWO | **Renno Hokwerda***

Theme question

How can we improve sustainability of operations and minimise the negative impact of human activities in the polar regions?

Dutch expertise

Research performed at Dutch universities is vital to improve sustainability of operations in the polar regions. Dutch scientists are developing tools for an integrated impact analysis of economic activities in the polar regions. Technological universities have built up expertise in modelling ice-structure interaction, for improved designs of maritime and coastal structures, for modelling underwater acoustics of shipping and construction works, and for performing studies into freezing sea spray on structures. Dutch scientists have the facilities and modelling skills to advance ice engineering research and studies on material behaviour in cold environments.

This theme accommodates integrated impact analyses of human activities and cold region technology, needed to enhance sustainability and safety in all forms of development (from economic to scientific) in the polar regions.

Links to international research focus areas

Increased marine accessibility, more attention to exploitation of hydrocarbon, minerals and energy, growing tourism, associated infrastructures and other activities pose questions about how to minimise the human footprint in the polar regions. Clear preconditions for sustainability, conservation of biodiversity and environmental quality are required. To improve the understanding of the impact operations can have on the environment, studies are needed to correctly account for the complexity of the environmental conditions in an environmental impact

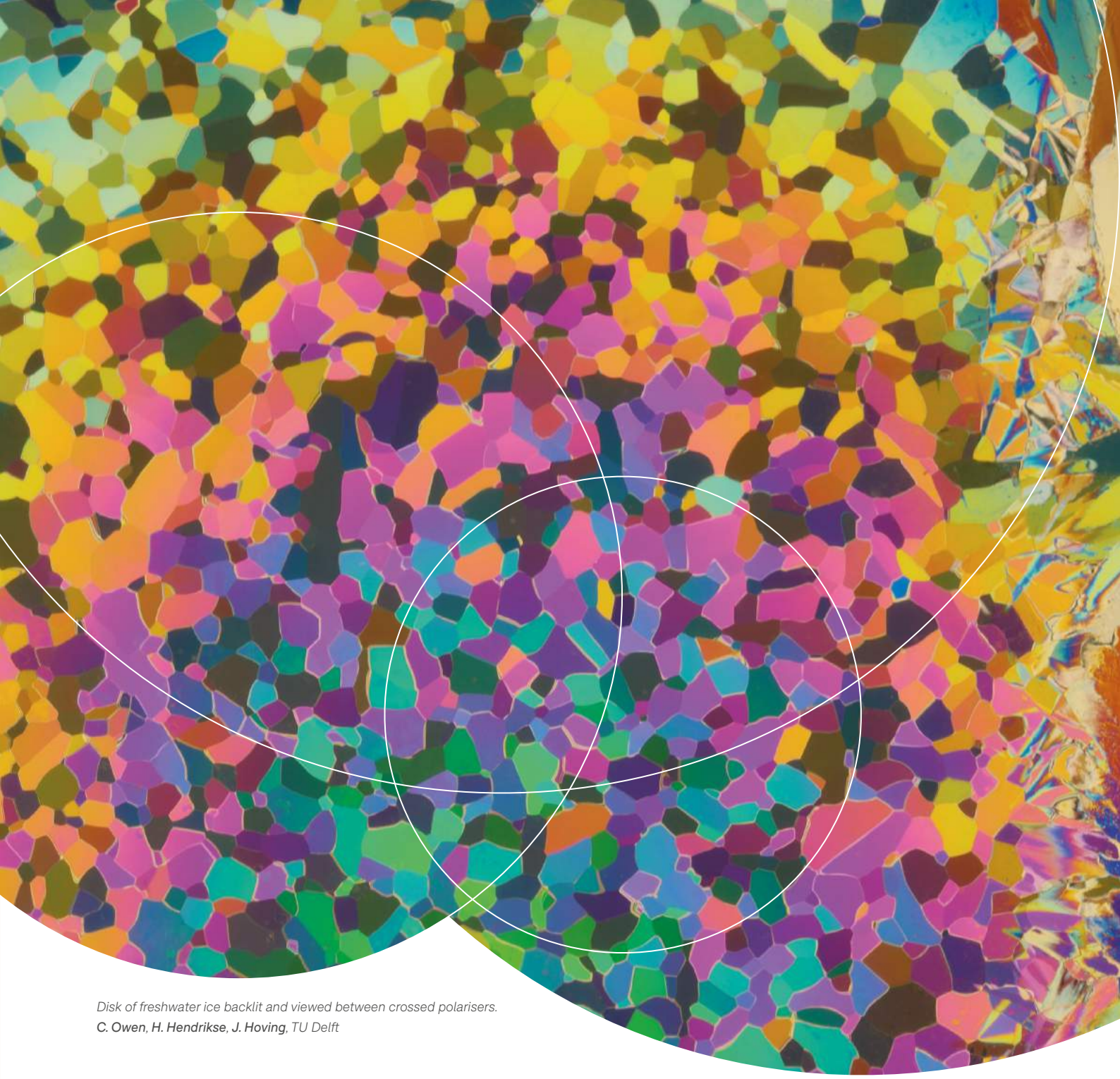
analysis. This relies heavily on data derived from stressor-ecosystem studies, but also on technological innovations that help reduce the impact of these developments, such as engineering methods to reduce underwater noise.

Technological developments and strategies for sustainable (green) shipping, such as the development of alternative fuels, electrification and energy efficiency, are of high interest. For safe operations, processes such as icing and the dependency on ice management vessels are a must. Understanding the physical processes of freezing sea spray formation in different storm conditions makes it easier to more accurately predict icing on ships and contributes to the development of winterisation guidelines for the IMO Polar Code.

The Arctic holds large quantities of minerals, such as bauxite, iron ore, copper, nickel, palladium and diamond. These minerals are in high demand in today's industries. In terms of renewable energy, the Arctic provides both resources and space on land and at sea. Large-scale electrification is moving further north into Arctic regions. Bundling solar and wind energy offers the potential for powering northern networks. Experiences and techniques for green energy may be applied in Antarctica as well.

Offshore, new technological challenges arise for structures and vessels as they encounter combinations of broken ice and waves in the extending marginal ice zone. To improve operational decision-making in polar regions, a thorough understanding of ice-structure interaction combined with advances in safety and risk management are required. To clean up the abundantly present marine litter in the polar seas, ecological-friendly technology for pollution response are needed. In addition, as specifically oil spills in ice-infested areas prove difficult to clean up, technology must first and foremost focus on preventing pollution.

Overview of public research institutions in the Netherlands that have been pursuing polar research.



Disk of freshwater ice backlit and viewed between crossed polarisers.
C. Owen, H. Hendrikse, J. Hoving, *TU Delft*

Chapter 4
Implementation

4.1 | Polar research funding

The NPP is funded through a covenant with five ministerial departments and NWO, which went into effect in 2021 and is open-ended, though it will run until at least 2025. The introduction of a five-year rolling budget provides continuity of funding with a long-term commitment. Any decision by an NPP covenant partner to adjust its funding will take effect no earlier than five budget years from the moment of decision. Budget increases can be effectuated directly.

This covenant includes and agrees on three pathways for funding polar research and activities:

1 A geographically and thematically balanced polar funding programme that also provides input for strategic opportunities and the international policy support of the entire NPP. This Pole Position-NL 3.0 is the strategy for this main body of polar research funding, with a budget of €3.4 million per year, from 2021 until at least 2025. Under the covenant, part of this budget may be committed to match polar calls in the Dutch Research Agenda (NWA) at the initiative of the Interdepartmental Polar Committee.
2 A contribution to polar research of €500,000 per year by NWO is earmarked as a **minimum** amount for funding polar projects via NWO's other funding instruments.
3 The Polar Activities Programme (PAP), at €270,000 per year, administered by and at the direct disposal of the ministries. The PAP operates outside of NWO and while it does not organise calls, it subsidises topical and applied research projects (e.g. plastic pollution in the Arctic).

General NWO conditions apply to all NPP calls. This includes the standardised NWO budget modules, the open access requirements, the San Francisco Declaration on Research Assessment, and Dutch legal conditions. The details of each call will be published in the call brochure.

Established selection criteria for all NPP project funding are scientific excellence and a clear link to the polar regions. A link to Dutch government policy is required due to the funding characteristics of the NPP. The NPP will guarantee a high level of scientific quality through peer review and optimise the approach to guarantee a high level of policy relevance and involvement of relevant stakeholders (action 1b).

To maintain a good balance and obtain the best possible impact of the available pathway 1 funding in the NPP, it is advised to balance the budget over three types of calls-for-proposals: topical, location-defined and strategic opportunities (action 3a). For enhanced focus, each alternating call can best be initiated from one out of three of these main science and policy funding perspectives:

1 **Topical**
Centred on policy-relevant key theme questions, well founded in Dutch expertise and with a proven track record

2 **Location-defined**
Assigned priority areas based on geography and available NL infrastructure

3 **Strategic opportunities**
(Inter)national flagship projects, expeditions and research facilities

This balanced approach provides, through 'topical' calls, both focus and mass for polar research in the Netherlands, aiding impact and visibility. For 'location-defined', it optimises the use of our investments so we can continue to deliver high-impact science in line with ongoing commitments with key partners. For 'strategic opportunities', it maintains the necessary flexibility to confront new polar challenges and embrace opportunities that will appear on the (inter)national polar roadmap. Examples of recent successful strategic opportunities include the MOSAiC Dutch call (2018), the Belmont Forum Arctic Resilience call (2018), the Arctic Top Sector Water & Maritime call (2018), and the NL contribution for participation in Beyond EPICA (2019). Larger projects are needed to facilitate multi-disciplinary projects to tackle the relevant research gaps. To obtain focus and mass, it is recommended to aim to fund mid-sized research proposals preferably developed by multidisciplinary, multi-institution research teams and relevant stakeholders (action 1c), projects ranging from two to nine scientific positions (PhD or postdoc) with a maximum of €1.8 million. This should be congruent with the total budget of the call. Depending on very specific policy requirements, calls can either be organised as standard calls-for-proposal or as 'sandpits', where researchers, policymakers and a jury come to a final set of projects to be funded in a collaborative effort. Additionally, unplanned strategic opportunities may also surface. A budget of €500,000 a year on average and a fast-track handling and decision procedure should therefore remain available to seize such opportunities.

A fair but practical funding balance in themes and between the Arctic and Antarctic is preferred. NPP has a hard requirement as a result of the consultative status of the Netherlands under the Antarctic Treaty since 1990. This is

Mobile laboratories and the Dirck Gerritsz Laboratory

The Dirck Gerritsz Laboratory
The Dirck Gerritsz Laboratory (DGL) is a long-term investment in polar infrastructure. This medium-sized facility opened in 2013 and has a life expectancy of 25 years and added a long-term focus to the NPP. It consists of four mobile labs, each stationed inside a shipping container, docked together in a station. Located at the premises of the British Antarctic Survey at Rothera Research Station, it offers access to remote parts of the Antarctic Peninsula region: Adelaide Island, Larsen C and Marguerite Bay.

Access to the DGL lab is enabled by a Memorandum of Understanding (MoU) between NWO-NPP and BAS that needs to be extended periodically. This MoU requires collaboration in science between the parties in exchange of logistical support from BAS. Without this, access to the lab is not possible. The location offers access to a rich marine environment as well as the critical Larsen C Ice Shelf.

Further development and support to maintain a successful and innovative mobile lab concept is required, including support of deployment of these labs on ships and other polar stations to obtain maximum flexibility.

Mobile laboratory Hoop aboard Polarstern, at the launch of the MOSAiC expedition. Photo: ***Esther Kokmeijer***

securing significant scientific research in Antarctica. A first priority for the NPP, therefore, is to follow up on that obligation. The type of call and strategic opportunities provide further tools to maintain a balance. For many years, the NPP has been able to demonstrate a healthy balance between research investment and scientific support, which it intends to continue.

Special attention is required to identify important long-term Dutch monitoring programmes that provide information on key indicators of climate change and ecosystem health (action 5a). This is of great significance to the international polar community. The initial focus will be on those programmes that have previously been funded as part of subsequent NPP and NWO projects. These efforts should be recognised, reported and supported as a national contribution to monitoring efforts that are guided under international coordination. Three important examples are the Sustaining Arctic Observing Network (SAON), the Rothera Time Series (RaTS), and the surface mass balance and weather monitoring of the Greenland and Antarctic ice sheets.

Complementary sources of funding

Polar researchers can also apply for funding from other NWO instruments, such as the Open Competition, Talent Scheme and User Support for Space Research. NWO has committed to making a **minimum** contribution of €500,000 million on average per year to polar research via these other NWO instruments. During the period 2016–2020, polar researchers were very successful at securing such grants, averaging €2.7 million per year for polar projects through NWO funding, outside NPP calls. In addition, universities' and institutes' own funding are a major contributor to our total polar research effort, as well as European funding via European framework programmes (Horizon Europe 2021–2027). Finally, the ministries provide funding for ad hoc contracted research via the Polar Activities Programme (PAP) under their direct control.

All these funding flows are complementary to the NPP, which will focus on its thematic and strategic programme, thereby securing the continuity of polar research funding, in synergy with our international collaboration networks and infrastructure.

4.2 | Infrastructure and partnerships

The Netherlands policy is to leave as small a footprint in the polar regions as possible, while still offering our researchers access to key areas. Our strategy is to first maximise the use of existing infrastructures, if possible, including both our own Antarctic and Arctic facilities via collaboration and strategic partnerships. Access to and use of NL facilities in the polar regions (action 3b) should be optimised, for example by improving communication and information exchange between researchers, funding ministries and the NPP secretariat – the 'Nexus' ambition (cf action 4c). It is also recommended to continue the long-term partnerships with BAS and AWI (action 2a).

British Antarctic Survey (BAS)

The Netherlands and UK have collaborated scientifically in polar research for over 30 years. Apart from access to the Dirck Gerritsz Laboratory, the MoU with BAS may provide access to the Bonner Laboratory, transport to/from Chile and the Falkland Islands, local transport and standard legal and environmental permits. Space and budget permitting, the MoU also offers access to the Signy and Halley Research Stations in Antarctica. In 2021, the new BAS icebreaker RRS **Sir David Attenborough** will first set sail for Antarctica.

Alfred Wegener Institute (AWI)

The Netherlands and Germany have collaborated scientifically in polar research for over 30 years. Via an MoU between AWI and NWO, NPP researchers are granted access to various German facilities, notably the research icebreaker **Polarstern**. This vessel operates in both the Arctic and the Southern Ocean and has facilitated numerous joint research projects. Access to other facilities – three Antarctic and three Arctic locations – may also be requested. AWI takes care of environmental permits for its expeditions. The continuation of the MoU as a successful collaborative NPP-AWI research programme, including exchanging scholarships, is recommended.

Photo: Esther Kokmeijer

Arctic Station

The Ny-Ålesund Research Station is an international research community in West-Spitsbergen, strategically located for terrestrial, marine, atmospheric and cryospheric research. One of the 19 institutions there is the Arctic Centre of the University of Groningen (RUG), which runs a summer-only facility that is open to both Dutch researchers (via RUG) and foreign researchers (via RUG or INTERACT). Dutch contributions include a long-running ecological monitoring activity. It is recommended to optimise access to and use of Dutch facilities in the polar regions (action 3b), e.g. the Arctic station in Ny-Ålesund.

Other

The Netherlands polar research community has connections with many international institutes that pursue polar research, often partly to gain access to their infrastructures. While most 'partnerships' are individual in character, the good reputation of the Netherlands polar research community, as well as the long-term cooperation and trust it has built with these institutes, have often generated goodwill that opens up new doors.

A brief overview of the current collaborations between NWO-NPP and other research facilities:

- NWO-NPP is a founding member of the Dronning Maud Land Air Network (DROMLAN) between South Africa and Queen Maud Land, which operates regular flights in this Antarctic sector in support of many national Antarctic programmes. It is located in Cape Town.
- By supporting SEES.nl, the NPP has facilitated a unique **citizen science** platform for multiple research disciplines. More details about this strategic opportunity in section 6.2.
- The INTERACT initiative enables transnational access for Dutch researchers to other countries' Arctic facilities, while it simultaneously grants foreign researchers access to Dutch facilities (Ny-Ålesund).
- Via a partnership between Hiber and NWO, Dutch polar researchers can use the Hiberband® Low Power Global Area Network at no charge. This offer is valid until 1 January 2024.

Data management and storage

Acquisition of data in polar regions is extremely expensive. The Antarctic Treaty already addressed this issue in 1959, urging people to share data and make it freely accessible. This resulted in a successful data management community under the umbrella of SCAR. This includes an obligation of every national Antarctic programme to take good care of data storage and accessibility. As a result, the NPP invested in the Netherlands Polar Data Centre (NPDC) and its website, all hosted by the Royal Netherlands Institute for Sea Research (NIOZ), as well as in an associated data manager who was to interact during the 'beginning and end of project' with researchers funded by the NPP to achieve good data management plans. In the light of the Antarctic Treaty and SCAR, as well as the trend towards more open science in the Arctic region, the NPP should continue to support the NPDC.

In line with NWO, all research funded through the NPP must be **open access** and adhere to the FAIR principles.[6]

A data management plan is now also mandatory in NWO applications and part of mainstream policy. To maintain this focus on sound data management within the NPP, it is recommended to investigate whether the current activities of the NPDC can become part of a Dutch Polar Research Centre, dovetailing with the coordinating activities that could be based in such a centre.

4.3 | Nexus

Nexus is the NWO umbrella concept for organising and addressing 'connections' in all senses of the term. It is recommended to improve the (inter)national connections – nexus of science to science, science to policy, and science to society (action 4c).

Internationally for NPP, this involves the active participation of Dutch researchers in the scientific committee working groups of SCAR, IASC and the Arctic Council with the aid of NPP funding (chapter 2). It is important to continue this as these platforms offer new and dynamic international connections, and provide their field with state-of-the-art results, developments and techniques. Additionally, the Netherlands is present and active in the European Polar Board, COMNAP and FARO for improved international collaboration, sustainable use of facilities and synergy in polar programmes. For a best possible return-on-investment, our nominated delegates need to be made fully aware that they represent their community (not themselves) and provide timely and proactive feedback on their activities. Active national participation through NPP, with suitable delegates, in international discussions to create and support collaborative opportunities is recommended (action 2c). Another recommendation is to enhance NL representation in international platforms with a clear task description for national delegates and knowledge exchange with the NPP governance bodies (action 2d).

Better interactions between the NPP, polar researchers and its governance, including the five NPP funding ministries, is needed to further increase the added value of these activities for all actors.

Another recommendation is to enlarge the visibility of Dutch Polar Research and policy-relevant results with communication, education, outreach and policy briefs (action 1e), by engaging policymakers both during and after the research process. This should provide the Dutch government with evidence-based and innovative knowledge for policy development (action 4d) emerging from the NPP.

The Netherlands Polar Symposium is a very successful annual event that gathers researchers, policymakers and third-party interest groups (NGOs, corporate) around a variety of polar subjects. It is organised in cooperation with the Association of Polar Early Career Scientists Netherlands (APECS NL). Each edition has a specific theme (Table 1). Chairs and presenters include public figures on the interface of science and society.

Table 1 Overview of Netherlands Polar Symposiums over 2015–2020

Year	Theme
2015	Polar tipping points
2016	The importance and challenges of long-term polar research studies
2017	The value of international collaborations and networks
2018	Polar impacts
2019	Poles under pressure
2020	*De Wereld Dooit Door* ('As the World Thaws' webcast)
2021	*TBA, in cooperation with the Dutch Arctic Circle*

[6] www.go-fair.org/fair-principles/

Apart from the NPP and its Polar Symposium, other venues and networks already provide Nexus links for specific target groups:

- The Dutch Arctic Circle (DAC) maintains a network for private sector actors and policymakers interested in Arctic developments, while NGOs and researchers can also join. It is operated by Wing and it organises regular events.
- The 'General Polar Meeting' (Algemeen Polair Overleg) is the annual gathering at the Ministry of Foreign Affairs for policymakers, direct subsidiaries and contracted researchers.
- The Association of Polar Early Career Scientists Netherlands (APECS NL) is a volunteer group, part of the international APECS structure, which organises various networking activities and regularly produces newsletters.
- The Willem Barentsz Polar Institute (WBPI) maintains a network for polar researchers in the Netherlands and has a quarterly newsletter. Its current set-up lacks capacity and funding to engage in a wider range of activities.

SEES.nl

A collaboration between NWO-NPP, the University of Groningen and Oceanwide Expeditions led to the SEES.nl expedition in 2015. This was a follow-up of Dutch expeditions to Edgeøya, Svalbard in 1968—1986. In the 2015 expedition, 50 researchers, 50 paying passengers and several VIPs and media took stock of this isolated area. The **citizen science** experiment was successful and gave the polar regions high visibility in the Netherlands. A sequel SEES.nl II was scheduled for 2020 but was postponed until 2022 due to the pandemic. This time, 10 of the 50 scientific berths are reserved for international researchers. If it proves to be successful again, preparations for a third SEES.nl should begin towards the end of the Pole Position-NL 3.0 period (anticipating 2025 or 2026) as a strategic opportunity, to continue measurements and further build on this developing legacy.

Visibility of the polar regions

The polar regions are highly visible in Dutch media. Glaciers, sea ice, permafrost craters and endless tundra provide beautiful and sometimes dramatic scenery and adventure stories in one of the last wilderness regions of the world. These worlds of ice and cold also show us explicitly and through powerful examples that our climate is changing, thereby shaping a new reality. The vast changes disclosed by research, the visible melting of ice and the model predictions for the future all help to raise a general awareness that this crisis needs our urgent attention and action. The regions are frequently described as 'canaries in the coal mine'. The NPP has contributed to this awareness via the funding of targeted projects (providing a budget for knowledge utilisation), policy briefs, special highly visible polar jackets for branding the national research programme, a webcast[7] and, last but not least, the SEES.nl expedition. Good outreach between science and society also fosters the democratic basis for (polar) scientific research and evidence-based policymaking. Such activities should be strongly supported with the aid of the NPP.

[7] *De Wereld Dooit Door*, 1 December 2020. Link with English subtitles: https://vimeo.com/485493853 www.nwo.nl/npp-en

US Secretary of State John Kerry in Ny-Ålesund, 2016.
Photo: ***Ole Magnus Rapp***

Chapter 5
Governance

The NPP is funded as part of the National Polar Strategy by:

- Ministry of **Education, Culture and Science** (OCW)
- Ministry of **Foreign Affairs** (BZ)
- Ministry of **Infrastructure and Water Management** (I&W)
- Ministry of **Agriculture, Nature and Food Quality** (LNV)
- Ministry of **Economic Affairs and Climate Policy** (EZK)
- the Dutch Science Council (NWO)

The ministries convene bi-monthly in the Interdepartmental Polar Committee (IPO), chaired by the Ministry of Foreign Affairs. The Ministry of Defence is also a member of IPO but is not a funder of the NPP.

The Programme Committee of the NPP (PC NPP) advises NWO on NPP funding and strategy decisions. The PC NPP essentially convenes every quarter and consists of:

- an independent chair;
- two delegates from the funding ministries; and
- two delegates from NWO, one member from the Science and one member from the Social Sciences and Humanities Domain board of NWO.

This Programme Committee was established in 2019 on the advice of the Committee Polar Infrastructure (2018), to improve transparency in decision-making and in strategic management. It was placed under the responsibility of NWO's Science Domain. Based on two years of operational experience and a new legal insight, the PC NPP will be transferred to a position directly under NWO's Executive Board (**Raad van Bestuur**) in 2021. This provides a better match between its polar expert role and position as a special programme addressing research in several domains under NWO governance.

Support

An experienced secretariat of at least 2.0 dedicated **FTE** polar programme officers is required to support the PC NPP and to run the science programme with all of its associated international commitments and (complex) management tasks. This includes a director to adequately represent the programme internationally.

The Programme Committee may advise NWO's Executive Board to appoint external committees and taskforces with specific Terms of Reference, including an evaluation committee to periodically evaluate the NPP.

Ice wedge in Siberia. Photo: **Rúna Magnusson**

Chapter 6

Further opportunities

*Dutch-Russian research team working on red knots (*Calidris canutus canutus*) in the context of the NWO-NPP project BodyShrinkage: investigating Arctic warming-induced body skrinkage of long-distance migrants, northern Taimyr, Russia (photo by* ***Job ten Horn****). From left to right: Job ten Horn, Anastasia Popovkina, Misha Zhemchuzhnikov, Thomas Lameris, Jan van Gils (PI), Maria Sukhova, Mikhail Soloviev, and Viktor Golovnyuk.*

6.1 | Resources for funding polar research

The innovative Dutch polar research capacity is not being fully utilised given the high scientific quality and policy importance of research proposals that, although of high quality, cannot all be funded as a result of limited financial resources. Additional funding sources could increase the output of our innovative polar research capacity. It is recommended to increase impact through the acquisition of additional funding (action 1d)

Identified options for polar funding multipliers at present are:

- European funders (Horizon Europe including trans-national consortia, ERC Starting and ERC Consolidator grants)
- External (international) parties (Belmont Forum, current MoUs, bi-multilateral agreements).
- Dutch Research Agenda (NWA-ORC and thematic programmes), specifically tailored by NWO for research requirements with societal and policy urgency, with annual invitations for new proposals. An example is the NWA Polar Tourism 'PT REPAIR' call in 2021.
- Knowledge and Innovation Covenant (KIC) at NWO, organising tailor-made calls for specific knowledge gaps, requiring external parties to match funding.
- The National Roadmap for Large-scale Research Facilities may provide a mechanism for the field to join forces and request in situ, numerical and remote sensing facilities.
- Via MoUs between NWO and the Swiss and Norwegian Research Councils. Swiss and Norwegian researchers can readily act as co-applicants in NWO calls, which has an active Money Follows Cooperation module. The MoU also works the other way around for Dutch researchers in their funding calls.

In addition, other NWO instruments will provide regular funding opportunities for polar projects of all sizes. The Growth Fund (2021) is a new development and has R&D and innovation as one of its pillars and may offer an extra window of opportunity while it evolves.

6.2 | Facilities and infrastructure

The Netherlands is at the forefront of innovations and practical solutions. Often they are the result of an infrastructure that supports long-running efforts in fundamental science at a variety of institutes. Its key to success is to have synergy in research facilities, not only in the polar regions but also in space, the Netherlands and in digital bits.

Terrestrial facilities

For all terrestrial and coastal researchers in the Netherlands, the INTERACT platform/initiative provides circumpolar access to in situ facilities. This initiative is strongly supported by international Arctic organisations such as IASC, FARO and EPB. The INTERACT catalogue provides information on the available infrastructure and logistics for Arctic researchers. The COMNAP catalogue provides similar information for Antarctica and was endorsed by SCAR, COMNAP and EPB.

Marine facilities and expeditions

For marine research, access to research icebreakers and research vessels with medium ice class is indispensable. In recent years, transnational access to European icebreakers has been streamlined via different organisations and routes, such as:

- The Arctic Research Icebreaker Consortium (ARICE) is an EU-funded project that provides access to and establishes joint Arctic research activities on research icebreakers from Sweden (**Oden**), Germany (**Polarstern**), Norway (**Kronprins Haakon**), Finland (**Fennica**) as well as a Canada (**Amundsen**) and the United States (**Sikuliaq**). The director of the NPP is currently a member of its advisory committee. The PeCaBeau expedition is a Netherlands-led (VU Amsterdam) expedition in 2021 under the Canadian and ARICE's flag. A successor (ARICE-2) is under discussion and would be highly valuable for the Dutch polar community, considering the success of ARICE.
- Barter system for transnational access. The Ocean Facilities Exchange Group (OFEG) provides the Dutch marine research community with access to international vessels based on an exchange of ship time on the RV Pelagia and the new vessel, which is still being built.
- NWO is a member of the International Ocean Discovery Program (IODP) which has planned several Arctic and Antarctic sediment drilling campaigns. Their scientific drilling vessels are unique in the world and have already hosted Dutch paleoclimatologists on Antarctic cruises.
- The renewal of the Dutch research fleet at NIOZ, expected to be finalised by 2024, may offer new opportunities for Dutch (sub)polar research. A dedicated funding round for projects may be explored to initiate a polar expedition, use of infrastructures (mobile labs) and partnerships.
- The SEES.nl expeditions to Edgeøya, Svalbard (one in 2015 and another scheduled to take place in 2022) provide a novel way of connecting academia, policymakers and society. The second SEES.nl expedition has reserved berths for international researchers to consolidate collaboration across boundaries.

Modelling

While in situ observations remain important, their spatial and temporal coverage in the polar regions is limited. Models are therefore crucial to put these observations into a broader context and to project future changes. There are a number of modelling issues that apply specifically to polar climate and environmental change:

- Spatial scales of processes/variability/couplings are generally smaller than elsewhere, which affects polar parameterisations and data storage.
- Climate model biases usually peak in the polar regions, leading to uncertain future projections of climate and impacts.

These require dedicated high-resolution model development and integration (ice sheet, regional climate, sea ice) for the polar regions, which align with (inter)national efforts and programmes.

Instruments

Researchers can apply for investments in NWO calls based on standardised conditions. These instruments must be reusable for a wider purpose than the individual project. Better international coordination will make it possible for other polar research groups within and outside the Netherlands to use such investments.

SIOS

The Svalbard Integrated Arctic Earth Observing System (SIOS) brings observations together into a coherent and integrated observational programme that will be sustained over a long period. The Artic Centre Groningen (AC-RUG) is an SIOS partner and coordinates the contributions from Dutch universities. Within SIOS, researchers can share instruments, acquire data and address questions that would not be practical or cost-effective for a single institution or nation alone. SIOS is planning to work more closely with surrounding regions, e.g. Zackenberg station in Northeast Greenland.

Modern techniques and methodologies

The toolbox of polar researchers is rapidly expanding with new techniques and technologies. Satellites are now capable of measuring an increasing number of parameters up to the granular level of detail. Satellite communications enable automated data collection of all sorts: from intelligent weather stations to next-generation bird GPS trackers. All these remote-sensing techniques generate unprecedented volumes of data – Big Data. This is further accelerated by desktop sources: data mining from online databases and user content generates a wealth of new data. Smart – yet costly – algorithms exploring digitised archives produce yet another explosion of data. Especially the conception of extremely complex computer models, which factor in the vast amounts of newly accessible data, are going to guide global science, including the polar sciences.

All these advancements offer a better understanding of the foundations of system earth and society. They enable more scrutiny in computer models, produce better local predictions and generate a host of new research questions that will shape the science of tomorrow. Apart from investments in these techniques and facilities, these advancements demand investments in user support activities. First and foremost, in situ observations remain crucial to calibrate instruments, validate models, develop new hypotheses and understand specific processes in detail. While in some cases desktop-based studies decrease the need for physical human presence and our footprint, fieldwork remains indispensable.

Long-term observational records are imperative to understand temporal dynamics and structural change. The climate, for example, is the average weather over 30 years and cannot be measured in a single season or year. For both remotely sensed data, in situ observations and numerical models, the validation of assumptions and reduction of noise cannot go without monitoring studies. Dutch universities and institutes are conducting several such studies. Long-term records require long-term commitment and continuity, which is incongruent with Dutch public research funding. Engaging in an NPP key polar monitoring support programme could unburden current research programmes, enhance their visibility and interoperability as a recognised national contribution to essential international monitoring programmes.

While fieldwork, laboratories and vessels remain important for both the analysis and calibration of instruments, computing power is more important than ever before. High-performance computing power (HPC) and proper data management are essential to study and store the flows of Big Data. This pressure is not confined to a specific discipline or geographical area. It is recommended to identify and secure uninterrupted development and use of state-of-the-art models of the polar system or parts of it (recommendation 5b).

South Magnetic Dip Point. Photo: **Martine van den Heuvel-Greve**

Chapter 7
Netherlands Polar Centre

Over the past five years, concerns for the continued effective operation of the Netherlands Polar Programme and calls for more synergy in polar research and policymaking have been voiced in and supported by the special Committee Polar Infrastructure (2018), the NPP Evaluation (2020) and the ministerial departments. While the decentralised geography of polar research in the Netherlands is an asset in its own right, a visible Dutch polar research centre has several important advantages that can assist in building a stronger, vital and even more successful polar research community.

The strategy committee recommends to further stimulate the development of an independent national home base for polar sciences e.g. a Netherlands Polar Centre (action 4a). Such a centre has the well-recognised potential to:

- Create more synergy among Dutch polar researchers and become a **virtual** home base.
- Organise and arrange better on-target (web-based) information and communication.
- Develop coordinated and bottom-up strategic science programmes that mobilise and capitalise on national strengths.
- Coordinate, manage and operate the Dutch polar infrastructure (e.g. Dirck Gerritsz Laboratory) and access to the polar regions, on behalf of NWO. This can include management of strategic partnerships.
- Coordinate and sustain important national polar monitoring programmes.
- Act as a broker for strategic opportunities, for example for (inter)national expeditions, and help Dutch projects to benefit from these opportunities.
- Coordinate the acquisition of EU consortium funding and other multipliers.
- Organise and support quality dialogues between researchers, policymakers and other stakeholders.
- And more, to be assessed and investigated by a special taskforce.

Setting up a national polar centre would require a governance structure with leaders that have authority in their field of research and who can represent their stakeholders, primarily the polar researchers in their respective knowledge institutes. A centre as a one-stop shop for polar research support would bring polar researchers, foreign partners, funders, media and other stakeholders closer together.

As further details go beyond the scope of this strategy document and the expertise of this committee, we advise to have NPP-PC and NWO appoint a taskforce to investigate options to improve the coordination and support of Dutch Polar Research, e.g. through the establishment of a virtual Dutch Polar Centre (action 4b). It should also indicate the required level of financial and in-kind support to be able to fulfil its tasks, its relationship with(in) NWO and any other feasibility requirements. The taskforce should contain high-level managerial and polar experience and table its decision document no later than Q4 2021 for approval from the ministries (IPO) and no later than Q1 2022 for approval from the NPP Programme Committee.

In founding a national polar centre, the Netherlands is following in the footsteps of successful examples in other, similar countries. National institutes elsewhere fulfil important national strategic and supportive roles, especially in countries with large logistics capabilities and the need to operate and access important polar infrastructure. They all have in common that they need to bring together a complex level of support and expertise to give polar researchers access to international infrastructure in polar regions, but also enhance the visibility, relevance and coordination of their national polar research. Recently, in December 2020, Switzerland selected its polar institute as a priority to become a research institution of national importance also tasked with bringing a new level of support to their polar research community. The new status comes with additional funding by the Swiss Confederation[8]. In 2013, the Austrian Polar Research Institute (APRI) was founded as a research consortium that promotes and coordinates research and education in the area of polar sciences at the participating organisations. Both are good examples and seen as support for creating a Dutch analogue.

[8] https://swisspolar.ch/2020/12/swiss-polar-institute-gains-new-national-status/

Magdalenefjorden, Svalbard. Photo: NWO | ***Renno Hokwerda***

Annexes

I Strategy development

Photo: **Suzette Bousema**, *Climate Archive.*

Synopsis

A research strategy committee was appointed by NWO and the Dutch government to develop this Pole Position-NL 3.0 strategy document. Work started in July 2020 and was completed in December 2020. Pole Position-NL 3.0 draws on the expertise and experience of its 12 members, who represent most disciplines in the Dutch field. It includes recommendations from the Committee Polar Infrastructure (2018), the NPP Evaluation (November 2020) and the five funding departments. In addition, the NPP bureau ran a survey (see below).

Strategy committee

Martine van den Heuvel-Greve, Wageningen University and Research (WUR) and WMR (chair)
Nicole Biebow, Alfred Wegener Institute, Helmholtz Centre of Polar and Marine Research (AWI)
Richard Bintanja, KNMI and University of Groningen (RUG)
Laurens Ganzeveld, Wageningen University and Research (WUR)
Lucia van Geuns, The Hague Centre for Strategic Studies (HCSS)
Monique Heijmans, Wageningen University and Research (WUR)
Jeroen Hoving, Delft University of Technology (TUD)
Femke de Jong, Royal Netherlands Institute for Sea Research (NIOZ)
Machiel Lamers, Wageningen University and Research (WUR)
Annette Scheepstra, Arctic Centre, University of Groningen (RUG)
Marck Smit, Royal Netherlands Institute for Sea Research (NIOZ)
Jorien Vonk, Vrije Universiteit Amsterdam (VU)
Roderik van de Wal, Utrecht University (UU)
Hannah Wijmenga, Ministry of Foreign Affairs (BZ)

Other parties involved during the process

NPP Programme Committee
NPP secretariat: drs. Dick van der Kroef, dr. Daan Blok and drs. Renno Hokwerda
IPO ministries (OCW, BZ, IenW, LNV, EZK; see chapter 6)
External readers and reviewers

Timeline

May 2020	Covenant signed, providing funding from 2021 till at least 2025
June 2020	Terms of Reference set for the strategy committee
July 2020	Strategy committee appointed
Sept 2020	Survey to the polar research community
Oct 2020	Theme development
Nov 2020	Input from the Evaluation of the NPP, 2016–2020 Consultation with Programme Committee and external experts
Dec 2020	Publication of the Netherlands' Polar Strategy 2021–2025
Jan 2021	Final draft
Feb 2021	*Work temporarily suspended due to Ransomware hack at NWO*
May 2021	Presentation of Pole Position-NL 3.0

Survey September 2020

A survey was sent to circa 200 Dutch polar researchers in September 2020, which generated ca. 30 detailed accounts from active researchers in the Netherlands.

Questions

- The four research themes (based on Pole Position-NL 2.0)
  - a Do you have other suggestions for short and concise titles of these theme(s)? Do you want to add specifics to the theme(s)?
  - b In which of these theme(s) does your research fit?
- Research gaps and monitoring
  - c What is the current state (recent developments) of the international research for the Dutch polar research theme(s) that you are involved in (or your field of expertise within this theme)?
  - d What are considered the main international research gaps for the Dutch polar research theme(s) that you are involved in (or your field of expertise within this theme)? Include reference to international bodies such as Arctic Council, IASC, SCAR etc. where possible.
  - e How can Dutch polar research contribute to these international research gaps for the Dutch polar research theme(s) that you are involved in (or your field of expertise within this theme)?
  - f Which main research gaps, for the Dutch polar research theme(s) that you are involved in (or your field of expertise within this theme), will be of benefit to the Dutch policy?
  - g Which type of long-term monitoring by Dutch polar researchers can contribute to the main international research gaps as identified above, for the Dutch polar research theme(s) that you are involved in (or your field of expertise within this theme)?
- Facilities and infrastructures
  - h Which of the Dutch facilities and infrastructure do you use for your research?
  - i Which other international facilities and infrastructure in the polar regions do you use for your research?
- International partnerships
  - j Which international partners are essential for polar research in your field? And why?
  - k Do you support, propose or foresee additional opportunities for extension of the portfolio of special partnerships? What country(/ies), institutions and for what reason?
- COVID-19
  - l The pandemic is affecting research in the polar regions more than anywhere else, with their already difficult access and restricted fieldwork seasons. Could you summarise how COVID-19 has affected your ongoing and/or planned polar research?
- Dutch polar research community
  - m The Dutch polar research landscape is relatively decentralised, with many activities taking place at over twelve universities or national institutes. The Committee Polar Infrastructure observed a very limited amount of structural interaction and limited synergy. Do you think that the Dutch polar field should be more organised?
  - n If yes, in what ways? How could a structural interaction be organised? Which roles could it have?

Results

Respondents unveiled several key trends:

- Dutch researchers demonstrate a high capability of organising access to polar infrastructures via partners, and in some cases they operated their own facilities in the Arctic.
- In the past, it has been difficult to arrange both access to research ships and receive project funding, which makes Dutch researchers miss out on some opportunities. However, with the new European barter system for transnational access, this need has largely been relieved.
- Dependence on facilities outside the polar regions is equally crucial, for example supercomputers (modelling), remote sensing (satellite data and technology) and laboratories.
- Funding monitoring activities is extremely valuable to science but difficult to find funding for. The 'roof tiling' approach – combining grants one after another – is risky and cannot guarantee longevity, while long-time series accumulate value over time.
- The value of SEES.nl and the annual Polar Symposium serve as key bridges between polar disciplines.
- Diverse responses on closer cooperation were voiced, but on the question how closer collaboration could be facilitated, most respondents identified concrete ideas, including communication channels (website), an information hub, SEES.nl, roundtables and workshops, and more. The name of the Willem Barentsz Polar Institute (WBPI) surfaced several times.

Documentation

- Netherlands' Polar Strategy Beslagen ten IJs 2021–2025 (December 2020)
- Evaluation of the NPP (November 2020)
- Recommendations from Interdepartmental Polar Committee (June 2020)
- Self-evaluation report of the NPP (February 2020)
- Polar Research Infrastructures: Future requirements (Committee Polar Infrastructure, 2018)
- NWO Strategy plan and website (2020)
- Strategy documents, including but not limited to: EPB, EU-PolarNET, IASC, SCAR (2020).
- Arctic Science Ministerial joint-statements-of-ministers (2016, 2018).
- Door de kou bevangen. Vijftig jaar Nederlands onderzoek in de poolgebieden (AGJ Buma, AJM Scheepstra and R Bintanja, 2015).

II Terms of Reference

Eider duck and duckling. Photo: ***Wil B. Geven***

Status June 2020.

What

The Netherlands Polar Programme (NPP) requires a new strategy for the period 2021–2025. The current strategy, Pole Position-NL 2.0, dates from 2015 and encompasses the period 2016–2020. The current Netherlands Polar policy framework runs for the period 2016–2020 and will be updated alongside the development for the new strategy of the NPP. The new NPP strategy will be fuelled by the funding ministries, by the involved research institutions in the Netherlands, and by input from relevant international organisations: the Arctic Council, the Antarctic Treaty System, the European Polar Board (EPB), EU-PolarNet, the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC).

Who

NWO carries out the NPP and is thereby responsible for producing a strategy for the programme. NWO considers the following parties relevant to include in the development of the new NPP strategy:

- Dutch polar researchers: what do they see as important themes and emerging research fields, what are the chances for the Netherlands? The composition of the strategy committee needs to be representative for the four current strategic NPP themes: 1. Ice, climate and sea-level rise, 2. Polar ecosystems, 3. Sustainable exploitation, 4. Social, legal and economic landscape.
- Technical expert of the Dutch mobile research laboratories.
- NWO, executing the strategy.
- The funding ministries of the NPP.
- Representatives from relevant stakeholders: KNMI, Dutch Arctic Circle (incl. businesses active in the Arctic region), Delta-commissariat, European Polar Board/ EU-PolarNet.

Time planning

- First strategy consultation: May 2020 [red.: July 2020], online [due to COVID-19]. Aim is to outline contours of a new strategy based on input from the polar research community in the Netherlands.
- Based on this input, the strategy committee produces a new strategy document for the NPP for the period 2021–2025: Pole Position-NL 3.0
- A concept strategy will be presented to the Programme Committee of the NPP by late summer [autumn] 2020.
- The new strategy needs to be finalised 1 December 2020, following the completion of the new Polar Policy framework by the Dutch government, which will be drafted by the funding ministries of the Netherlands Polar Programme, collected under the Interdepartmental Polar Committee (BZ, I&W, OCW, LNV, EZK).

Considerations

1 The current Dutch Polar policy framework and the NPP strategy (Pole Position-NL 2.0) are formulated to encompass a wide spectrum of polar research areas and disciplines. The following considerations are to be taken into consideration by the new strategy development for the NPP:

2 Are the four current NPP themes up to date? Do these need to be limited or expanded?

3 Are policy-relevant themes sufficiently addressed?

4 Optimisation funding instruments NPP (needs research field, focus of research): e.g. thematic calls, sandpits, strategic priorities.

5 Which (parts of) agendas from the strategic white papers from EU-PolarNet/EPB/IASC/SCAR/ COMNAP/ Arctic Council working groups may be included in the NPP strategy?

6 May the current strategy document be used as a basis for the new strategy or should the entire document be revised?

7 The Dutch Dirck Gerritsz Laboratory on the British Rothera base in Antarctica is a critical polar Research infrastructure for the Netherlands, financed by the Ministry of Education, Culture and Science (OCW), needs to be maintained and its usage optimised.

8 How can the NPP better connect to other NWO funding instruments (KIC, NWA, GWI)?

9 The role of long-term research (monitoring).

10 Extension of international collaboration with collaborating countries (e.g. France, Canada).

11 Opportunities for increased cohesion in Dutch polar research through the establishment of a virtual Dutch Polar Centre in the future.

12 Does the strategy explicate the extent of the polar regions which the NPP covers through their funding (both in the Southern and Northern hemisphere)? This consideration is dependent on the aims the Netherlands and their national polar strategy wishes to accomplish.

III Ten years of the Netherlands Polar Programme

*Faroe Islands. Photo: NWO | **Renno Hokwerda***

POLE POSITION-NL 1.0

2011

- The Netherlands Polar Programme is created by merging the Netherlands AntArctic Programme (1990) and Netherlands Arctic Programme (2005). NPP at €3.7 million per year.

2012

- Two calls: a Greenland and Svalbard science-driven call and a bi-polar policy-driven call, resulting in 20 projects.

2013

- The Dirck Gerritsz Laboratory is opened by Minister of Science dr. R. Plasterk. It has an expected lifetime of 25 years.

2014

- Two calls: a polar policy-driven call and a Dirck Gerritsz call, resulting in 11 projects.

2015

- SEES.nl in August 2015.
- NWO The Hague accommodates the secretariat of the European Polar Board.
- Book 'Cold stroke: Fifty years of Dutch research in the polar regions'.

POLE POSITION-NL 2.0

2016

- Updated Netherlands' Polar Strategy. NPP at €3.9 million a year.
- A science-driven call, resulting in 13 projects.
- Joint Dutch-Belgium project at the Belgium Antarctic station.
- 1st Arctic Science Ministerial at the White House, Washington DC, USA.

2017

- Arctic Top Sector Water call, resulting in three projects and the Icewhale design study.
- NWO internal transition.

2018

- The Committee Polar Infrastructure publishes its pivotal report and is the first to advise a Netherlands Polar Centre.
- NWO-NPP contribution to Beyond EPICA Oldest Ice, the flagship European ice drilling campaign, operating until 2029.
- Dutch MOSAiC call leads to three projects staged on this flagship expedition. The first time the sandpit call was tested with the NPP.

2019

- A Royal Visit to Bremen and Bremerhaven includes the Alfred Wegener Institute, which signed a new MoU with NWO-NPP.
- NWO-NPP contribute to the Belmont Forum Arctic Resilience call, resulting in two partly-Dutch projects.
- Installation of the NPP Programme Committee.
- A polar policy-driven call of €5.5 million, resulting in 4 nationwide consortia.

2020

- COVID-19 pandemic disrupts most fieldwork, SEES.nl II postponed and MOSAiC expedition reconfigured.
- Netherlands marks 30 years with consultative status in Antarctic Treaty and 30 years as founding member of IASC.
- Polar Symposium goes online.
- NPP co-funds EU-PolarNet II's Dutch representation.
- External evaluation of the NPP 2016–2020.

POLE POSITION-NL 3.0

2021

- Updated Netherlands' Polar Strategy. NPP at ≥ €3.9 million per year. Introduction of a rolling budget for NPP.
- NPP co-funds and assists with the National Research Agenda 'Polar Tourism' call.
- Renewal of the MoU with BAS and AWI.

2022

- SEES.nl II, 13–20 July
- New funding calls.

IV Links and resources

Netherlands Polar Programme

Homepage
nwo.nl/npp-en

Evaluation report of the NPP 2016–2020
nwo.nl/npp-en

Dirck Gerritsz Laboratory background and information
nwo.nl/onderzoeksprogrammas/nederlands-polair-programma/het-dirck-gerritsz-laboratorium

National Polar Data Center
npdc.nl

De Wereld Dooit Door webcast (English subtitles)
nwo.nl/npp-en

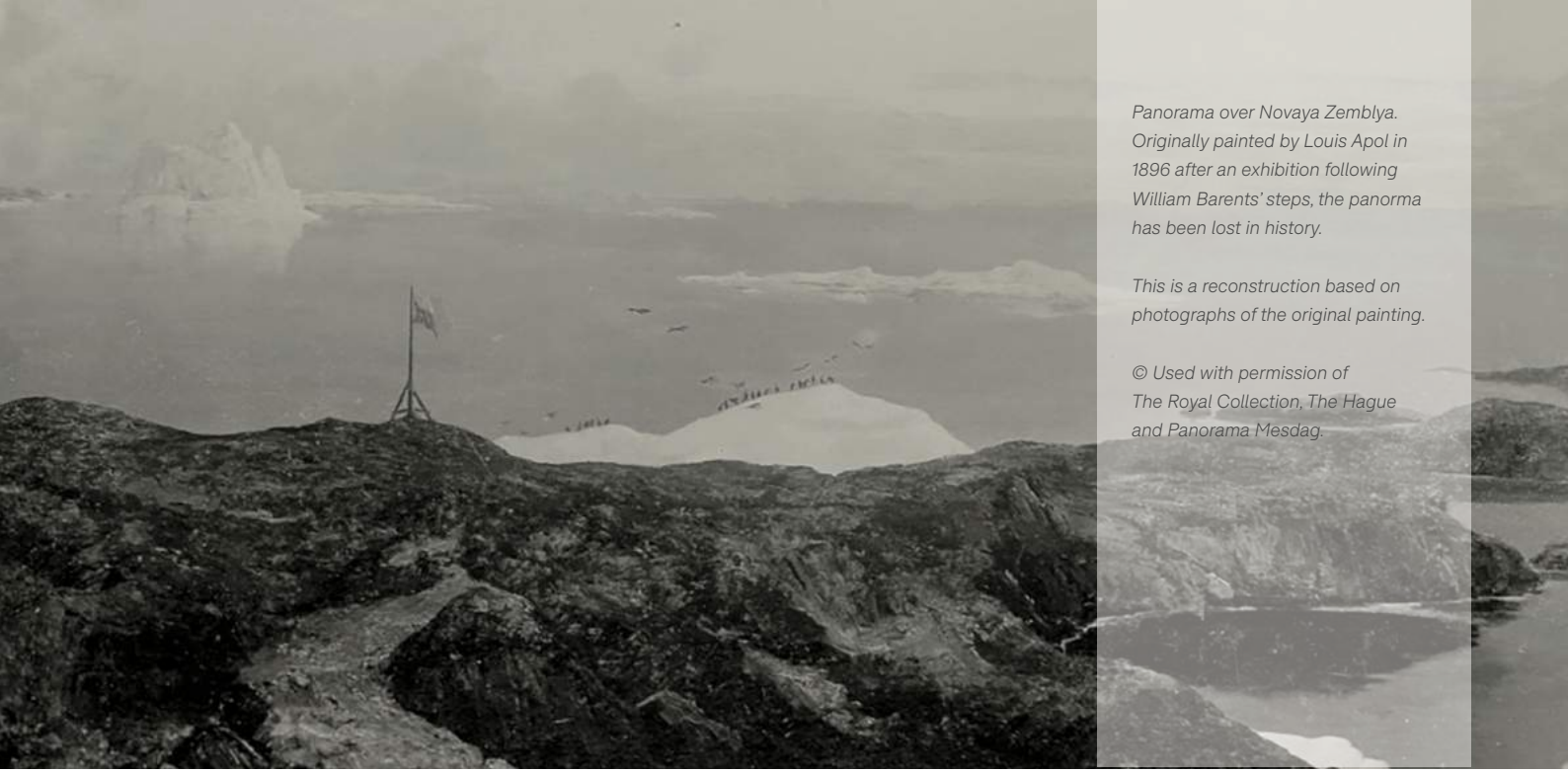
Overview of polar research in the Netherlands

The book Door de kou bevangen: 50 jaar Nederlands poolonderzoek. [Caught by the cold: 50 years of Dutch polar research]. AJM Scheepstra, A Buma & R Bintanja (2015).
rug.nl/research/arctisch-centrum/collaboration/dutchcollaboration/wbpi/

Overview of polar dissertations in the Netherlands since 1950
rug.nl/research/arctisch-centrum/collaboration/dutchcollaboration/wbpi/50jaarpolaironderzoeknl/nederlandse-polaire-proefschriften

Overview of Dutch fieldwork in the Arctic and Antarctic since 1950
rug.nl/research/arctisch-centrum/collaboration/dutchcollaboration/wbpi/50jaarpolaironderzoeknl/veldwerk/

Overview of Dutch polar projects funded by the NPP and NWO since 2016. The list also includes Horizon 2020 projects with a Dutch component.
nwo.nl/npp-en



Panorama over Novaya Zemblya. Originally painted by Louis Apol in 1896 after an exhibition following William Barents' steps, the panorma has been lost in history.

This is a reconstruction based on photographs of the original painting.

Netherlands' Polar Strategy

Prepared for Change / Beslagen ten IJs
government.nl/documents/publications/2021/03/01/polar-strategy

External polar networks

Willem Barentsz Polar Institute
rug.nl/research/arctisch-centrum/collaboration/dutchcollaboration/wbpi/

RUG Arctic Station in Ny-Ålesund
poolstation.nl/
nyalesundresearch.no/

Association of Polar Early Career Scientists Netherlands (APECS NL)
apecsnetherlands.com/

Dutch Arctic Circle (DAC)
dac-netwerk.nl/

V List of acronyms

Polar lab 'Liefde' on display as an exhibition venue at Rotterdam, 2020. Photo: **Esther Kokmeijer**

AC	Arctic Council
AMAP	Arctic Monitoring and Assessment Programme (Arctic Council)
AOS	Arctic Observing Summit
ARICE	Arctic Research Icebreaker Consortium
ASM	Arctic Science Ministerial
ASFF	Arctic Science Funders Forum
ATCM	Antarctic Treaty Consultative Meeting
ATS	Antarctic Treaty System
AWI	Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research
BAS	British Antarctic Survey
CAFF	Conservation of Arctic Flora and Fauna (Arctic Council)
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
COMNAP	Council of Managers of National Antarctic Programs
DAC	Dutch Arctic Circle
DGL	Dirck Gerritsz Laboratory
EPB	European Polar Board
EPRP	European Polar Research Programme
FARO	Forum of Arctic Research Operators
IASC	International Arctic Science Committee
IASSA	International Arctic Social Sciences Association
ICARP	International Conference on Arctic Research Planning
IPO	Interdepartmental Polar Committee (Interdepartementaal Polair Overleg)
MoU	Memorandum of Understanding
MPA	Marine Protected Areas
Nexus	NWO ambition to establish better connections: science-science, science-policy, science-society
NIOZ	Royal Netherlands Institute for Sea Research
NPC	Netherlands Polar Centre
NPDC	Netherlands Polar Data Center
NWO	Dutch Research Council (Nederlandse Organisatie voor Wetenschappelijk Onderzoek)
PAME	Protection of the Arctic Marine Environment (Arctic Council)
PAP	(Netherlands) Polar Activities Programme
SCAR	Scientific Committee on Antarctic Research
SDG	Sustainable Development Goals
SDWG	Sustainable Development Working Group (Arctic Council)
SIOS	Svalbard Integrated Arctic Earth Observing System
WBPI	Willem Barentsz Polar Institute

Publication
The Netherlands Polar Programme
Dutch Research Council (NWO)

Mail address
P.O. Box 93138
2509 AC The Hague

Visitor address
Laan van Nieuw Oost-Indië 300
2593 CE The Hague

E: npp@nwo.nl
W: www.nwo.nl/npp-en

May 2021