The Economics of Ecosystems and Biodiversity (TEEB) for the Arctic: A Scoping Study

Executive Summary
Acknowledgements

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About the project
The TEEB Scoping Study for the Arctic was directed and funded through an international partnership with funding and in-kind support from partners and from the Nordic Council of Ministers, through the Terrestrial Ecosystem Group (TEG). Partners are the Conservation of Arctic Flora and Fauna working group of the Arctic Council (CAFF) with Sweden as the lead country, the UNEP Regional Office for Europe, the UNEP TEEB Office, WWF Global Arctic Programme and GRID-Arendal. The Study is an early implementation pilot project that follows up on Recommendations from the Arctic Biodiversity Assessment and fulfils Action 12.1 from the Actions for Arctic Biodiversity, 2013-2021: Implementing the recommendations of the Arctic Biodiversity Assessment.
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Memorandum to the Senior Arctic Officials

17/09/2015

The Economics of Ecosystems and Biodiversity in the Arctic (TEEB) scoping study

For information/action

Background

The Arctic Council has recognized the significance of assessing and understanding the multiple services and values that ecosystems provide. This is evident in several initiatives such as Ecosystem Based Management, the Adaptation Actions for a Changing Arctic, the Arctic Resilience Report, and in particular the Arctic Biodiversity Assessment recommendations that were approved at the Arctic Council Ministerial in Kiruna in 2013.

In response, the Conservation of Arctic Flora and Fauna (CAFF) Working Group initiated an effort to better understand ways that the Arctic Council can address this important topic. The TEEB Arctic scoping study led by Sweden was carried out by the CAFF, United Nations Environment Programme (UNEP) TEEB, World Wide Fund for Nature (WWF), and GRID-Arendal is an important first step. It is submitted by the CAFF Board to the Senior Arctic Officials for approval at their October 2015 meeting.

Organization

► Steering Group: Sweden, WWF Global Arctic Programme, UNEP Regional Office for Europe, UNEP TEEB, GRID-Arendal, CAFF Secretariat, Project consultant.
► Project funding and support came from the Nordic Council of Ministers, UNEP, WWF and CAFF
► Communication group: CAFF Secretariat, WWF, TEEB Office

Next steps:

The TEEB Arctic scoping study provides a basis for beginning a dialogue on the complexities of evaluating ecosystem services within the Arctic. Continuing in this dialogue CAFF is exploring possible next steps. CAFF will provide an update to the Senior Arctic Officials at their March 2016 meeting.

Communications:

► Project website: www.arcticteeb.net

Actions required:

► Senior Arctic Officials: Approval of The Economics of Ecosystems and Biodiversity (TEEB) for the Arctic Scoping study
What is TEEB?

The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative coordinated by the United Nations Environment Programme (UNEP). TEEB draws attention to the benefits that people gain from nature (ecosystem services), including food from fishing and hunting, maintenance of culture, water, enjoyment of wilderness, nature and wildlife, and provision of raw materials. Equally important but less obvious benefits include climate regulation and flood control. TEEB also brings attention to the costs to society when ecosystems are damaged and when plant and animal populations are lost. TEEB provides an analytical approach, tools and guidance that can help make the range of nature’s benefits more visible when politicians, businesses, communities and others make decisions that might affect these benefits or put them at risk.

The TEEB Scoping Study for the Arctic

The scoping study is predominantly based on the TEEB scoping study approach and methodology. It differs from this model, however, in two ways: 1) it includes information and discussion related more generally to improving understanding of the full range of Arctic ecosystem services, as well as information and discussion on aspects of governance and of valuing ecosystem services in the context of the circumpolar Arctic and Arctic Council; and 2) it does not conclude with a defined set of specific policies for assessment in a full TEEB study, but rather provides guidance and examples on policy focus areas that could be further refined and assessed using TEEB methodology. These differences are related to the multi-jurisdictional nature of Arctic governance, the diversity of value systems around the Arctic, and to meeting the needs identified by Arctic Council, both through the ABA and through recommendations on implementation of ecosystem-based management in the Arctic.

Summary

The report presents the results of the scoping study on ecosystem services and the application of a TEEB approach and methodology in the Arctic and concludes with options for follow-up work. This summary is divided into three sections:

1. Laying the foundations: Key findings from compiling and synthesizing information, issues, current practices, methodologies and perspectives on Arctic ecosystem services and their values in relation to decision making
2. Policy focus areas: List and discussion of policy areas identified during the scoping study for potential follow up using the TEEB approach
3. Way forward: Options for the next steps. This includes, but is not limited to, application of TEEB methodology to identified policy focus areas and considers options for practical implementation of TEEB at a range of jurisdictional and spatial scales
Laying the foundations: Key findings

Context and issues

**Key Finding 1.1.** Featuring ecosystem services in policy development and implementation is needed to help define and balance societal needs and priorities in the rapidly changing Arctic policy landscape.

There is growing pressure to find solutions to questions of resource allocation that affect socio-economic development and quality of life in the Arctic. While nature and its benefits are important to Arctic residents and Arctic landscapes and iconic species are well-known around the world, this does not necessarily translate into policy.

The study identified the following issues as context for further work, as outlined in the way forward section:

1. **Climate change** and the risks and uncertainty it brings to the future of biodiversity and associated ecosystem services
2. Planned and projected growth in **industrial development and shipping**
3. **Globalization** in terms of economic interests in the Arctic, but also in terms of communications and cultural and economic change around the Arctic;
4. Concerns about **food and water security**
5. Arctic **governance** and policy regimes in the context of the above issues

Arctic ecosystem services

This scoping study is a first cut at an inventory and synthesis of ecosystem service categories, with a focus on the less visible regulating and supporting services. The ecosystem services discussion draws from the project’s draft ecosystem services inventory and invited input from experts on what ecosystem services they saw as important and what they perceived as risks to these services.

Risks to ecosystem services and biodiversity are of two types: (1) those related to physical, ecosystem and biodiversity processes (for example, decreasing sea ice cover and changing patterns of marine biodiversity), and (2) risks related to social responses to these drivers of change (such as increased marine shipping, oil and gas and mining development, and expansion of commercial fisheries).

**Key Finding 2.1.** Systematic conclusions on Arctic ecosystem services and their status and trends cannot yet be made based on the data gathered in the scoping study.

This conclusion is in line with the general lack of comprehensive information for the whole of the Arctic, and reflects the findings of the ecosystem services chapter of the ABA. Nevertheless, sufficient information exists to allow identification of general characteristics and trends, which are outlined in the points below.
**Arctic ecosystem services inventory**

As part of the scoping study, and as a response to ABA recommendation #12 (to evaluate the range of services provided by Arctic biodiversity), a systematic inventory of ecosystem services was initiated. This inventory, if further developed, will lay the foundation for “assessing the value of significant Arctic ecosystem services relevant to the well-being of local communities and regional economies, and those of particular global significance” (recommendation of the Arctic Council Expert Group on Ecosystem-Based Management). The inventory is a work in progress.

**Structure and content of the inventory**

<table>
<thead>
<tr>
<th>Ecosystem services</th>
<th>Ecosystem(s) it depends on</th>
<th>Scale (level) at which it operates</th>
<th>Who benefits</th>
<th>In what way it is important</th>
<th>Status, trends, information on resilience</th>
<th>Current and projected risks (threats)</th>
<th>Studies (examples) on valuation</th>
<th>State of knowledge</th>
</tr>
</thead>
</table>

### Cultural services

- Aesthetic information
- Cultural identity, heritage, and sense of place
- Information for cognitive development
- Inspiration for human creative thought and work
- Knowledge systems and education
- Recreation and tourism
- Spirituality and religion
- Well-being: psychological and physical health

### Provisioning services

- Biochemical and medicinal resources
- Food – reindeer husbandry, other terrestrial mammals, berries and mushrooms, birds, marine mammals, commercial fisheries, small-scale fisheries, aquaculture, agriculture
- Fresh water for human consumption and use
- Raw materials – timber, fibres, resins, animal skins, feathers and down, ornamental resources, biomass fuel

### Habitat/supporting services

- Food web maintenance
- Genetic resources
- Nutrient cycling
- Primary productivity
- Soil fertility (including soil formation)

### Regulating services

- Air quality regulation
- Biological control (disease regulation and pest regulation)
- Carbon storage and sequestration
- Climate regulation (e.g., carbon storage and sequestration, atmospheric and oceanic circulation, frequency of extreme events): global, regional, and local
- Erosion regulation
- Natural extreme events (e.g., storms, floods)
- Pollination
- Water flow regulation
- Water purification and waste treatment

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Key Finding 2.2. Ecosystem services work should take a holistic approach and operate at the level of ecosystem service bundles.

Regardless of the type of ecosystem service being discussed, no one service can be treated as a separate, unconnected entity. In all cases ecosystem services arise from functioning ecosystems and are thus intertwined.

This holistic approach is consistent with indigenous world views and Traditional Knowledge.

Key Finding 2.3. Although syntheses, guidelines and analyses of policy options at the pan-Arctic scale can raise the profile of ecosystem services and provide direction, work on ecosystem services is most effective when it builds on analysis at smaller scales.

The way in which ecosystem services are recognized and valued varies a great deal across the Arctic depending on what people see as being important for their livelihoods. Ecosystem services also vary from place to place due to differences in climate, landscapes and ecosystems. This means that work on Arctic ecosystem services, including on valuation of services and their integration into policy, must be closely linked to local and regional scales.

Key Finding 2.4. Arctic ecosystem services provide benefits to a range of stakeholders at various scales, both directly and indirectly – and the stakeholders who benefit from services and those who affect the availability of the same services are not always the same.

The variety of beneficiaries – ranging from local to global – highlights the overall importance of Arctic ecosystem services that goes beyond the immediate inhabitants of Arctic ecosystems. Understanding the flow of ecosystem services and related benefits forms the basis for assessing the value of these services and understanding and improving their governance.

Key Finding 2.5. Reduction of greenhouse gases remains a top priority for conserving ecosystem services.

Certain ecosystem types are key for certain services. For example, wetland soils, permafrost sediments and ice and snow dynamics are essential for climate regulation. While conservation actions can be taken to protect specific key ecosystems, physical changes such as sea ice loss and permafrost melt can only be addressed by a global effort to reduce greenhouse gas emissions.

Inuit monitoring methodologies: A holistic approach

An important principle behind Inuit monitoring methodologies, for example, is focusing on the relationships among components of the ecosystems as opposed to individual pieces. As noted by the Inuit Circumpolar Council-Alaska:

“For example, monitoring walrus includes monitoring stomach contents, benthic species, ice thickness, wind directions, water temperatures, and the associated social components. Examples of social components include the transfer of knowledge and importance of a young hunter hunting walrus for the first time and transitioning from one being provided for to one that is providing. Social components also include village feast and sharing systems.

All of these components; how these components interact; and changes within the connections and/or new connections made are all important monitoring objectives for Inuit survival. This may result in multiple different suggestive research actions, such as the need to identify cultural key stone species as well as ecological key stone species.” (Inuit Circumpolar Council-Alaska

Pollination of berries: A holistic view of ecosystem services

This example, taken directly from one response to the study’s stakeholder consultations, illustrates how ecosystem services come in bundles that are difficult to tease apart, and that a holistic approach to them is the common approach taken by Arctic Peoples. In this case, pollination of berries, a regulating service, affects provisioning and cultural ecosystem services and has an associated set of trends, impacts and concerns.

Pollination of berries is an important ecosystem service

Regulating Service

as berries are an important dietary element

Provisioning Service

as well as a culturally-important activity that bonds the generations by taking all ages out into nature.

Multiple Cultural Services

Definitely affecting food security and well-being, as well as indigenous cultural values.

Trends

In some areas northerners have told us that berry abundance, timing and taste have changed.

Concerns

They are worried that some mining activity will negatively affect berries, making them less available and nutritious.

Loss of value

Projected impacts of climate change

Distribution, abundance and active compounds are expected to change with the changing climate.
Key Finding 2.6. Arctic environmental conditions are associated with potential for rapid changes in ecosystem services and high uncertainty – providing a strong incentive to include ecosystem services in policy.

The extreme environmental conditions experienced in the Arctic make the coupling between physical processes, biological processes and human processes extremely tight and visible. This means that changes in physical and biological function have very immediate, clear and strong consequences for ecosystem services. Policies that incorporate ecosystem services can therefore offer immediate rewards in human benefits if they conserve favourable physical and biological ecosystem processes. But this sensitivity of ecosystem services to environmental change also makes the future of ecosystem service provision in the Arctic highly uncertain. The main certainty is that large changes are occurring or expected to occur to most ecosystem services – and that climate change compounds the risks from other stressors.

Governance

The concept of ecosystem services has its origin in efforts to include the role of ecosystem functions for human well-being in policy processes and in governance in general.

Viewing ecosystem services through a 'TEEB lens' makes explicit how and why aspects of biodiversity and ecosystems are relevant for society and thus for governance practices. The TEEB approach helps decision-makers recognize and demonstrate the wide range of benefits of ecosystems, landscapes, species and other aspects of biodiversity and, where appropriate, pursue policies to safeguard them.

Key Finding 3.1. Incorporation of Arctic ecosystem services into policies and governance practices is a key method for the integration of environmental, economic, and social policies.

Such policy integration is at the heart of our ability to consider the long-term effects of human activities in ways that are reconcilable with the limited resources and limited regenerative capacity of our planet. The governance section provides guidance on identifying policy tools and governance mechanisms for implementation of an ecosystem approach.

Key Finding 3.2. Recognizing Arctic ecosystem services and capturing them in decision-making processes can strengthen the resilience of Arctic social-ecological systems to rapid changes in the region.

Bringing ecosystem services into policy supports inclusive, integrated and adaptive decision-making; enables co-production of knowledge across knowledge traditions; and facilitates the establishment of feedbacks between cause and effect of human activities, including those that operate across large spatial scales, long time scales and multiple governance levels.

Key Finding 3.3. The TEEB approach can make the diverse values that people hold for nature visible by assessing and communicating the role of biodiversity and ecosystem services in the economy and to society.

The TEEB approach does not limit the valuation of ecosystem services, and their mainstreaming into policies and practices, to economic instruments. The use of legal instruments or resource management regimes may be just as effective and legitimate.
Key Finding 3.4. Recognizing, demonstrating and capturing the diverse values of ecosystem services in policy instruments for strategic planning and integrated management of natural resources and space can help reconcile biodiversity conservation with development.

The integration of ecosystem services approaches into planning and management processes in the Arctic context highlights the role of natural capital and ecosystem services as the basis for continued human well-being and livelihoods. It also contributes to ensuring that natural capital is not ‘traded in’ to meet short-term needs in a manner that limits the freedom of future generations to choose their own development paths.

Key Finding 3.5. Capturing the benefits and the scarcity of Arctic ecosystem services in economic policies promotes the improvement of economic models and processes.

Making ecosystem services more visible in economic policies advances the capacity to account for natural values and to make closer links between opportunity and risk, between cost and benefit, and between private or corporate activities and public goods. Strengthening these links provides incentives for stewardship and helps to make decisions involving trade-offs transparent.

Key Finding 3.6. Mainstreaming of nature’s values by means of ecosystem services requires adjustments to existing policies and instruments as well as the development of new ones.

This transition will also require institutional changes as well as consideration, in public and private decision making, of evolving cultural values and norms.

Key Finding 3.7. The Arctic Council, as a leader in bringing together knowledge across the circumpolar North, has an important role to play for further work on Arctic ecosystem services. These ecosystem services are recognized through the values assigned to them from the perspectives of key Arctic stakeholders and rights holders.

Improved understanding of the issues surrounding regional environmental and resource governance, as well as issues surrounding sustainable human development (including economic development) under current and anticipated conditions, can provide a foundation for effective implementation of relevant policies, both in the Arctic and internationally.

Key Finding 3.8. Taking an interdisciplinary approach that combines economic and sociocultural analyses to the benefits people receive from Arctic nature faces a number of challenges and concerns. However, it also offers a complementary approach for communicating to decision makers the importance of nature to people, and a toolkit for evaluating policy options and integrating stewardship into decisions.

Contexts where ecosystem service valuation with an economic approach is appropriate can be identified in participatory and interdisciplinary settings, and methods that adequately capture nature’s significance to people can be refined, developed, applied and communicated to decision-makers.
Valuing Arctic ecosystem services

The scoping study presents an overview of concepts and techniques and discusses ways of attributing value to ecosystem services in the context of the Arctic.

Monetary values are often used when a common denominator is needed in a policy context to help describe a trade-off. Methods used to estimate monetary values are sometimes based on what people pay, or would be willing to pay, for a particular experience or benefit from nature.

Monetary values are also estimated for loss or potential loss of benefits of nature – for example, the lost value of fisheries damaged by oil spills, or the cost of loss of climate regulation services due to climate change. What is being valued is often the cost of irreversible damage or damage that is only reversible at prohibitive costs. This type of monetary valuation can provide a powerful argument for taking a precautionary approach to avoid the damage and the associated cost, either by taking measures to reduce the risk of other damaging events (as in the oil spills example), or by making the argument for changes to current policy by showing the costs of the consequences of a ‘business as usual’ approach.

Non-monetary methods of valuation include ranking of preferences and measures such as percentage of households that make use of a particular provisioning service. Biophysical measures can also provide information on values of ecosystem services, often through proxies or indicators – for example, measures of carbon sequestered or berries produced over specified areas.

Non-monetary valuation of ecosystem services can also be achieved through analysis of information gathered using narrative and descriptive methods, such as through interviews, focus groups and social survey questionnaires, as well as analysis of existing documentation (for example, statements and submissions made in planning hearings or public meetings). Transcripts of ethnographic interviews and accounts by Indigenous Peoples of subsistence practices and associated ways of knowing and experiencing home ecosystems are especially relevant in the Arctic. Working with indigenous organizations and with experts from all relevant disciplines to ensure that such information is appropriately used is an essential part of ecosystem service valuation.

Key Finding 4.1. The ecosystem services link is crucial when striving for sustainable management of complex social-ecological systems, and valuation in this context can provide powerful information for evaluating alternative management strategies. Cohesive, integrated and commonly accepted frameworks for assessment of the values of Arctic ecosystems are needed.

Respondents to the study’s stakeholder consultations underlined the need for systematic and coordinated approaches to ecosystem services valuation.

Key Finding 4.2. Any effective, equitable and sustainable policy must account for a diversity of perspectives and encompass a diversity of value systems.

A resilient policy strategy will identify a diverse suite of available interventions and also provide opportunities for diverse audiences to participate in identifying and resolving issues around current and future trade-offs associated with the strategy.
Key Finding 4.3. There is a persistent risk that social and cultural attributes of ecosystem services are neglected while the monetized economic benefits and ecological causes of ecosystem service change are over-emphasized.

Cultural ecosystem services, compared with other ecosystem service categories, are considered more challenging to recognize, less studied and ultimately less likely to be integrated into decision making. As such, they warrant special attention in the Arctic context, where social identity and well-being are so closely tied to ecology and landscape. In particular, space must be made for indigenous perspectives and Traditional Knowledge, as these may differ sharply in world view and knowledge systems, as compared to the dominant perspectives of many non-indigenous land and resource managers.

Key Finding 4.4. Health values are often overlooked in ecosystem services analyses

Health values are linked to food security, and also encompass values associated with a broad range of physical and psychological health benefits from nature, such as nature experiences, local identity and natural heritage.

Policy focus

An important part of the TEEB Arctic Scoping Study is to identify policy areas that will receive most benefit from further assessment using the TEEB methodology.

Key Finding 5.1. Policy related to increasing and changing development patterns in the Arctic would benefit from incorporation of consideration of ecosystem services. Participants in this scoping project identified a list of policy areas for further consideration, and two of these were assessed as ‘policy examples’ through a TEEB approach, at a broad scoping level: expanding shipping and oil and gas development in the marine environment, and industrial development in the North American Arctic.

The following box lists stakeholder responses to questions and discussion on identifying policy areas for consideration for a TEEB Arctic study. The list is a mix of policy areas, social-ecological systems, and sectors. Starting with any one policy area or policy type inevitably brings several others into consideration.
List of potential policy areas for a TEEB Arctic study

Broad policy areas identified

► Marine shipping and marine oil and gas development; increased vessel traffic (Bering Strait)
► Land-based mining and oil and gas – resource extraction; environmental assessment of northern projects; decisions on land-use permits
► Climate change, both through increasing the global awareness of the significance on Arctic climate change for climate regulation, and in relation to adaptation in the Arctic
► Food security
► Infrastructure development

More specific policy areas identified

► Reindeer herding
► Northward movement of commercial fisheries; fisheries and aquaculture policies and regulations
► Tourism, cruise ship and land-based; cultural tourism
► Introduction of new species for harvest (aquaculture, for example); invasive species, e.g., introduced through ballast water
► Wildlife and fisheries harvest allocation; wildlife management
► Research policy: framing research more in terms of ecosystem services, change ways that research is presented; enhancing or restoring Arctic research agendas
► Additional specific policy areas raised (less frequently than those listed above) as options to consider included bio-prospecting, contamination of foods, and waste disposal

Types of policies, tools and governance mechanisms identified

Reykjavik workshop participants concluded that this category can best be considered as part of the analysis of specific policy areas: for example, analysis of fiscal policies or circumpolar governance mechanisms considered in relation to oil and gas development, or strategic planning techniques considered in relation to industrial development on land.

► Strategic planning: land-use planning and management, or, more broadly, spatial planning, including protected areas; industrial development and land-use strategies; conservation strategies
► Participatory processes: co-management; more local control in decision making; increased participation of Indigenous Peoples and local people of the Arctic in decision making; broad stakeholder involvement in decision making
► Resource rights issues, restrictions and responsibilities in relation to ecosystem services; benefit sharing; indigenous community–industry joint ventures; prevention of negative impacts on traditional ways of life
► Economic and fiscal policies; allocation of funding; subsidies; natural capital accounting; transformation of conventional economics to account for nature
► Circumpolar governance and cooperation
Based on a list of criteria developed as part of the study, the following policy areas were assessed:

- Expansion of marine oil and gas activities and marine shipping.
- Industrial development activity in terrestrial ecosystems, with a focus on cumulative effects (North American Arctic)

These assessments are at a broad, scoping level and provide the groundwork for further studies to build on.

**Way forward**

**Policy context and objective**

Policy regimes in the Arctic are complex. They involve policies of eight diverse nations, many Indigenous Peoples, and sub-national governance. Policy regimes also involve cross-sectorial and cross-scalar policy and governance arrangements among diverse parties (e.g., co-management systems and impacts and benefits agreements). At the international level, relevant policies and regulations are rooted in bilateral, Arctic regional, and circumpolar agreements and institutions, as well as in commitments and regulations under global-scale multilateral agreements, notably those pertaining to Arctic Ocean areas beyond national jurisdiction. This means that there are many opportunities to introduce TEEB approaches into policies, but that care must be taken in identifying the types and levels of policy options that have the most potential for positive change.

At the circumpolar scale, the Arctic Council is the key forum for development of policy directions and for the development and dissemination of tools and methods for policy change. This is the primary policy context envisaged for a TEEB Arctic study and for studies that provide guidance for further refining TEEB methodology. National-level TEEB studies aim to develop specific, place-based policy options for consideration by decision-makers. Local or other grass roots efforts can develop, exemplify, and test policies that are relevant for TEEB. Critical needs and synergies for TEEB studies are linked to connecting policies across these scales. The TEEB Arctic study would provide vertical integration across these governance scales, as well as horizontal links, particularly among TEEB and ecosystem services initiatives in the eight Arctic countries.

The overall objective of this suite of options is to reduce the pressures and threats on Arctic ecosystems by mainstreaming the many and diverse values of biodiversity and ecosystem services into decision making. The way forward options presented below aim at providing rationale, recommendations, supporting information, tools and methods that enable and encourage incorporation of the values of ecosystem services into policy and practice.

**Mapping stakeholder engagement**

The scoping study includes an initial analysis of stakeholders for a TEEB Arctic study and initial analysis of their potential roles in and expectations for such a study. Categories of stakeholder groups identified are: the Arctic Council, national governments, indigenous organizations, NGOs, sub-national governance institutions, business, researchers, Traditional Knowledge holders, regional governance institutions, local communities, and non-Arctic nations with involvement in the Arctic. Stakeholders can be divided into knowledge holders and potential users of the results of the study – and most of the Arctic stakeholder groups are both. The analysis highlights the unique and central role of the Arctic Council in creating the basis for engagement and mutual understanding.
Key Finding 6.1. Engagement of Arctic Indigenous organizations and a broad range of stakeholders in participatory development of knowledge and policy alternatives is central to a successful TEEB Arctic study. Follow-up work to this scoping study should be structured so that those who wish to contribute can do so through a range of avenues.

Key Finding 6.2. Early policy-maker involvement is crucial for designing effective approaches to policy change. This includes policy-makers at international and national levels, and includes people working on policy not directly related to environmental management, such as trade, business and fiscal policy.

Options for the way forward

The presentation of this suite of options (Key Finding 7.1) is in two parts:

1. A TEEB Arctic study, or set of studies, based on two to five policy areas
2. A number of additional options, some of which address fundamental issues and challenges to the application of the TEEB approach in the Arctic context

Some options would be done in collaboration with and enhance ongoing Arctic Council initiatives. All options would complement the TEEB Arctic study. These options are aimed at increasing the visibility of the values of ecosystem services in policy through improving the knowledge base, raising awareness of the values of ecosystem services, and developing tools, guidance, methodologies and information products.
Scoping of policy areas: Examples of types of policies that could be assessed in a TEEB study

Policy Area 1: Expansion of marine oil and gas activities and marine shipping

1. Governance mechanisms that cross scales and address distributional impacts, bringing the interests and voice of local actors (Indigenous Peoples, coastal communities) to complex multilateral governance arrangements
2. Inclusion of multiple knowledge and value systems in policy making from local to international scales
3. Positioning of ecosystem services as priority, using the precautionary approach: first, securing Arctic biodiversity as the guiding principle (e.g. through marine spatial planning, ecosystem-based management, marine protected area networks) and, second, managing the opportunities of shipping and oil and gas development

Icebreaker. Photo: VikOl/Shutterstock.com
Policy Area 2: Development activity in terrestrial ecosystems, with a focus on mineral exploration and development, and cumulative effects (North American Arctic)

1. Making wider use of spatial planning and strategic environmental assessment approaches at the scale of ecologically meaningful regions, such as for caribou herd ranges
2. Incorporation of the full spectrum of ecosystem services into environmental impact assessment through guidelines, procedures, methodologies and regulations at all levels for all activities subject to EIA in the Arctic
3. Improvement of participatory processes
4. Ecosystem value accounting: Making use of financial policy instruments that capture the values of ecosystem services
**Methodology**

The TEEB methodology includes the use of policy scenario analysis to make the case for policy change. Within each policy context, a TEEB Arctic study would conduct valuation exercises on the change of ecosystem service provisioning, and the consequences for beneficiaries of ecosystem services, comparing alternative scenarios with a ‘business as usual’ scenario. This evaluation will provide evidence for policy-makers about the importance of Arctic ecosystems and biodiversity to local and global well-being. The aim is to support policy change that incorporates these values into decision making.

TEEB studies need input from a diversity of interests and disciplines. The approach can only work with active participation of, and consultation with, a broad range of experts and stakeholders. Institutional capacities and governance have to be taken into account to develop viable and realistic policy options. For the Arctic, with its multiple governance jurisdictions, this means that the relevant regions and scales of the policy areas being assessed are very important.

**Process and Governance**

The TEEB scoping study methodology includes development of a preliminary project governance structure, work plan, and resource mobilization and communications strategies. This planning, will need further refinement and scrutiny through the Arctic Council.

The study would be phased over a four-year period, from its approval to proceed to its presentation at an Arctic Ministerial Meeting. The bulk of the analytical work, however, would take place over a two-year time period (years 2 and 3). Initial time is needed for start-up, including resource mobilization and engagement of stakeholders. Time is also needed in the latter phase of the study to allow for adequate time to synthesize and discuss results with stakeholders, and to develop and review policy recommendations through the Arctic Council.
Part 2. Options for improving capacity to understand Arctic ecosystem services and their values, and to apply this knowledge to policy

These options are organized in categories, with examples of actions. The actions would be reviewed and refined through a collaborative process.

1. Guidance, methods, tools and information to support policy

1.1. Raise awareness of the roles and value of ecosystem services among Arctic communities with the aim of empowering communities, grass roots organizations and local administrations for better discussions/negotiations with sub-national/federal governments and corporations on policy related to Arctic development.

1.2. Through collaborative processes, raise awareness of the ways that Arctic Indigenous Peoples value nature. For example, facilitate discussions between Indigenous Peoples and economists, aimed at informing ways to accommodate indigenous values in economic policies and practices.

1.3. Make the role of natural capital and ecosystem services explicit in relation to adaptation and adaptive capacity. This is best done through bringing results from this scoping study into, and working in collaboration with, Arctic Council initiatives, for example, by
   a) considering adaptation options for policy makers that include the non-monetary and economic aspects of biodiversity, through the Adaptation Actions for a Changing Arctic (AACA); and
   b) creating resilience indicators that would encompass ecosystem processes (building on the human development indicators) through the Arctic Resilience Report.

1.4. Make visible (in economies) the wider value of Arctic biodiversity conservation and sustainable biodiversity use schemes, and identify financing opportunities for such schemes that are based on recognizing ecosystem services.

1.5. Apply economic analysis with the goal of
   a) accommodating the multiple value systems underpinning mixed and livelihood economies in the Arctic, such as reindeer herding and community economies based, or partly based, on subsistence hunting, fishing and gathering;
   b) capturing Arctic social and ecological resilience in economic information and valuation; and
   c) facilitating investment in the insurance value of Arctic natural capital.
2. Knowledge base

Adopting ecosystem-based approaches in policy and practice brings with it a set of knowledge needs. Some of these needs can be met with existing knowledge that is spread through the academic literature and through knowledge held by agencies and other places, often partially reported on in grey literature. Knowledge is also held within indigenous organizations and documentation of Arctic indigenous management schemes. Knowledge is rarely articulated as pertaining to ecosystem services, or as benefits of biodiversity and ecosystems to humans, or as relevant to ecosystem-services-based decision making.

Options for actions to address knowledge gaps related to Arctic ecosystem services:

2.1. Complete and maintain the Arctic Ecosystem Services Inventory. A draft ecosystem services inventory was prepared as part of the scoping study (see Ecosystem services section above). The inventory is a start on a structured and synthesized literature review of Arctic ecosystem services, the ecosystems they are derived from, their associated benefits, status, trends, threats, uncertainty, knowledge gaps, and what work has been done on valuation. To be a useful source of synthesized information, and a basis for further information tools, the inventory requires further work. The inventory could

   a) be a ready resource for information and overviews of available information on ecosystem services and what is known about them in relation to beneficiaries, threats, trends and valuation, both to raise awareness and to provide an entry point for policy-related assessment work;

   b) serve as a metadata center and service through CAFF’s Arctic Biodiversity Data Service; and

   c) provide input to research and monitoring plans and agendas, and potentially also to industry monitoring and research planning

2.2. Take steps to capture or present new research results in ways that make them useful to ecosystem-services-based policy development. This could be awareness raising through research meetings of the need to make this connection, increased expert networking, such as through a community of practice on ecosystem services, and/or through changes to funding mechanisms for research.

2.3. Clearly identify knowledge gaps (both at the broad underpinning and methodological scale, and for specific geographic scales) and develop mechanisms to bring them into discussion of research agendas.

2.4. Facilitate and coordinate monitoring of the social and economic importance of ecosystems (through the Circumpolar Biodiversity Monitoring Program).
3. Synthesis, analysis and information products

3.1. Analyze linkages over scale, time and actors that affect when, where and to whom the costs and benefits of industrial development in the Arctic on biodiversity and ecosystems occur, considering also current and future use and spatial subsidies, to demonstrate the value and help frame the distributive impacts of decisions.

3.2. Prepare ecosystem services inventories with regular status reporting. Include interdisciplinary valuation of ecosystem services at the level of LMEs and national scales, but also initiate a regular review and assessment process at the pan-Arctic scale. Review and assessment would be in collaboration with existing Arctic Council processes, including the framework for assessment of biodiversity status and trends established through the CBMP.

3.3. Develop indicators to help describe the status of Arctic biodiversity and ecosystems. Include indicators that convey the proximity to potential thresholds or tipping points and attach confidence metrics to all indicators reflecting the level of knowledge and understanding. Development of such indicators needs to be done through co-production of knowledge based on a collaboration of Traditional Knowledge holders and scientists. (Indicator development is underway through the Circumpolar Biodiversity Monitoring Program.)

3.4. Develop resilience indicators that make explicit the role of natural capital and ecosystem services in building of adaptive capacity. These would have similar use for policy making but be more encompassing of ecosystem processes than human development indicators.

3.5. Develop and test tools to evaluate Arctic ecosystem services in local and sub-national EBM, marine spatial planning, land-use planning and management, and in co-management schemes where they can directly contribute to co-producing knowledge and adaptive governance.
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