RESILIENCE AND MANAGEMENT OF ARCTIC WETLANDS

PHASE 2 REPORT

May 2021

ARCTIC COUNCIL

CAFF
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EXECUTIVE SUMMARY

Arctic wetlands store an enormous amount of global carbon, offer crucial support for global biodiversity, and provide important ecosystem services for indigenous and other communities. They also constitute considerable parts of the Earths remaining wilderness areas. Yet with rapidly warming temperatures and a dynamic human footprint these ecosystems are changing fundamentally, bringing both Arctic peoples and ecosystems closer to potential tipping points.

With urgency in mind, the May 2017 Arctic Council Ministerial meeting in Fairbanks, Alaska approved the project "Resilience and Management of Arctic Wetlands" (RMAW). Housed within the Arctic Council's biodiversity Working Group Conservation of Arctic Flora and Fauna (CAFF) and led by Sweden and Iceland, the project is charged with strengthening "knowledge on management needs in response to global change, including changes in climate and land use, and to identify where knowledge is currently lacking, but is needed for developing public policy and management strategies under conditions of rapid change" (https://caff.is/wetland). The overall project goal is to develop recommendations for measures that could help reduce degradation, restore previous damage, and improve management and stewardship of Arctic wetlands. To date, the project has delivered a review of scientific literature pertaining to Arctic wetlands (Seifollahi-Aghmiuni, Kalantari, et al., 2019), a report on indigenous uses of Arctic wetlands (Inga et al 2018), a Phase 1 report that also takes note of related research not identified in the scoping study (Land & Carson, 2019), a report on Indigenous involvement in wetlands management, including co-management (Buschman 2019), and two expert workshops. This report incorporates and expands upon the materials in those publications, including further review of a range of peer reviewed and grey literature to identify publications pertaining to restoration, management and stewardship of Arctic wetlands.

Much remains to be learned about Arctic wetlands, yet quite a lot is known about their structure, processes and functions. There is a wide range of published material addressed to or highly relevant to both the scientific and practical considerations related to restoration and management of wetlands in the Arctic. Similarly, the body of peer-reviewed publications that examine treaties, EU- or national laws regulating activities that impact Arctic wetlands is also plentiful, and is complimented with manuals and other applied materials published by governments, industry organizations and NGOs interested in wetlands and the Arctic. Despite the availability of an extensive body of information, wetlands in the Arctic and elsewhere continue to be degraded and lost more rapidly than forests. These losses carry potentially dire consequences for benefits

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to people, including loss of direct water-based ecosystem services, continued decline of biodiversity, and positive climate feedbacks through carbon emissions caused by wetlands drying and degradation, especially peatlands.

This report offers the following conclusions and highlights important knowledge gaps that if addressed, could contribute to implementation of policies, engagement of publics and indigenous communities, and greater resilience of Arctic wetlands.

- Little to no systematic analysis has been carried out regarding the influence of societal interests' policy and advocacy networks of development and implementation of Arctic wetlands policy, restoration efforts, and management.

> Arctic wetlands store an enormous amount of global carbon, offer crucial support for global biodiversity, and provide important ecosystem services for indigenous and other communities

KEY MESSAGES

- Research findings make it clear that restoration of damaged or compromised Arctic wetlands ecosystems offers substantial benefits across multiple areas of interest – water-centric ecosystem services, biodiversity, and increasingly over the past decade, climate mitigation.

- Comprehensive information on Arctic wetlands ecosystems is currently lacking but needed to adequately identify the location and type of wetlands with high levels of accuracy. Recent developments in the use of geospatial data and artificial intelligence provide the basis for substantial improvements in mapping of the extent and condition of Arctic wetlands, opening up valuable opportunities for pan-Arctic collaboration to improve wetlands inventories and keep them up-to-date.

- A considerable and broad experience with wetlands restoration and conservation dates back many decades. Expressed in an extensive body of publications by government agencies, practitioners' organizations, trade organizations and consultancies, NGOs and scientists, a significant portion of this literature is Arctic-specific or Arctic relevant.

- The key obstacles to scaling up and expanding wetlands restoration and management efforts in the Arctic are not due to a lack of knowledge about wetlands ecosystems processes and functions, or steps that can be taken to improve their status. Policy design and difficulties with implementation appear often to be obstacles, however, and accurate, up-to-date mapping is needed to target policy initiatives.

- The ways in which public opinion influences the development and implementation of wetlands restoration and stewardship in the Arctic are important, but largely unresearched.

- There is relatively little comparative analysis of national-level policies that impact Arctic wetlands.

- While policy pertaining to Arctic wetlands is expansive, preliminary evidence points to three key challenges for effective policy:

  - inconsistency and/or conflict between policies and goals addressed to different aspects of wetlands,

  - the distribution of responsibility for policy implementation into agencies and departments with differing, sometimes contrasting missions,

  - difficulties with good communications between responsible agencies and departments.

- Participation by indigenous and local communities in decision making, restoration and stewardship of Arctic wetlands is widely considered to be a crucial ingredient for success.

1. INTRODUCTION: ARCTIC WETLANDS IN A GLOBAL CONTEXT

> Wetlands are more than a peculiar landscape form. Indeed, the World Conservation Strategy has identified wetlands as one of the key life support systems on the planet, in concert with agricultural lands and forests. Their importance goes beyond their status as the habitat of many endangered plant and animal species. They are a vital element of national and global ecosystems and economies.
>
> **(Government of Canada, 1991).**

> Wetlands provide us with water, they protect us from floods, droughts and other disasters, they provide food and livelihoods to millions of people, they support rich biodiversity, and they store more carbon than any other ecosystem. Yet, the value of wetland remains largely unrecognized by policy and decision makers
>
> **(The Ramsar Convention on Wetlands 2018).**

Warning signals from recent international environmental reports are prompting countries and non-governmental organizations around the globe to search for ways to reorganize human activities, mitigate their ecological impacts, and reduce subsequent harmful consequences for human well-being. Among the most worrisome of the reports, the 2018 IPCC 1.5 degree report signalled a new level of urgency in the need to effectively tackle climate change (IPCC, 2018). The 2018 IPBES[1] Global Assessment on Land Degradation and Restoration found that "an urgent step change in effort is needed to prevent irreversible land degradation and accelerate the implementation of restoration measures," emphasizing land use as one of the important drivers of ecosystem degradation (IPBES, 2018). In the spring of 2019, the UN issued a report detailing an unprecedented level of risk for biodiversity loss, with nearly a million species facing potential extinction (UN 2019). The September 2020 UN Summit on Biodiversity emphasized the urgency, signalling a need to step up global efforts.

These warnings add dramatic emphasis to events already being experienced, including heatwaves, drought and heavy precipitation that leave communities bone dry or inundated with water following storms or rapid snowmelt. These developments, including both climate change and biodiversity loss, are linked to the deterioration of wetlands. Wetlands' importance as

Photo: Gustaf Hugelius

1. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

one of the planet's "key life support systems" and "a vital element of national and global ecosystems and economies" was understood 30 years ago. Yet, despite expanded conservation efforts, wetlands ecosystems continue to disappear. An estimated 87% of the global wetland resource has been lost since 1700 (Ramsar, 2018a). Wetlands disappear, at a rate three times faster than forests, therefore also wetland-dependent species are in serious decline (Ramsar, 2018a).

It is widely understood that wetland changes are both more extensive and rapid in the Arctic, and that the breadth and speed of change threatens to propel both Arctic communities and ecosystems beyond tipping points (Box et al., 2019; Carson & Peterson, 2016). The acceleration of permafrost thaw is turning Arctic ecosystems into a new net carbon source, contributing to an important feedback driving climate change, while record low sea ice contributes to increased coastal erosion, creating difficulties for indigenous mobility and securing of food (Meredith & Sommerkorn, 2019; Richter-Menge et al., 2019). In instances of permafrost thaw or loss of traditional livelihoods, these changes will be largely irreversible once critical thresholds are passed. And while some of these changes will be felt most acutely by local communities, systemic feedbacks connected with changes such as loss of albedo or accelerated carbon emissions carry global implications. With Arctic change propelled largely by drivers originating outside the Arctic, this makes for a complex – and daunting – set of challenges.

1.1 WETLANDS: CRUCIAL ECOSYSTEMS, LONG MISUNDERSTOOD

In spite of the insights highlighted above, many publications over the past three decades note how wetlands have previously – and until quite recently – been misunderstood, underappreciated, and often seen as wastelands – or even hazardous (for a sample, see: (Matthews, 1993). Yet while the importance of wetlands ecosystems has become increasingly well-understood over the decades since the 1960s, popular misconceptions persist. Moreover, efforts to balance conservation and wise use are falling short, with roughly two-thirds of the world's wetlands loss occurring between 1970-2015 and annual rates of loss even accelerating after 2000 (Ramsar, 2018a). Curiously, the area covered by restored wetlands has grown, suggesting that despite the difficulties entailed in balancing conservation and use of natural wetlands for an overall sustainable trajectory, there is enough appreciation of wetlands' importance to seek to restore wetlands. However, on a global scale the area restored thus far remains rather limited

1.2 WHY ARE ARCTIC WETLANDS IMPORTANT?

Nearly half the world's wetlands are located in the Arctic, where they make up as much as 60% of all Arctic ecosystems. While large expanses lie frozen during parts of the year, Arctic wetlands include a complex mix of peatlands, shallow open waters, wet tundra's and seashore areas (Land & Carson, 2019).

Wetlands are a socially and ecologically crucial Arctic ecosystem (CAFF , 2012; Nakashima & Unesco, 2009). At the local scale, they provide tangible ecosystem services, including buffering and storing heavy precipitation and snowmelt and filtration of drinking water. They also provide vital habitat, especially nesting and breeding areas for migratory bird species and spawning areas for fish, thereby supporting biodiversity (Barry et al., 2013; Barthelmes et al., 2015). Wetlands ecosystems support traditional livelihoods including reindeer husbandry, hunting and fishing, as well as other cultural and recreational activities, and tourism (Land & Carson, 2019; MEA, 2005).

The far less tangible reality is that intact wetlands, and peatlands in particular, store a stunning amount of global carbon. While they make up only about 3% of the Earth's land area, wetlands store an estimated 20% or more of its terrestrial carbon (Scharlemann et al., 2014) – more than is stored in forests. Arctic wetlands represent the largest regional store of carbon on the planet, as highlighted in Figure 1 below (Scharlemann et al., 2014). Yet, these wetlands are being degraded by the impacts of climate change and by more direct human activities involving transport, resource extraction and agriculture (Seifollahi-Aghmiuni, et al., 2019).[2] In addition, wetlands, specifically peatlands, help protect against permafrost thaw, another important source of increased carbon emissions (Crump, 2017). Overall, there are few areas where ecosystem stewardship[3] – restoration, conservation and wise use under changing conditions – can address so many critical issues at once

2. A table summarizing activities that disturb and/or degrade wetlands is included in section 3 below (see table 3.1, Votteler & Muir 2002).
3. We use the term "stewardship" to capture management (conservation and wise use) and caring dimensions. See (F. S. I. Chapin et al., 2010)

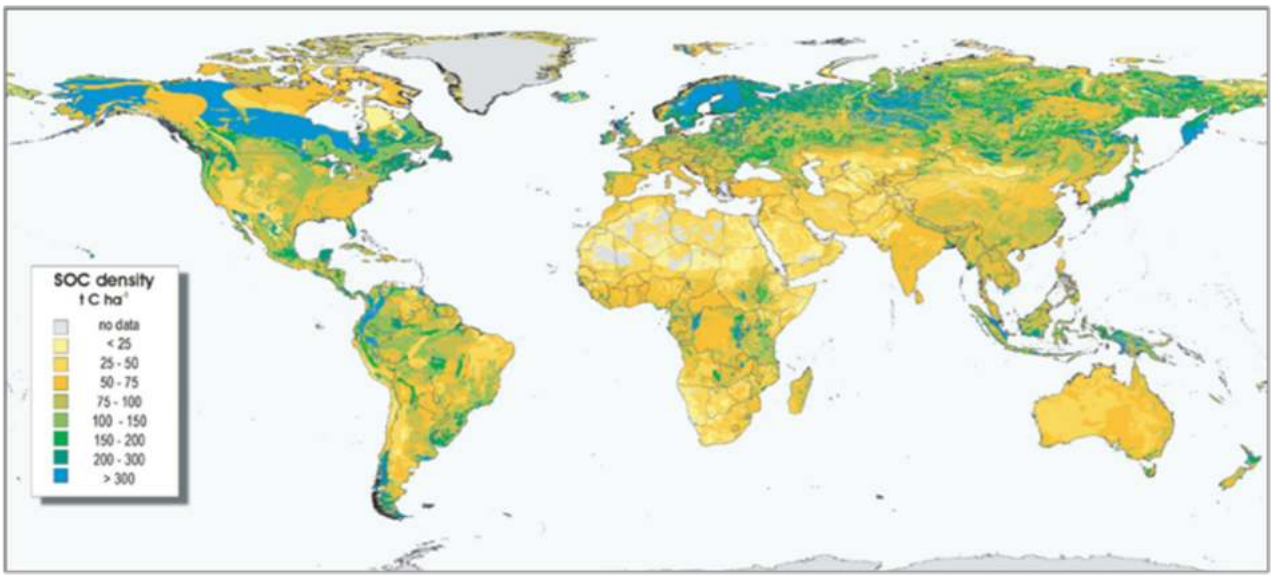

Figure 1: terrestrial carbon storage (source: Scharlemann et al., 2014)

2. PROJECT OVERVIEW

With these factors in mind, the May 2017 Arctic Council Ministerial meeting in Fairbanks, Alaska approved the project "Resilience and Management of Arctic Wetlands" (RMAW). Housed within the Arctic Council's biodiversity Working Group Conservation of Arctic Flora and Fauna (CAFF) and led by Sweden and Iceland, the project is charged with strengthening "knowledge on management needs in response to global change, including changes in climate and land use, and to identify where knowledge is currently lacking, but is needed for developing public policy[4] and management strategies under conditions of rapid change" (https://caff.is/wetland). The overall project goal is to develop actionable recommendations for measures that could help reduce degradation, restore previous damage, and improve management and stewardship of Arctic wetlands.

Work began with a review of current scientific knowledge regarding Arctic wetlands and identification of knowledge gaps and research needs concerning sustainable development policies (2019). To date, this includes a review of scientific literature pertaining to Arctic wetlands (Seifollahi-Aghmiuni, Kalantari, et al., 2019), a report on indigenous uses of Arctic wetlands (Inga et al 2018), a Phase 1 report that also takes note of related research not identified in the scoping study (Land & Carson, 2019), a report on Indigenous involvement in wetlands management, including co-management (Buschman 2019), and two expert workshops. This report incorporates and expands upon the materials in those publications.

Using the analytical lens of the Social-Ecological Systems (SES) perspective, knowledge gaps identified in the Phase 1 scoping study were analysed further. The literature review was expanded through identifying existing relevant knowledge not picked up in the initial review (in part because it was either not explicitly labelled wetlands or was not specified as Arctic). Among other things, the Phase 1 report identifies indirect and direct human activities that result in wetlands degradation. Using the SES perspective, this report helps direct attention to areas likely to constitute important policy-relevant gaps. In particular, this report addresses three key questions: 1) restoration and management – to what extent are restoration initiatives and management strategies used to restore and conserve Arctic wetlands being documented, and are they widely shared?; 2) wetlands-relevant policy – what kinds of policies are Arctic states currently mobilizing to pursue wetlands protection and resilience, and how are they organized?; and 3) limiting factors - what specific types of knowledge gaps or missing linkages constitute limiting factors or obstacles to accelerating and scaling up the kind of extensive and vigorous efforts to restore and protect Arctic wetlands ecosystems that appear to have widespread support? Of these gaps, which factors warrant strategic effort on the part of research, policy, and practice communities?

4. Public policy can be defined as any action guided or carried out by governments. A more in-depth discussion of what is meant by "public policy" is included in section 4.

2.1 SOCIAL ECOLOGICAL SYSTEMS (SES) APPROACH

Our analysis of issues relevant to Arctic wetlands is grounded in the SES framework often used with work on resilience (Binder et al., 2013; Chaffin & Gunderson, 2016). The SES model (Binder et al. 2013; B. Walker et al. 2002; Berkes, Colding, and Folke 2002) provides a holistic perspective for examining Arctic wetlands ecosystems, the nature of their importance, and what actions people can or should take in the interest of protecting the ecosystem services people enjoy from healthy, functioning wetlands in the Arctic and elsewhere. An SES perspective highlights the interdependencies of the coupled human and natural systems (Figure 2). Change in both social and ecological systems is influenced by mitigating or amplifying feedbacks within and between these systems. Change is often uneven, with periods of relative stability punctuated by sudden change and shifts past tipping points, beyond which recovery to the earlier state is unlikely in the near term (Liu et al. 2007).

The description of "human and natural systems" as coupled is an analytical distinction; humans are an indivisible part of the natural system. However, two key differences between the social and ecological parts of the system have important consequences. First, human survival is utterly dependent on the benefits provided by ecosystems. Those ecosystem services (depicted in the bottom centre of figure 2) are important because they provide food, water, shelter, and other resources that constitute our life support system. Human activities involved in utilizing these benefits have both deliberate and unintentional impacts on those very services. The second difference is that while ecosystems are steered by physical and biological processes, human activities are steered by individual and collective choices, although within natural constraints) (depicted on the left of the diagram). On a collective or societal level, we speak of these choices in terms of public policy. In this particular instance, we are concerned with the diverse policies of the Arctic states that have a material impact on use and conservation of wetlands. Better understanding the ways in which human activities are steered, and which in turn impact the health of those ecosystems (upper middle), is key to managing ourselves within the boundaries of ecosystems' carrying capacities (Ostrom, 1990; Ostrom et al., 1999).

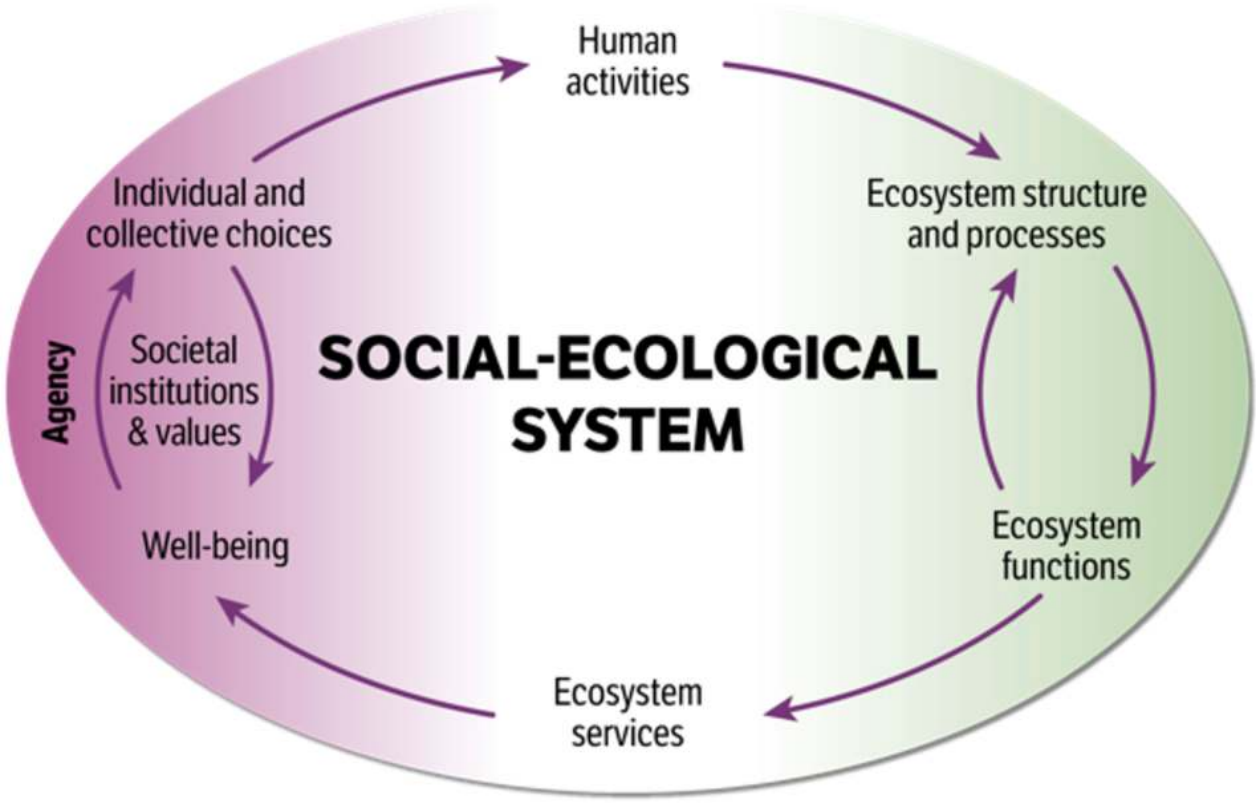

Figure 2: social-ecological system model (source: ARR 2016)

2.2 STRUCTURE OF THIS REPORT

Many scientists and policymakers note that current knowledge of wetlands ecosystems is sufficient to support raising the priority level of Arctic wetlands restoration and conservation, and ensuring that wetlands use is sustainable at local, regional and global scales. Yet, better knowledge is needed about which specific types, and locations, of wetlands should be prioritized for restoration and protection in order to maximize ecosystem services benefits. In addition, a more comprehensive understanding of how Arctic states apply knowledge to regulate human activities that impact wetlands could help guide the organization of conservation and restoration efforts, the challenges being encountered, and what kinds of improvements are being pursued. This report focuses on that space, with an eye toward sharing effective practices and identified pitfalls, and toward sharing the best insights available from individual Arctic states for their mutual benefit.

Section 3 provides a brief overview of characteristics of Arctic wetlands ecosystems that are especially relevant for this report and identifies specific kinds of activities that contribute to disturbing and degrading these ecosystems. The published scientific and grey literature on these questions are both quite well developed. This section therefore limits itself to questions related to actions that can be taken to manage activities in support of long-term sustainability and resilience.

Section 4 examines the ways human activities are steered that culminate in disturbance, management or restoration of wetlands. Because societies' ways of orienting to and acting related to wetlands have evolved over time, we take a brief tour through that change process through the lens of the Icelandic experience, which represents a sort of ideal-type case example.

From there, Section 4 examines management strategies currently in practice as well as types of initiatives for restoring wetlands ecosystems. It then examines how human activities that impact wetlands are guided and steered through governments' public policy decisions about which ecosystems services should be prioritized, over what time horizons, who should participate in decisions and their implementation, and how different types of priorities should be balanced against one another. Finally, section 4 concludes with a discussion of approaches to participation in wetlands management and related decision-making regarding priorities and compromises. Throughout Section 4, the overall narrative is provided through a sampling of the scientific and grey literature on each of these topics. Illustrative examples from the Arctic states are included both for concreteness and to provide opportunities for comparison and learning across national boundaries.

Section 5 discusses several important types of knowledge gaps. These gaps constitute challenges to achieving the kind of ambitious engagement for which there appears to be a general consensus among Arctic states (Arctic Council, 2019) – for conserving Arctic wetlands, restoring damaged or degraded wetlands[5], building resilience, and managing for the long term. These include four key areas: 1) how wetlands are understood by local and broader populations within Arctic states, as well as policymakers' perspectives; 2) the engagement of civil society organizations in issues of Arctic wetlands, including the kinds of ideal and material interests they may pursue and how they interact with other societal actors; 3) an overview of institutional issues that emerge in a complex, social and regulatory environment that spans both geographic and temporal scales, and what kinds of analysis might help unlock capacity for achieving ambitious goals, and 4) the organization of new tools for near real-time evaluation and assessment of wetlands' status, as well as comparability across the arctic.

Section 6 concludes this report by revisiting overall project goals and identifying how the knowledge and insights summarized through the body of this Phase 2 report can be synthesized in ways that support delivery of overall project goals.

5 Wetlands restoration is part of a broader agenda of ecosystem restoration, as noted in Section 4.4.1, under the Convention for Biological Diversity (DBD), see https://www.cbd.int/sp/targets/rationale/target-15/.

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3. DEGRADATION OF ARCTIC WETLANDS ECOSYSTEMS: HUMAN CAUSES

Decades of study reveal a great deal about wetlands structure, processes and functions (represented on the right-hand side of Figure 2). This knowledge is reflected in extensive scientific and grey literature. Science regarding wetlands-based ecosystem services has developed substantially over the past several decades, covering topics that ranging from water-related benefits to biodiversity and climate regulation. The Phase 1 systematic review (Seifollahi-Aghmiuni, Nockrach, et al., 2019) identified gaps pertaining to the top middle area of the SES diagram – human activities that impact wetlands ecosystems – and the left side of the diagram, where those activities are negotiated, decided upon and steered. In short, some of the most crucial knowledge gaps pertain to how Arctic wetlands-relevant public policy is organized and carried out.

Human activities and wetlands impact, research specifies a variety of actions or activities that disturb and/or degrade wetlands ecosystems – whether directly or indirectly, knowingly or unintentionally. Summarized by Votteler and Muir (2002) in table 3.1, these actions are categorized as physical, chemical and biological, and climate change-related actions. Damaging activities often take place in a public policy context that permits them, and in some instances, places higher priority and value on short-term benefits than it does the longer-term consequences. In the Arctic, some of the most common activities that have caused damage include ditching and draining, construction of infrastructure, transport, and activities that contribute to climate change.

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Table 3.1. Actions that alter wetlands (adapted from Votteler and Muir 2002)		
physical	Filling	adding any material to raise the bottom level of a wetland or to replace the wetland with dry land
	Draining	removing water from a wetland by ditching, tiling, pumping, etc.
	Excavating	dredging and removing soil and vegetation from a wetland
	Diverting water away	preventing the flow of water into a wetland by removing water upstream, lowering lake levels, or lowering ground-water tables
	Clearing	removing vegetation by burning, digging, application of herbicide, scraping, mowing, or otherwise cutting
	Flooding	raising water levels, either behind dams, by pumping, or otherwise channelling water into a wetland
	Diverting or withholding sediment	trapping sediment by constructing dams, channels, or other types of projects, thereby inhibiting wetland regeneration in natural deposition areas such as deltas
	Shading	placing pile-supported platforms or bridges over wetlands, causing vegetation to die because of a lack of adequate sunlight
	Conducting activities in adjacent areas	disrupting the interactions between wetlands and adjacent land areas, or incidentally affecting wetlands through activities at adjoining sites
chemical	Changing nutrient levels	increasing or decreasing nutrient levels within the local water and or soil, system, forcing wetland plant community changes
	Introducing toxins	adding toxic compounds to a wetland either intentionally (for example, herbicide treatment to reduce vegetation) or unintentionally, adversely affecting wetland plants and animals
biological	Grazing	Consumption and compacting of vegetation by domestic or wild animals
	Disrupting natural populations	reducing populations of existing species, introducing exotic/invasive species, or otherwise disturbing resident organisms
climatic	Physical deposit of atmospheric particulates	Changing chemical or physical properties of surface, impacting plant growth or absorption of solar radiation
	Increases in average seasonal temperatures	Increases in rates of evaporative loss, reduction in surface water volume and surface area of lakes, rivers and streams, permafrost thaw[6] (especially important in the Arctic)
	Changes in precipitation patterns	Changes in surface water, volume and surface area of lakes, rivers and streams, drying of wet areas, permafrost thaw
	Reductions in snowpack or glacier extent	Can reduce volume of water that flows into waterways, groundwater, and replenishment of wet areas

Some human activities, such as the kinds listed above, contribute to wetlands degradation. Other activities are explicitly intended to restore, manage, conserve and otherwise exercise good stewardship over Arctic wetlands. As restorative actions often are not encouraged by market incentives, they require collective decisions and resource input. This is in part because "many of the goods and services wetlands provide have little or no market value. Because of this, the benefits produced primarily go the general public. Therefore, the government provides incentives and regulates and manages wetland resources to protect the resources from degradation and destruction" (Votteler & Muir, 2002, p. 1).

6 Permafrost thaw is especially important in the Arctic due to its release of additional greenhouse gases and its subsequent role in reinforcing a positive feedback loop (WEF, 2020). Higher seasonal temperatures also degrade palsa mires.

4. ARCTIC WETLANDS STEWARDSHIP: ACTIONS AIMED AT RESTORING, MANAGING & PROTECTING ARCTIC WETLANDS UNDER CONDITIONS OF RAPID CHANGE

In this section we emphasize what can be described as the public policy aspects of managing activities that impact wetlands ecosystems. In the framework of the SES diagram (Figure 1), it focuses on ways in which "agency" is steered by governmental decisions at community, member state, and international scales of the social-ecological system. This steering typically entails balancing multiple goals and diverse interests, which in turn requires multiple types of expert knowledge. The environment in which these activities are carried out is defined by the broader context of wetlands-related public policy in each Arctic state.

4.1 DEGRADATION OF ARCTIC WETLANDS AS A PUBLIC POLICY PROBLEM

We use the term "public policy" to describe deliberate actions that are guided or carried out by governments. In its simplest form, public policy is "anything a government chooses to do or not to do" (Dye, 1972, p. 2). A more fine-tuned definition takes public policy "as a system of laws, regulatory measures, courses of action, and funding priorities concerning a given topic promulgated by a governmental entity or its representatives" (Kilpatrick, 2000). As such, public policy reflects a set of decisions by government officials to acknowledge a problem and do something about it – or to do nothing (Howlett & Cashore, 2014). That "something" might include the commissioning of further studies to improve knowledge of the problem, its causes and consequences; a gathering together of experts to develop proposals for taking action; initiating pilot projects aimed at testing approaches to addressing the problem, or a full-blown public program aimed at mitigating or alleviating the problem and/or its causes.

The widely acknowledged degradation of Arctic wetlands ecosystems and the subsequent negative effects on a variety of values and important benefits derived from wetlands is a public policy issue. As outlined in Table 3.1, some human-caused degradation is the result of intentional physical actions such as ditching and draining to make areas amenable to other uses. In other instances, physical degradation may be a side effect of activities such as heavy equipment use in pursuit of goals. Damage and degradation can also result from activities that produce chemical pollution, or biological impacts of activities such as heavy grazing. Finally, degradation can result from distant activities that indirectly disturb the hydrology or temperature range of ecosystems through forces such as acid rain, climate change, or other regional or global phenomena. From a policy perspective, these varying sources of impacts represent different types of policy problems. They in turn, require different types of public policy responses and corrective actions. Actions causing degradation can also lie outside of or transcend national boundaries and therefore lie beyond the reach of national-level policies.[7]

Arctic wetlands are a subject of public policy as a result of acknowledgement of the potential for human activities to either to disturb and/or degrade wetlands, or to conserve, restore and manage them. These activities carry subsequent changes in the short and long-term benefits available to local communities and societies at large. The desire to steer human activities to produce benefits for local communities and for societies provides the motivation to develop policy, while the complexity of balancing diverse goals can be seen as a common challenge. Perceptions of the kind of policy question wetlands represent have evolved over time, as noted earlier in this report. Wetlands use in each of the Arctic states has its particular historical trajectory, anchored in different social and political histories, and mixes of natural resources. And while the evolution of thinking has moved broadly toward understanding the important role played by healthy wetlands, perceptions remain quite different for diverse kinds of constituencies.

7 It is also useful to emphasize that governments are not regulating nature, but human activities that impact a particular type of Arctic wetland ecosystem. Examples of kinds of activities that are regulated are listed in Table 4.5.1 below.

This evolution of the Icelandic orientation to wetlands, and consequently, Iceland's public policy orientation, is instructive for several reasons. First, it reflects the fundamental shift in thinking about wetlands, reflecting the better understanding about wetlands' ecological significance and their importance to people. This change in understanding emerged initially from people observing harmful impacts to bird species or other wildlife, and also from scientific observation of harms to other ecosystem services. Improved understanding helped establish degraded wetlands as a problem warranting governmental intervention. This led policymakers to support further scientific investigation and engage scientists and managers in considering options for addressing the problem. Second, recognition of harms to wildlife from farming practices and in Iceland helped re-align societal interests, opening the way for restoration of lands previously farmed or drained for agriculture. Most recently, the emerging understanding of wetlands' role in climate regulation and the ways restoration can help Iceland address its mitigation targets has added an important incentive. In all these changes, it is important to note that transformation has unfolded over decades – a process quite typical of major policy shifts that are not driven by urgent crisis (Carson, 2004; Hall, 1993; P.A. Sabatier, 1999; Paul A. Sabatier & Weible, 2014).

BOX 4.1.1.1: THE EVOLUTION OF WETLANDS POLICY: AN ICELANDIC EXAMPLE

Fig. 4.1. Almenningur in upper Southern lowlands, one of the few remaining fen areas not affected by draining. Photo: Sigmar Metúsalemsson

Iceland has extensive wetland areas (mires and peatlands) with a total extent of about 9.000 km2 or 9% of the island´s total area. Two thirds of the wetlands are in lowland areas below 300 m a.s.l. Due to the basaltic bedrock, high volcanic activity and aeoloian deposition the wetland soils are rich in mineral content and their pH is high (Arnalds et al. 2016). The wetlands are therefore dominantly relatively fertile graminoid fens, rich in sedges and brown mosses (Fig. 1). True bogs with Sphagnum-moss dominance are seldom found. Fifteen different habitat types have recently been described within Icelandic wetlands (Magnússon et al. 2016), with some of the rarest ones being highland palsa mires and aapa mires (Fig. 2).

Through the centuries, some of the most important uses of wetlands were grazing of livestock, haymaking, and extraction of peat for fuel and construction of buildings. Extensive draining of wetlands in Iceland did not occur until the mid-twentieth century, incentivized by governmental subsidies to farmers and municipalities. The draining activities peaked around 1970. From 1951 to the present day, over 34.000 km of drainage ditches were cut in the wetlands and additional 60.000 km of shallower closed drains were ploughed in the drained areas. It is estimated that 4.200 km2 of wetlands were disturbed by the draining, most of them being in the lowlands where very few wetlands now remain in their natural state. Some 15% of the drained areas were turned into hayfields, but the remaining area mainly used as improved grazing areas for livestock (Fig. 3). Most of these grazing areas remain moist, in spite of the draining, maintain some wetland flora and support a diverse and rich plant and bird life. Afforestation is increasing in Iceland and some of it is on drained fens (Fig. 4).

Fig. 4.2. Lauffellsmýrar, extensive aapa-mires in Southern highlands. Photo: Sigmar Metúsalemsson.

Initiation of wetland restoration – Fuglavernd/BirdLife Iceland

Over the past several decades, agricultural practices in Iceland have changed, with farming declining in remote parts of the country. Considerable portions of drained areas have fallen out of use or farming is not dependent on them. This has opened up opportunities for restoration of wetlands. In 1995 Fuglavernd/ BirdLife Iceland made a request to the Ministry of Agriculture and Environment to initiate and support efforts to restore some drained wetlands. This led to the appointment of a Wetland Restoration Committee, which operated between 1996 – 2006 (Garðarsson et al. 2006). . The committee started its first restoration project in 1996, and by 2006, fifteen sites in different parts of the country had been restored to at least some degree. At many sites the focus was on restoration of small ponds and lakes to facilitate return of waterfowl, while some drainage ditches were filled in or blocked to rewet fen areas (Fig. 5). Research and monitoring were initiated to ascertain what effects the efforts were having on water table, vegetation, green-house gas emissions and birdlife (Óskarsson 1998, Magnússon 1998, Auhage, Guðmundsson & Skarphéðinsson 2012, Sigurbjörnsdóttir 2018). The committee provided a report summarizing the work accomplished and providing recommendations and advice on further restoration Although restored areas were relatively small, they attention to the importance of wetlands and their restoration in Iceland, an important first step.

Towards no net loss of wetlands - EIA

Following the implementation of the Environmental Impact Assessment Act (EIA) and the Strategic Environmental Assessment Act (SEA) in Iceland disturbance or destruction of natural habitats, including wetlands, due to new developments and constructions, had to be compensated for if possible. This led to increased participation and support from operators in wetland restoration, led by The Icelandic Road and Coastal Administration (IRCA). If a new road was to cut through a natural wetland a restoration of at least equal areas of nearby disturbed wetland had to be carried out. This was in accordance with international treaties on the conservation of biodiversity and wetlands in particular, e.g. the Ramsar convention. Several wetland restoration projects in Iceland have been carried out and funded by IRCA in cooperation with wetland specialists at the Agricultural University of Iceland. This has mainly been done by filling in or blocking ditches of drained fens.

Wetland restoration to reduce green-house gas emissions

With ever rising levels of atmospheric CO2 concentration and gradual global warming the focus on wetlands and their role in the carbon-cycle has increased. Wetland restoration has been shown to be an effective way of reducing greenhouse gas emissions and a significant contribution in countries with extensive drained peatlands. In 2006 wetlands were included in the IPCC guidelines for classification of broad land-use categories and peatland restoration was accepted as a valid means to combat greenhouse gas emissions. In Iceland research has shown that the relatively extensive drained peatlands in a sparsely populated country were emitting about two-thirds of all anthropogenic greenhouse gases (Guðmundsson & Óskarsson 2005). In 2010 a new climatic action plan (Government of Iceland 2010) was proposed by the Icelandic Government. Although wetland restoration was included in the list of actions to be taken, no funding was allocated. In 2019, a new plan action plan (Government of Iceland 2019) was made where wetland restoration was listed again. In the meantime, an expert group was established in 2014 by the Ministry for the Environment and Resources to make recommendations on wetland restoration policy, including which institution should be responsible for overseeing restoration. In accordance with the group´s recommendations the Soil Conservation Service of Iceland (SCSI) was given the task of leading wetland restoration in the country. The SCSI set aside funds for wetland restoration projects, appointed specialists

Fig. 4.3. Old fen area in Southern lowlands with extensive drainage. The fens have been turned into hayfields, improved pastures and reforestation plantations. Photo: Sigmar Metúsalemsson.

Fig. 4.4 Afforestation on a drained peatland in Southern Iceland. Photo: Sigmar Metúsalemsson.

to work on them, to advise landowners and monitor changes in restored areas. With these concrete steps, wetland restoration was finally acknowledged and gained a foothold within governmental institutions. The system is such that landowners send in applications to the SCSI which then surveys the land to see if wetland restoration is feasible. If so, advice and financial support is provided to start restoration. During 2019, wetlands restoration was initiated at an additional 15 sites, bringing the total number of sites under restoration to about 50.

What has been learned and/or accomplished?

- Wetland restoration started off slowly in Iceland, gaining momentum over the last 20 years
- In the first years the main focus was on restoration of wetland bird habitats but in the last 10 years reduction of GHG emissions from drained peatlands has been given greater attention
- At about 50 sites throughout the country, restoration has been started or is in the planning stages
- It is estimated that about 10 km^2 of wetlands (ponds, lakes and fens) have been restored, in contrast with 4.200 km^2 of wetlands that were disturbed by draining.
- The SCSI has wetland restoration on their list of responsibilities and employs specialists.
- A Wetland fund was established to secure private funds for wetland restoration to combat climate change.
- A new governmental action plan put forward in 2019 aims for a 10-fold increase in wetland restoration in Iceland from between 2019-2022.

Fig. 4.5. Dagmálatjörn, a restored wetland in Southern Iceland. Photo: Borgþór Magnússon

4.2 WETLANDS RESTORATION

The level of degradation of wetlands ecosystems and subsequent unwanted consequences in the Arctic and elsewhere, have led to investments in repairing damage where feasible. There are a substantial number of publications and even a UN Decade on Ecosystem Restoration 2021-2030 (UNEP/FAO, 2020). This body of published work includes both scientific studies and guidance publications by NGO's, commercial actors and governments. For example, commercial actors such as the Canadian Sphagnum Peat Moss Association (Quinty & Rochefort, 2003) have published handbooks for wetlands restoration, as has the NGO International Mire Conservation Group (IMCG) (Schumann & Joosten, 2008).

A substantial number of publications has also been developed by governmental bodies and agencies. For example, extensive guidance on restoration is provided by U.S. Government departments responsible for wetlands issues, including the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS, 2008; US EPA, 2015a). Publications linked from these websites provide scientific insights, sometimes highly technical guidance, and draw on the diverse range of knowledge required to assess and restore wetlands ecosystems, such as "Hydrology Tools for Wetland Determination" (NRCS, 1997) "Wetland Restoration, Enhancement, or Creation (NRCS, 2008). These documents also provide a selection of easily accessible guidance for developing policy on wetlands restoration and protection with topics such as "Principles of Restoration" and "Incorporating Restoration into Planning Documents" (US EPA, 2015a). Highlighting the results achieved with restoration efforts, a "best practices" compilation for wetlands restoration in Finland (Similä, Aapala & Penttinen, 2014) provides practical insights, an overview of the EU-funded Swedish wetlands restoration project "Life to Ad(d)Mire" (Tenning, 2014) summarizes positive project results, and the International Union for the Conservation of Nature (IUCN) takes a global perspective to report on the positive outcomes of a wide range of restoration efforts, many of which have implications for efforts in the Arctic (Cris et al., 2014).

A Nordic Council of Ministers 2012 report examines the broader issue of restoring damaged ecosystems in a region that spans the Arctic and sub-Arctic (Halldorsson, 2012). This report includes chapters pertaining specifically to wetlands restoration in the Nordic countries, which have in many instances been intentionally ditched and drained for agriculture, forestry or similar purposes. Subsequent reports published by the Nordic Council of Ministers include a report on Nordic peatlands, (Barthelmes et al., 2015) and a follow-up report with recommendations for action (Joosten, 2015) – both of which emphasize the climate mitigation potential of restoration and management of Arctic peatlands. We return to the Joosten (2015) and other recommendations in the conclusions of this report.

Photo: Wang LiQiang, Shutterstock.com

BOX 4.2.1.1 POIKKIMAANAAPA, TERVOLA SMALL-SCALE RESTORATION IN NORTHERN FINLAND

Poikkimaanaapa is an example of a small-scale ecological restoration in Northern Finland. The site was identified when an experienced field worker noticed an extraordinary thick bunch of common reed (Phragmites australis) and common juniper (Juniperus communis) growing next to a forest road. After having taken a closer look at the vegetation, she discovered a spring – more precisely, a petrifying spring with tufa formation (Cratoneurion), which is an EU Habitats Directive Annex I habitat type.

Unfortunately, the spring was located next to a peat mining area alongside a deep ditch. One could already see that the area surrounding the spring was drying because of the ditch. Hence, to conserve the spring and the valuable vegetation it maintained, the ditch would have to be filled.

A rare type of habitat:

The spring itself is a rare habitat type and its overall conservation status in the boreal region is unfavourable to inadequate. This particular spring and the rich fen around it are a habitat for several threatened vascular plants: a willowherb (Epilobium laestadii, EN), yellow march saxifrage (Saxifraga hirculus, VU) and small-fruited yellow-sedge (Carex viridula var. bergrothii, VU). There are also many threatened or near-threatened mosses growing in the spring: Irish ruffwort (Moerckia hibernica, VU) ja Short-tooth hump-moss (Amblyodon dealbatus, CR), Lesser curled hook-moss (Palustriella decipiens, NT), Claw-leaved hook-moss (Palustriella falcata, NT) ja Fern-leaved hook-moss (Cratoneuron filicinum, NT), of which hook-mosses are typical inhabitants of Cratoneurion springs.

The spring is situated on state-owned land managed by Metsähallitus Forestry Ltd, and is mainly used for forestry. This area was rented out to a peat mining company, Turveruukki Oy. Therefore, one had to agree on filling the ditch with Metsähallitus Forestry Ltd and Turveruukki Oy. After agreement was reached, Metsähallitus Parks & Wildlife Finland planned and managed the restoration work. An excavator for filling the restoration activities was provided by Turveruukki Oy.

Figure 4.6. The restoration area (the spring - in yellow, the ditch to be filled - in red, the channelized ditch for redirecting water - in blue).

Before filling the ditch next to the spring another ditch closer to the peat mining area had to be channelled in order to be able to redirect the water there and avoid wetting in the peat mining area. Filling the ditch next to the spring turned out to be the hardest part of the work due to the strong impact of groundwater. Care also had to be taken not to disturb threatened species on the site. Eventually, the spring water flowed onto the fen instead of into the ditch, which was now filled up. The coming years will show how this restoration has worked out.

Metsähallitus, Parks & Wildlife Finland, took responsibility for the restoration. In this instance, restoration activities cost about 1500 euros – funded by Metsähallitus Parks & Wildlife Finland (planning costs are not included.

The peer-reviewed scientific literature also includes publications on restoration of wetlands ecosystems, including Arctic wetlands. This body of publications includes articles in the natural sciences (Burger, 2008; Martin Søndergaard & Erik Jeppesen, 2007; Moss et al., 1996), and also includes articles in the social sciences that examine social factors important in supporting and facilitating restoration efforts (Baker & Eckerberg, 2013a; Petts, 2007). With a broader sweep, the U.S. Association of State Wetland Managers (ASWM) published a "wetland restoration bibliography" that as of April 2015 included 124 articles on restoration science and practice, 44 articles on "restoration program development, planning and management" and 28 books (ASWM, 2015). The vast majority of these are in peer reviewed journals or book chapters. While only one was explicitly Arctic – an account of a project on Alaska's North Slope (Kidd et al., 2004), a survey of the bibliography suggests that many others are highly Arctic-relevant. Finally, a recent book by Bonn et al (2016) represents an effort to integrate the "science, policy and practice" of peatlands restoration. It provides an especially good example of what appear to be relatively few efforts to achieve a synthesis that addresses each of the elements in the SES model, and to embrace responsibility for pursuing the science-policy synthesis all the way to action.

BOX 4.2.1.2 LIFE PROJECTS – AN EU WETLANDS RESTORATION INITIATIVE IN FINNISH LAPLAND

"Freshabit LIFE IP Naamijoki" in Finnish Lapland

Alainen Teuraoja and Kivijärvenoja in a Natura site were ditched in the 1940's and 50's to lower the water level in Lake Teurajärvi and Lake Iso Kivijärvi in order to increase the area of agricultural land. This had severe negative effects on the water quality in The Naamijoki river.

The overall aim of the ecological restoration of Teuravuoma-Kivijärvenvuoma Natura 2000 site (FI1300701) is to improve the ecological state of Natura 2000 waters and to enhance biodiversity. This effort is combined with other water protection procedures in the area. The site, made up of mostly aapa mires, is located in the Naamijoki river catchment area (1265 km2) which is a tributary of the Tornionjoki river, which belongs to Natura 2000 and is an important spawning area for threatened (EN) Salmo trutta m. trutta. Actions were will be taken to reduce nutrient and suspended solid runoff to improve water quality and simultaneously to restore the peatlands next to the streams.

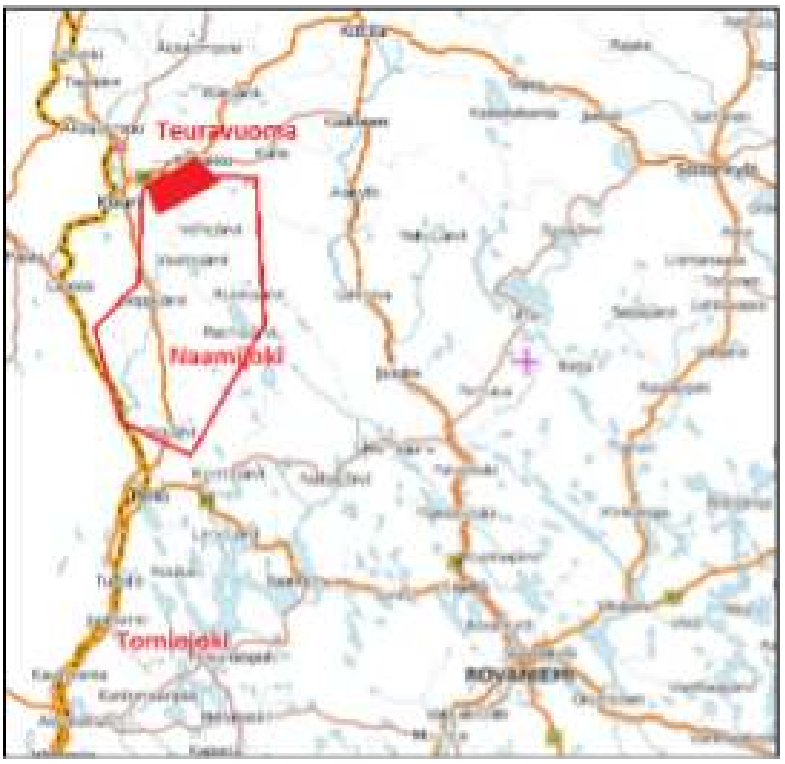

Figure 4.7. Restoration of the Teuravuoma-Kivijärvenvuoma Natura 2000 site

At least three observations can be made regarding the knowledge about, and practice of, wetlands restoration:

1) the considerable and broad experience with wetland restoration dating back many decades is expressed in publications by a variety of organizations – government agencies, practitioners' organizations, trade organizations and consultancies, NGOs and others, and they have produced an extensive body of both grey and academic literature to document knowledge and provide tools for practitioners.

2) the literature makes it clear that restoration of damaged or compromised wetlands ecosystems offers substantial benefits across multiple areas of interest – water-centric ecosystem services, biodiversity, and increasingly over the past decade, climate mitigation.

3) it is highly unlikely that the primary challenges involved in scaling up and expanding wetlands restoration efforts lie in a lack of knowledge about the function of wetlands ecosystems or what steps can be taken to improve their status.

BOX 4.2.1.3 RESTORATION EXPERIMENTS IN THE RUSSIAN ARCTIC

The Nenets Autonomous Area (NAA) is situated in the Archangelsk Province. It is the northernmost administrative area of European Russia. The mean temperature of July is 12°C. The mean annual precipitation is about 400 mm. Most of the NAA is situated in the tundra zone, 15% in the forested tundra, and some small areas in the northern taiga zone. The main river of the NAA, the Pechora with its numerous tributaries, has its source in the Komi Republic. The Barents Sea with a few large (Kolguyev, Vaigach) and many small islands forms the northern border of the NAA. The Area has two uplands – the Timan Ridge and Pay-Khoy Ridge. The rest of the area consists of waterlogged plains that are traditionally referred to as Malozemelskaya Tundra (west from the Pechora) and Bolshezemelskaya Tundra (east from the Pechora). The area is situated in the zone of palsa mires. The NAA possesses most parts of the Europe's richest Timan-Pechora gas and oil basin. Migratory birds of at least three flyways (East Atlantic, West Asian/African, and Mediterranean/Black Sea) nest in the Nenets Autonomous Area. The area is of key importance for ten species of sea mammals and has been intensively used. The NAA contains two federal protected natural areas – the Nenets State Nature Reserve (zapovednik) and Nenets Federal Nature Reserve (zakaznik) – and eight regional protected areas.

Experimental efforts on ecological restoration were started under the UNDP/GEF/EU project on "Conservation of carbon pools of forest and wetland ecosystems in the permafrost zone of the Republic of Komi and the Nenets Autonomous Area" in 2012. These comprised major disturbance types and background sites: open soil pit, exploratory drilling sites, winter roads (the so-called "zimniki") and were carried out in different locations within the NAA – Bolshezemelskaya Tundra (Verkhnyaya Kolva, Shapkina) and the Pechora Delta (Kumzha site, Kashin Island). Experimental restoration has been completed at four sites, where also monitoring and assessment of results has also been conducted.

- 2012 - Plots survey and assignment
- 2013-2015 - Baseline survey and designs.
- 2015-2016 - Implementation

Approaches included measures to prevent soil erosion and restoration of eroded landscape forms, creation of accumulative landforms, water retention, promotion of organic matter accumulation and permafrost restoration (by preventing fast thawing of seasonally frozen soils).

2016-2017 - Monitoring

Monitored parameters included: vascular plants, mosses and lichen species composition and cover dynamic, soil temperature, soil moisture, water table and permafrost table depth and GHG measurements. The last monitoring studies were undertaken in 2017 when studies were stopped due to a lack of funding. The results have been presented in several scientific workshops and published as abstracts.

Yamal LNG

The Yamal LNG project includes the construction of an integrated liquefied natural gas (LNG) production complex based on the resources of the South Tambey gas condensate field in the north-eastern part of the Yamal Peninsula. The Project footprint includes areas directly or indirectly affected by the Project and associated facilities located within the Project and South Tambey license area (974 km2 and 2031 km2).

The licensed area is situated in the Yamal landscape province near the southern border of the Arctic tundra (southern side of the Vanuimuayakha river valley). The presence of permafrost has a significant impact on the development of the terrain, and the associated hydrological processes cause a high saturation of moisture. The thickness of permafrost in the Project area ranges from 20 to 350 m. The licensed area, despite sandy sediments, is largely paludified (up to 30% of the area) and located in the zone of polygonal mires.

During the implementation of the Yamal LNG Project, infrastructure facilities were created, including temporary (winter roads) and permanent roads, exploration drilling sites, open pits, etc.

The infrastructure facilities of the Yamal LNG project have a direct and indirect impact on the ecosystems, disrupting vegetation cover, hydrological and temperature conditions, increasing the depth of the permafrost active layer and, in the long run, thawing permafrost.

The Yamal LNG EIA recommends the development of a remediation plan for disturbed areas by the end of exploitation, which will determine the methods, timing and criteria for its successful implementation. The routine procedure of land reclamation in accordance with the valid Russian regulations includes two stages - technical (waste disposal, site planning, slope stabilization) and biological rehabilitation (consolidation of unaffected areas and passages with a mixture of sand and peat and sowing of grass after mechanical levelling of the surface).

Ecological restoration of disturbed lands or restoration of natural ecosystems is more in line with the requirements for Yamal LNG to take measures to prevent total losses for the areas of "natural habitats", where possible, as well as national and international obligations in the field of environmental conservation.

The experimental site is located within the first alluvial-marine terrace and is comprised of marine sands. Nevertheless, during exploitation of the territory, the meso- and micro-relief was significantly transformed. Heavier soil than the original soil (presumably ground from deepening the Lake Glubokoye) was dumped on the top of the sand. Such mesorelief structures as flat hillocks of sedimentary rocks of heavy mechanical composition are not typical for the first terrace. Therefore, designing the landscape types typical for the second terrace as a part of the target ecosystem was planned.

The original landscape of the first terrace was more homogeneous than the target landscape. Prior to the planning and development, hilly-polygonal swampy tundra on flat hillocks and sedge bogs on peaty-gley oligotrophic soils with gleesems on flat relief elements prevailed here. The vegetation on the hillocks was represented by polygonal-shrubby fluffy lichen-moss communities of tundra with sedge-moss communities along the cracks and shrubby moss-lichen tundra, often with the presence of cereals. Small depressions on the hillocks include a grass moss tubercle tundra with willow or a shrubby fluffy-sphagnum marsh tundra. A similar structure was partially preserved on the western and southern shores of Lake Glubokoye, where a reference area was chosen.

Ecological restoration works included levelling large artificial ridges, terracing slopes to prevent erosion processes, fixing slopes and ravine banks with living material (willow cuttings, vegetation cover); forming traps (pockets) with organic soil; creating a polygonal-valve relief; controlling erosive relief forms; ploughing and digging to create an uneven surface and obstacles; preparing peat and moss chips and application to restoration sites. The technical work was carried out with the use of bulldozers, backhoes and also manually. All works including plot assignment, baseline study, design and implementation were carried out in 2019. Due to company regulations and privacy concerns, the results were not made public.

4.3 WETLANDS MANAGEMENT AND STEWARDSHIP

The term "management" can be broadly defined as the organization and execution of coordinated activities in order to achieve pre-specified goals[8]. Publications dealing with wetlands management generally assume a similar definition of what management entails. They then focus attention on wetland-specific dimensions needed to define baseline conditions and preferred status and subsequently, define goals. These dimensions include defining and categorizing wetland types, establishing boundaries, and identifying current and preferred properties in terms of species, chemistry, hydrology, and more generally, "ecological character". A similar focus was seen in the topics types of publications identified in the initial review for phase 1 of this project and is important because the unique characteristics of different types of Arctic wetlands ecosystems are the basis for any management efforts.

Management efforts would be substantially strengthened by the development of a pan-Arctic wetland dataset and corresponding maps. For example, pan-Arctic maps would help establish a baseline for future change assessments and provide an improved level of quantitative information for assessing extent and status of wetlands. The information would support national mapping and could be integrated and/or supplement existing national inventory systems. In addition, pan-Arctic maps would help establish a consistent system for mapping and assessment across political boundaries.

These physical characteristics help define the specifics of the suite of tasks and activities to be organized, coordinated and executed. Yet, wetlands management is a fundamentally social process, since management entails guiding people's actions to secure improvements or to minimize negative expected or unexpected impacts on wetlands areas. Management activities include planning, decisions about how to balance and/or integrate use with conservation, monitoring schemes, defining participants (who should participate and on what basis), and funding. In general, since these activities entail social organization, the importance of "Arctic" in the search term (and geographic location) is less important, since many aspects of social organization per se are not place-specific. That said, the participation

Photo: Daniel Schreiber, Shutterstock.com

of and co-management with Arctic indigenous communities is vital, in part as a matter of rights, due to the importance of culturally-embedded indigenous knowledge, and due to the links between traditional livelihoods and wetlands (Davidson-Hunt & Berkes, n.d.; Inga et al., 2019; Parsons et al., 2017). As wetlands management efforts are goal-driven, it is unsurprising that these management activities are often labelled in accordance with goals specified in terms of restoration, conservation, protection, or resource management.

8 The very concept of "management" of natural systems is contested; it is considered by many resilience scholars to reflect an industrial mode of thinking, with problematic assumptions about maximizing outputs, linearity in change processes, and failing to grasp the inherently dynamic nature of complex systems. Leading resilience scholars have instead advocated use of the term stewardship to address these shortcomings (F. Stuart Chapin et al., 2010; Chapin III et al., 2015; Folke et al., 2009; Mathevet et al., 2018), aalthough as Welchman (2012) notes, the stewardship concept also has its detractors. As highlighted earlier in this report, the stewardship concept is preferred as a way to characterize efforts to exercise responsibility and to care for ecosystems in a context of inherent variabilities, as well as the increased instabilities being driven by climate, land use change and biodiversity loss.

Publications on wetlands management also include a wide selection of grey literature, including handbooks aimed at providing practical guidance (Chatterjee et al., 2008; including for example:, Ramsar, 2010) compiled by both government and expert organizations, as well as related scientific publications (Berkes et al., 2000; Burger, 2008; Elliott, 2014; Folke et al., 2004). Some of these publications specialize in specific aspects of management, such as functional assessment and monitoring (G. Kofinas et al., 2003; Maltby, 2009; Niemi, 2010; Shepherd et al., 2013), or planning and setting goals and objectives (Bryson, 2001; F. S. Chapin III et al., 2003; Ernst & Riemsdijk, 2013; Keene, 2015; Lena Gipperth & Ragnar Elmgren, 2005). Since 2000, an increasing number of publications speak to issues of participation, especially by local communities and indigenous peoples (European Commission, 2003, 2003; Franzén et al., 2015; Jonsson, 2005; Reed, 2008; Stringer et al., 2006), in some instances helping to establish an expectation of local participation as a norm.

Three general observations can be made regarding wetlands management or stewardship:

1. Based on the reviewed literature, the meaning of "management" is largely taken for granted, with a focus on the ecosystems more often than the characteristics of social organization needed to address or minimize disturbance.

2. Participation by indigenous and local communities is increasingly recognized as an essential ingredient of successful management

3. Participation is a catchphrase that includes a wide range of activities that range from simply informing locals of planned activities, to offering opportunities for input on those plans, to engagement in shared or co-management processes.

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BOX 4.3.1.1 RESTORATION AND CONSERVATION IN NORTHERN ALASKA

There are numerous education, conservation and restoration projects going on in Arctic Alaska, carried out by a diversity of actors. Eklutna and Great Land Trust are both public-private collaborations that use fees to secure lands for conservation. Red Mountain Consulting, another example, is one of the state's leaders in permafrost restoration (http://redmountainalaska.com/) and recently completed a botanical garden to educate community members on the traditional uses of tundra vegetation. Many of the plants are wetland species (https://www.ktuu.com/content/news/Botanical-garden-opens-at-northernmost-tip-of-North-America-512869271.html).

Photo: Reimar, Shutterstock.com

The Conservation Fund used compensation fees to purchase arctic lands for conservation and the Natural Resources Conservation Service (NRCS) (under the U.S. Department of Agriculture – USDA) has initiated trail building and restoration activities to limit transportation and overland travel impacts to wetlands (see https://www.conservationfund.org/projects/kobuk-valley-national-park http://www.akleg.gov/basis/get_documents.asp?session=29&docid=2517).

In 2017 The corps of engineers ended its substitution fee program from The Conservation Fund. This was its only Arctic program https://www.eenews.net/stories/1060082899. https://www.poa.usace.army.mil/Media/News-Releases/Article/1344637/corps-terminates-third-partys-mitigation-in-lieu-fee-program-in-alaska/

Minimizing All-Terrain Vehicle Impact in Bird Habitat: Reconciling Harvest and Conservation on Private Land in Western Alaska[9]

Some of the highest densities of breeding birds in the world occur near the community of Hooper Bay, in the Yukon-Kuskokwim Delta. These birds and their environment are important food and cultural resources to local indigenous people, who want to maintain these assets as part of key conditions for their community's well-being. However, use of all-terrain vehicles (ATV) to access harvesting areas has caused habitat degradation and disturbance to breeding birds. The Sea Lion Corporation[10], the largest local private landowner, has worked with its partners to address this issue. These efforts have included: 1) locally-developed outreach products encouraging habitat protection; 2) a field-based outreach program to encourage best ATV use practices; and 3) building a hardened trail as a durable travel surface to direct ATV traffic. Community engagement and compliance with these efforts have been positive, but further work is needed to reinforce newly developed social norms for appropriate ATV use. More proactive habitat management guidelines to reduce disturbance may also be necessary. To successfully reconcile local harvest needs and habitat conservation, community leaders recognize the importance of developing and implementing land management plans rooted in a participatory process and based on local culture and traditions.

[9] Authors of Minimizing All-Terrain Vehicle Impact: William Naneng1, Ryan L. Maroney2, Myron Naneng1, and William Tinker1
[10] Sea Lion Corporation (SLC) is an Alaska Native Village Corporation from Hooper Bay and located on the southwest coast of Alaska. See https://www.sealion.com

4.3.1.2 WETLANDS RESTORATION IN NORTHERN NORWAY:

Restoration of Hjerkinn artillery range

Located quite far from the CAFF defined Arctic, in the Dovre mountains in the middleof South Norway, a large restoration project has been going on for 15 years. This is the project to restore the 165km2 Hjerkinn artillery range. It is mainland Norway's by far largest restoration project . The area is located 11-1200 m a s l, far south of the CAFF defined Arctic, but still e g Palsa mires are found in the adjacent areas. This is also part of the key area for the Norway's wild reindeer, one of the last wild reindeer populations in Europe. . The artillery range was established in 1923, and the Parliament decided to shut it down and restore it back to nature in 1999. After successful restoration most of the area was included in the Dovrefjell-Sunndalsfjella National Park in 2018. The last parts of the area were restored in summer 2020, and the project is finalized.

The intention of the project was to restore and secure the habitat for wild reindeer as well as the wider mountain ecosystem, including the unique vegetation, and key species such as arctic fox, wolverine, raven and lemming. As the system of roads and bomb fields used by the defence has been redeveloped and put back to nature large areas of wetlands and scrubland has been restored and revegetated. The recovery of water courses and wetlands as well as techniques for revegetation could be useful for similar efforts in the Arctic.

The Svea Project – restoring a large coal mining area into "wilderness"

The largest restoration project ever undertaken in the Norwegian Arctic is going on in the Svalbard archipelago, where the whole coal mining town of Svea will be demolished, and the landscape / tundra (including ponds, minor lakes) will be restored. The process is expected to take 5-6 years from its start 2018 and have a total budget up to USD 250 million.

Fig 4.8. Many road systems have been redeveloped and revegetated. Photo credit: Forsvarsbygg

The Norwegian Parliament has decided that the mining activity in the Svea mines and the adjacent Lunckefjell mine will be terminated, and the areas restored according to §64 in The Svalbard Environmental Protection Act. This paragraph states that when industry or other activity ends, the owner is responsible for removing remaining installations and infrastructure and restore the area to its original appearance.

The area holds large landscapes linked to glacial and fluvial processes. Mining activity has caused large impacts, including e g road constructions, fillings on tundra and in shallow marine areas. In some cases, impacts to several landscape elements are irreparable However, the landscape still holds large natural values and existing knowledge on species occurrence and plant communities shows that this area is typical for this part of Svalbard. Part of the area consists of barren land, while in others vegetation has been strongly modified and destroyed by infrastructure and mining. Svea is a demanding project, taking place in an expansive and extreme environment. Principles have been formulated to provide overall guidelines for planning and implementation, and these may be relevant for other Arctic locations needing restoration. The goal and level of restoration in the Svea-area must be decided by the level of technical infrastructure, ongoing nature dynamic, and the link between nature and cultural heritage.

Principles for planning and implementation:

- Prepare for natural processes, efforts must work in concert with nature's processes and contribute to the restoration and contribution that nature itself will make.
- Avoid and mitigate negative impacts caused by the restoration activity, including banning introduced plant material for restoration.
- Some of the actions should have an immediate effect. The short-term result is important, while at the same time, the long-term perspective must be clearly communicated.
- Bear in mind the link between details and overall perspective. An overemphasis and focus on details might drain resources without necessarily having the maximum impact on the overall outcome.

Fig 4.9. A part of the Svea mining town, Svalbard. The intention is to restore the landscape and its ecological and geomorfological processes. Only a handfull of cultural monuments will be kept. Photo: Martine Løvold, County Governor of Svalbard

Overview of Norway's existing policy applicable to Arctic wetlands

) Nature for life — Norway's national biodiversity action plan (Meld. St. 14 (2015–2016) makes it clear that restoration of wetlands, together with improvement of condition according to the water management plans (Water Framework Directive), are the Government's most important efforts to meet obligations and follow up on Aichi target 15 (CBD) – to restore at least 15% of degraded ecosystems.

According to the Water Framework Directive (EUWFD) which has been implemented in Norway, all water bodies should have good condition, and if not efforts should be made. Restoration is seen as an important effort in this respect. Knowledge gathered on lakes and rivers through the implementation of the directive is important and useful when executing the national restoration plan.

Wetland restoration plan for Norway (2016 – 2020)

It has been estimated that mires and other wetlands today cover some 19.000 km2 in Norway (mainland). This is far less than about 80 years ago, when the area of mires could have been some 30.000 km2.

The Norwegian Agriculture Agency and the Norwegian Environment worked out a national plan for wetland restoration in Norway (mainland) for the period 2016 - 2020. The plan reflects national goals to reduce greenhouse gas emissions, promote climate adaptation, and improve ecological status. The plan also includes a review of the latest research on wetland restoration, a criteria set for choosing the best localities for restoration, as well as a concrete plan for implementation. So far, more than 80 wetlands, mainly mires, have been restored. However, few of these are located within the CAFF defined Arctic. The national restoration plan is under revision and will be prolonged for another period. The plan is based on the Ramsar Convention's definition of wetlands, and is designed to contribute to the Government's intentions to reduce climate gas mission, adaption to climate changes and improvement of ecological conditions (See link: Miljødirektoratet og Landbruksdirektoratet 2016)

4.4 WETLANDS POLICY AT DIFFERENT GEOGRAPHICAL SCALES

As noted at the beginning of this section, public policy has many manifestations - laws, regulatory measures, courses of action, funding, and also the organizational architecture established for implementation. Much public policy involves a combination of these. In the next sections, we examine the broad contours of the Arctic states' policies that affect wetlands restoration and management/stewardship and govern wetlands use. While the limitations of this report preclude a detailed examination and analysis of each country individually, the country-level comparison of policy and actions offers useful insights for identifying challenges common to the different countries, and for identifying meaningful approaches to tackling these shared challenges.

Photo: Sophia Granchinho, Shutterstock.com

Arctic states' interest in their Arctic wetlands (particularly peatlands) has increased substantially over the past decade in conjunction with the increasing understanding of the region's wetlands vulnerabilities and their role in mitigating or accelerating climate change (Barthelmes et al., 2015; Hahn & Dinesen, 2019; Ramsar, 2018b). As part of this growing recognition, attention to wetlands and peatlands is also gaining attention within UNFCCC processes, with Iceland taking the early initiative with support from wetlands experts (Iceland, 2008; Kaat & Joosten, 2009). As international agreements, both Ramsar and the Convention on Biological Diversity serve as catalysts for both legislative and practical action at the national level. Pittock et al (2011) note that although enforcement mechanisms provided for in international law are generally weak, they provide an important legal foundation for enacting the national legislation required to implement the obligations taken on.

Policies pertaining to Arctic states' wetlands have over the years been formulated, negotiated, adopted, and implemented at different political and spatial scales. Due to the focus on public policy, we define scales broadly according to international, national, and subnational levels although ecosystems follow a different logic. National governments are typically dominant in defining the contours of public policy, although there are relevant exceptions. Here we propose a modification to account for differences in spatial scale. Canada, the Russian Federation and the United States are federal systems, while the Nordic countries operate within a quasi-federal system through the European Union, related regional agreements such as the European Economic Area (EEA), and through a highly institutionalized Nordic cooperation. The Nordic countries' transposition of European Union Directives, due either to their membership in the EU or due to other agreements, shares important similarities with the way sub-national entities (states or provinces) comply with national legislation in federal systems. Figure 4.X highlights some of the important policies guiding or regulating human activities impacting wetlands, organized according to scale from international, to national/regional, to national or in the case of federal systems, state levels.

Table 4.4.1 – Policies that support conserving wetlands and managing their use

	International (Ramsar, CBD, Agenda 2030 Paris,	National/Federal / European Union	EU National / U.S.-state /Canadian-provincial
Canada	Ramsar, CBD, Agenda 2030, Paris	Federal Policy on Wetland Conservation (FPWC)	Canada's federal wetlands policy applies to national lands. The primary authority for regulating activities impacting wetlands in Canada lies at the provincial level and varies somewhat across provinces.
Russian Federation	Ramsar, CBD, Agenda 2030, Paris	State Standard GOST 17.5.1.01-83	
USA	Ramsar, CBD, Agenda 2030, Paris	Clean Water Act (CWA)	Alaska Wetlands Plan
Denmark /Greenland	Ramsar, CBD, Agenda 2030, Paris* * Greenland participates in the Paris Agreement via Denmark and provides data to national reports in combination with the Faroe Islands.	WFD	Greenland has multiple ministerial orders to protect its wetlands. Greenland's first 11 Ramsar sites were designated in 1987 by the newly established Greenland government, with a 12th added in 2012.
Iceland	Ramsar, CBD, Agenda 2030, Paris	WFD	Climate Action Plan, 2010, updated 2015.
Finland	Ramsar, CBD, Agenda 2030, Paris	WFD	National Biodiversity Strategy and Action Plan (2012-2020), River Basin plans linked to WFD
Norway	Ramsar, CBD, Agenda 2030, Paris	WFD	Plan for restoration of wetlands in Norway (2016-2020)
Sweden	Ramsar, CBD, Agenda 2030, Paris	WFD	Goals and plan for thriving wetlands in, Local Nature Conservation Program (LONA) which funds local wetlands restoration projects. River Basin plans linked to WFD

4.4.1 REGULATION OF ACTIVITIES THAT IMPACT ARCTIC WETLANDS

The Ramsar Convention is a logical starting point for examining wetlands policy (Ramsar.org). It is wetlands-specific and also the oldest of the international agreements focused specifically on environmental protection, coming into force in 1975. As of 2020, 171 countries are parties to the Convention and all eight Arctic states are signatories. As the only international treaty specific to wetlands, the Ramsar Convention provides a substantial body of background information, technical guidance and links to scientific publications in support of implementing and pursuing the Convention's goals. Its wetlands focus has evolved from species protection to ecosystem conservation (Söderberg 2016; Nilsson et al. 2012). Ramsar's approach to prioritizing the "maintenance of ecological character" of a designated area has been described as a paradigm shift in which planning as a means of minimizing unintended or unwanted consequences has taken hold and spread (Keene, 2015). The Ramsar Convention has three implementation pillars; wise use of all wetlands designation and management of Wetlands of international importance (Ramsar sites), and international cooperation . Ramsar`s model for wetlands conservation requires that signatory countries designate a minimum of one wetland area of "international importance" on the basis of selected ecosystem characteristics. The boundaries of these areas are precisely delineated and mapped (Ramsar Convention 2017). These areas are to be "used wisely" in accordance with Ramsar`s principles, which correspond with the accepted definitions of sustainable development (Gardner & Davidson, 2011). As just one example, maintenance of ecological character is an explicit goal of Greenland's ministerial order on wetlands (Regelsæt Database, 2016).

BOX 4.4.1.1. GREENLANDIC WETLANDS CONSERVATION AND THREATS

Greenlandic wetlands stretch across all its bioclimatic zones except for the polar desert zone (Bay 1997) i.e. they are distributed from the subarctic areas in the continental fjord region of South Greenland to the continental zone in high arctic Greenland. Greenland has the longest extent of all the arctic countries, which give rise to a variation of the species composition of the plant communities. The wetlands are mostly found in the lowlands, and are classified according to the Ramsar convention into inland wetlands: lakes, ponds, fens, grasslands, and marine wetlands i.e. salt marshes along coasts.

Conservation status and Management

Twelve areas have been designated for inclusion in the Ramsar list of Wetlands of International Importance (Egevang and Boertmann 2001; Ramsar 2012). The National Park in North and East Greenland includes many wetland areas. The wetland areas in North and East Greenland are in remote areas and are presently not under the influence of humans although mining activities are expected to occur in the future, whereas some of the wetland areas in West Greenland are threatened by human activities. The local population in West Greenland does not use the wetlands directly, but as they hunt caribou Rangifer tarandus groenlandicus and muskoxen Ovibus moschatus they are indirectly using the wetlands. These habitats constitute important foraging areas for mammals and birds. Waders and geese are dependent on the wetlands for feeding and nesting sites during their stay in the arctic summer; and ducks and divers nest in close proximity to open water in the wetlands.

Current and potential threats

Exploitation of natural resource during the last decades of the 1990s and continuing into the 2000s are a potential threat to the wetlands. Environmental investigations conducted prior to mining and oil exploitation activity have placed a focus on locating vulnerable habitats, rare, red-listed and endemic vascular plant species and assessing the threats to the habitats. Traffic is acknowledged to impact wetland wildlife and guidelines have been developed to minimize the impact to wetlands and other vulnerable habitats by human activities connected with exploitation of natural resources. National legislation has been adopted, restricting the use of motorized vehicles outside of inhabited zones

A decline in the population size of waders in two of Greenland's Ramsar sites has been recorded due to human impacts (Egevang and Boertmann 2001). (Egevang et al., 2001)

The large wetland in the lowlands of Jameson Land is potentially threatened (Fig. 3) by future oil exploration, but such plans are currently on hold. Vulnerable to human activities it is of utmost importance that investigations in connection with Environmental Impact Assessments undertaken prior to exploitation focus on the distribution and the use of the wetlands.

Ramsar notes that the Arctic is underrepresented among Ramsar sites and urges that parties to the Convention designate more sites in the Arctic (Ramsar, 2018b). Table 4.4.2 below shows the Arctic states, their year of accession, total number of Ramsar sites, number of sites in the Arctic (CAFF boundary), and the responsible authority:

Table 4.4.2 Arctic States' participation in the Ramsar Convention

Country	Year in effect	Sites	Arctic sites	Responsible agency(ies)
Canada	1981	37	6 (CAFF boundary)	Canadian Wildlife Service/ Environment and Climate Change Canada
Denmark/Greenland*	1978/-	43/12	12	Ministry of Environment (DK)/Department of Nature and Environment (GL)
Finland	1975	49	1 (CAFF boundary)	Ministry of the Environment
Iceland	1978	6	6	Environment Agency of Iceland
Norway	1974	63	26 (within the CAFF Boundary; (9 in Svalbard, 17 on the mainland)	Norwegian Environment Authority
Sweden	1974	66	11 (1 site approx. 40% within CAFF boundary)	Swedish Environmental Protection Agency
Russian Federation	1975	35	7 (2 of the sites partly within CAFF boundary)	Ministry of Natural Resources & Environment
USA	1986	39	1	Bureau of Oceans & International Environmental & Scientific Affairs, U.S. Department of State U.S. Fish and Wildlife Service, U.S. Department of Interior
total	–		70 (in 2020)	–

Source: Ramsar.org country profiles (https://www.ramsar.org/country-profiles) and Nordic Baltic Wetlands Initiative (NorBalWet)

In addition to the Ramsar Convention, three other major international agreements include targets likely to substantially impact wetlands either directly or indirectly. These include:

- Convention on Biological Diversity: - Aichi target[9] 15 agreed by the Contracting Parties of Convention on Biodiversity for 2011-2020 aims at restoring at least 15 percent of degraded ecosystems worldwide, thereby in addition to supporting and protecting biodiversity, also contributes to climate change mitigation and adaptation and to combating desertification.
- Agenda 2030's Sustainable Development Goals (SDG) (2015): Goal number 15[10] includes target 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world with indicator 15.3.1 Proportion of land that is degraded over total land area.
- Paris Agreement (2015): Restoring carbon-rich ecosystems of the tundra and other types of northern peatlands will contribute to reaching the targets adopted in the Paris Agreement by reducing

9 https://www.cbd.int/sp/targets/
10 https://sustainabledevelopment.un.org/sdg15

Country	CBD Status	Agenda 2030 status	Paris Agree-ment	remarks
	Signatory	Signa-tory	Signatory	
Canada	X	X	X	
Denmark/ Greenland*	X	X	X/(X)	As noted previously In Table 4.x above pertaining to major wetlands-related policies
Finland	X	X	X	
Iceland	X	X	X	
Norway	X	X	X	
Sweden	X	X	X	
Russian Federation			X	
USA	X*	X**	X***	*the U.S. is a signatory, but has not ratified the CBD. **although the U.S. signed the agreement, the Trump Administration has declined to incorporate Agenda 2030 into the national agenda. *** In June 2017 the U.S. announced its intention to withdraw from the Paris Agreement

Table 4.4.3: Arctic States' participation in wetlands related international conventions

- The UN Decade on Ecosystem Restoration (2021-2030): in addition to the international conventions listed above, the UN Decade on Ecosystem Restoration was approved by the UN General Assembly in March 2019. The resolution calls for restoration of essential but damaged ecosystems and highlights the priority importance of "preventing, halting and reversing the degradation of ecosystems worldwide", noting that the poor condition of many "forests, grasslands, croplands, wetlands, savannahs, and other terrestrial and inland water ecosystems, marine and coastal ecosystems" threatens human well-being, requiring immediate attention. It notes wetlands' potential for helping to achieve some 14% of the climate mitigation needed to stay under the 2 degree target, and in particular that peatlands' importance as carbon sinks and wetlands (UNEP/FAO, 2020). The International Union for the Conservation of Nature (ICUN) has along with the organization Partners of the Ramsar Convention called for a "Wetland Decade" within the framework of the UN Decade (ICUN, 2019).

4.4.2 REGIONAL/NATIONAL SCALE

At the regional/national scale, wetlands are typically part of a broader framework of water protection, land use regulation, or species protection and are therefore regulated in the context of a broader body of rules. As previously noted, we define the regional/national scale as including Canada, the Russian Federation, the USA and the Nordic countries. In many respects, the Nordic countries function as a region in regulatory terms by virtue of scale and membership in the European Union (EU) or European Economic Area (EEA)[11] , and by virtue of their institutionalized close collaboration on a wide range of policy and practical issues. On opposite sides of the Atlantic, the U.S. Clean Water Act (CWA) and the European Union Water Framework Directive (WFD) are examples of overarching laws primarily addressed to broader issues and at a national scale, yet substantially regulate activities that impact wetlands in the Arctic.

9 https://www.cbd.int/sp/targets/
10 https://sustainabledevelopment.un.org/sdg15
11 Greenland is not part of the EEA or the EU, although it maintains close ties with Europe through special agreements, including on fishing.

CANADA

According to Rubec and Hanson (2009), Canada was in 1991 among the first countries to formalize a national wetlands conservation policy. However, while the policy is overarching and influences the development of national policy and programs, Canada's Federal Policy on Wetland Conservation (FPWC) applies only to lands directly under Canada's federal jurisdiction or to actions taken or supported by the Government of Canada. The primary authority for regulating activities impacting wetlands lies instead at the provincial, rather than national level (Bonn et al., 2016). Nevertheless, Canada's wetlands policy establishes several key principles/goals that have shaped provincial policies: 1) no net loss of wetlands functions, 2) no further loss of wetland area where loss has been severe, and 3) improvement and restoration of wetlands where loss or degradation has reached critical levels. An additional supporting document, the Implementation Guide for Federal Land Managers (Government of Canada, 2002), outlines a logic for wetlands protection that includes a three-step mitigation hierarchy of avoidance, minimization, and compensation for unavoidable impacts. This hierarchy has been adopted by several of Canada's jurisdictions, although it is not uniform. As of 2009, documentation notes the need for standardized protocols for monitoring the success of compensation projects and systems to assemble information in Canada[12].

RUSSIAN FEDERATION

In the Russian Federation there is no Arctic-specific regulation of activities that impact wetlands ecosystems. Russian national policy regulates both use and conservation of land area. Use and its economic benefits are given priority, but conservation and restoration are also emphasized and highlighted in terms of societal benefit. Activities that impact wetlands are regulated in the Russian Federation in accordance with the terms and definitions given in the State Standard GOST 17.5.1.01-83, which addresses nature conservation and restoration, including wetlands.

Reclamation and ecological restoration in the Russian regulatory system carry an historical legacy and therefore contain a variety of inconsistencies. For example, Russian legislation (federal and regional level) does not contain the terms "ecological or ecosystem restoration". Instead, "reclamation" is used – a the term that dates back to the Soviet Union. In accordance with the terms and definitions given in the State Standard GOST 17.5.1.01-83 "Nature conservation. Land reclamation. Terms and definitions", land reclamation is a scope of activities aiming at the restoration of productivity and national economic value of disturbed lands, as well as the improvement of environmental conditions in the interest of society. The objects of reclamation are disturbed lands - territories where elements of the natural environment have been completely or partially disturbed or destroyed. These elements include vegetation and soil cover, soils, or topography of the area. This also includes contaminated land.

Photo: Valerii M , Shutterstock.com

[12] Wetland mitigation banking is not commonly practiced by any Canadian jurisdiction (defined by U.S. Army Corps of Engineers as restoring, enhancing, or preserving wetlands and other aquatic resources for purposes of providing compensatory mitigation in advance of authorized impacts to similar resources at another site).

The legal regulation of the issues of reclamation, restoration of ecosystems and disturbed lands in the Russian Federation remains fragmented and consists of multiple federal laws and regulations (government decrees, departmental regulations and instructions, methodologies and State Standards (GOST), etc.). In addition, a variety of regulatory acts have been adopted at the sub-national level by subjects of the Russian Federation and local authorities. The key findings of the legislation integrated analysis are:

- Generally, ecosystem restoration is not regulated by legislation of the Russian Federation. However, there are several laws that address the restoration of certain ecosystem functions, for example: hydrology, soil fertility, forest productivity, pasture productivity.
- Many natural Arctic ecosystems provide pasture lands for reindeer and are designated as agriculture land. As a result, restoration of this type of Arctic ecosystem restoration is supported by Russian legislation.
- The lands which are subject to reclamation have been disturbed by various types of anthropogenic impacts. These result from different uses under various land use categories (industry, agriculture, forestry, etc).
- After reclamation, land should be assigned to the same land use category which it was assigned to before it was disturbed.
- Disturbing recreational lands or protected areas is prohibited by law. Reclaimed lands cannot be assigned as protected areas or recreation lands.
- Restoration of natural ecosystems is not listed in any legal act as a target of reclamation or a subject of use. There is no such land use category.
- A number of policy conflicts can be found within the reclamation legislation with international legislation and common use.

The Paris Agreement was ratified by the Russian Federation in September 2019. Pending legislation related to the regulation of emissions of greenhouse gases opens additional potential for protection and restoration of Arctic wetlands ecosystems. The draft of the Federal Law “On State Regulation of Greenhouse Gas Emissions and Amendments to Certain Legislative Acts of the Russian Federation” was prepared by the Ministry of Economic Development of Russia on 2019-03-01. The current version contains many references to the protection and restoration of GHG sinks. GHG sinks restoration could be included among the incentives for the restoration of the natural ecosystems in the Arctic.

UNITED STATES

In the United States, the Clean Water Act (CWA) is the principle legislation regulating human activities that impact wetlands, with questions related to property rights and securing of natural resources also weighing in (Gardner, 2011). The development of the CWA itself followed a long historical trajectory that culminated in its adoption in 1972, with subsequent amendments bringing minor changes.

Section 404 of the CWA regulates the discharge of dredge and fill materials into surface waters of the U.S., including wetlands (US EPA, 2015b). Section 404 requires that any person, company, tribe, or government agency planning to work in waters of the U.S. must obtain a permit from the Army Corps of Engineers (Corps) before initiating any activity that results in discharges of soil or other materials into wetlands or other waters (US EPA, 2015b). Detailed guidelines developed by the lead agencies govern the process and requirements for seeking such a permit (US EPA, 2015c), with emphasis on four key questions (Votteler & Muir, 2002): 1) does the proposed discharge represent the least damaging practical alternative; 2) does the action comply with other environmental standards or regulations; 3) will it significantly degrade wetlands; and 4) have all appropriate and practical steps been taken to minimize potential harm to wetlands?

Some methods of altering wetlands are not regulated by Section 404. Unregulated methods include: wetland drainage, the lowering of ground-water levels in adjacent areas, deposition of material that is not specifically defined as dredged and fill material by the CWA, and removal of wetland vegetation (OTA, 1984).

Five separate Federal agencies share primary responsibility for wetlands protection. The Corps is the lead agency responsible for implementation of the 404 program in Alaska, in partnership with the U.S. Environmental Protection Agency (EPA). Corps staff works with applicants to assist them in the permitting process. The Corps is responsible for issuing the public notice for applications for individual projects using the "Public Notice of Application for a Permit." The Environmental Protection Agency and the Army Corps of Engineers are two agencies with very different missions. Hough and Robertson (2009, p. 16) describe the history of wetlands mitigation under Section 404 as “largely the story of these two federal partners attempting to bring together their divergent missions and divergent constituencies to serve the common need to protect the nation’s wetlands.”

Section 401 of the CWA also grants states the legal authority to review an application or project that requires a federal license or permit (in this case a 404 permit) that might result in a discharge into waters of the

U.S. The applicant must apply for and obtain a Certificate of Reasonable Assurance from the Alaska Department of Environmental Conservation (DEC) to conduct a regulated activity. By agreement between the Corps and DEC, the "Public Notice of Application for Permit" public noticed by the Corps for an individual permit serves as the DEC application for a Certificate of Reasonable Assurance. DEC reviews the project as described in the Corps project public notice; coordinates with other state and federal agencies and local governments; reviews any public comments; and either approves, approves with conditions, waives, or denies the project based on compliance with the Clean Water Act, state water quality standards, and other applicable state laws. DEC charges a fee to develop the Certificate of Reasonable Assurance. Authority for wetlands protection is also structurally divided between the Federal and state governments, opening potential for other goal divergence (Houck 1995). The only American state with territory in the Arctic, Alaska has its own particular concerns and priorities that contribute additional complexity.

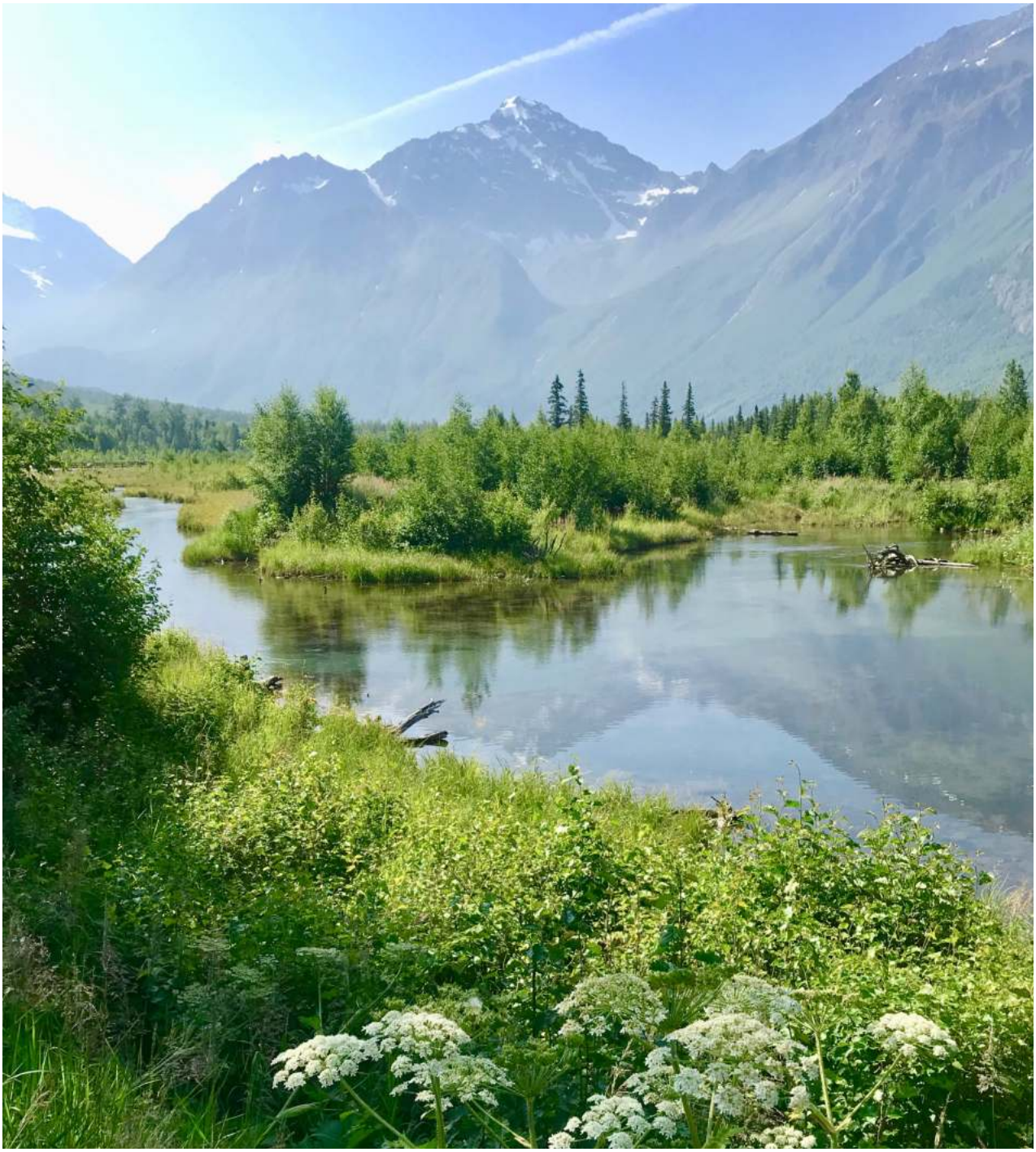

Photo: Maggie Wade, Shutterstock.com

As elsewhere, the United States policy environment guiding human activities that impact Arctic wetlands is complex. A comprehensive overview of U.S. Federal wetland protection policies highlights a wide range of policies and programs that follow the themes identified in the Table 4.x below: A) encouraging conversion* through programs or laws, B) discouraging or preventing wetlands conversion through regulation; C) discouraging or preventing wetlands conversion through acquisition; and D) discouraging or preventing wetlands conversion through policies or programs. Conversion" is defined here as fundamental change in the ways wetlands areas are used, for example, land use changes that entail draining or filling.

Wetlands Impact	Example of policy or program
encouraging conversion of wetlands to other uses through programs or laws	• Federal Crop Insurance (USDA) – indirectly encourages farming in frequently inundated areas, including wetlands • U.S. Tax Code (IRS) – Encourages draining and clearing of wetlands for agricultural purposes with tax deductions and credits for development activities. • Surface mining Control and Reclamation Act (DoI) (1977) – establishes program for regulating surface mining and reclaiming coal-mined lands, including wetlands. (US OFFICE of SURFACE MINING & RECLAMATION and ENFORCEMENT, 1977) • Water Resources Development Act (Corps) (1976, 1990) – water development projects directly and indirectly degrade wetlands
discouraging or preventing wetlands conversion through regulation	• Coastal Zone Management Act (NOAA)(1972) – provides federal funding for wetlands programs in most coastal states, including preparation of management plans. • Arctic National Wildlife Refuge Act (see ANWAR)) established in 1960 by Eisenhower Administration, under legislation dating back to Theodore Roosevelt (1903). • National Environmental Policy Act (AFA) (1969) -requires environmental impact statement for any federal actions significantly affecting environment.
discouraging or preventing wetlands conversion through acquisition	• Migratory Bird Conservation Act (1929) Established commission to approve acquisition of migratory bird habitat • Land and Water Conservation Fund Act (1964). Provides for acquisition of wildlife areas • Coastal Wetland Planning, Protection and Restoration Act (FWS)(1990) - Provides for interagency wetlands restoration/conservation planning and acquisition in coastal States. • North American Wetlands Conservation Act (DOT) (1989) – Authorizes funding for wetland mitigation banks for State Departments of Transportation. • U.S. Tax Code Tax Reform Act (IRS) (1986) – tax deductions for donors of wetlands and to some non-profit organizations. • Wetlands Loan Act (FWS)(1961) - Provides interest-free loans for wetland acquisition and easements.
discouraging or preventing wetlands conversion through other policies or programs	• Endangered Species act (1973) – provides for protection of wildlife, fish and plant species in danger of extinction • Executive Order 11990 – Protection of wetlands (AFA) (1977) requires Federal agencies to minimize impacts of Federal activities on wetlands. • Fish and Wildlife Coordination Act (FWS)(1965) – requires Federal agencies to consult with FWS before issuing permits for most water-resource projects • Food, Agriculture, Conservation, and Trade Act of 1990 (NRCS) – Wetland reserve program purchases perpetual nondevelopment easements on farmed wetlands to subsidize restoration of croplands to wetlands

Table 4.5.1 examples of policy & programs impacting wetlands (Votteler & Muir, 2002) (updated)

Federal Agency	mission
U.S. Army Corps of engineers (Corps)	Navigation and water supply
U.S: Environmental Protection Agency (EPA)	Wetlands protection primarily for their contribution to the chemical, physical, and biological integrity of the USA waters
Department of the Interior, Fish and Wildlife Service (FWS)	Steward of the National Wetlands Inventory Managing fish and wildlife, game species and threatened and endangered species
Department of Commerce National Oceanic & Atmospheric Administration (NOAA)	Managing the coastal resources
Depart of Agriculture Natural Resources Conservation Service (NCRS)	Wetlands affected by agricultural activities
State of Alaska, Department of Environmental Conservation (DEC)	

Table 4.5.2 – distribution of federal and state authority for wetlands-related issues

NOTE: As more responsibility is delegated from the Federal Government to the States, State wetland programs are gaining in importance. Thus far, States have devoted more attention to regulating coastal wetlands than inland wetlands.

THE NORDIC STATES AND THE EU WATER FRAMEWORK DIRECTIVE

The WFD (Directive 2000/60/EC) has been characterized as "one of the most important and most ambitious pieces . In what the EU characterizes as a "multi-stakeholders' cooperation process at the biogeographical level, including seminars, workshops and cooperation activities to enhance effective implementation of legislation in the history of the European Union's (EU) environmental policy" (Bourblanc et al., 2013, p. 1449)23/11/2020 08:32:00 (Bourblanc et al., 2013). As a "framework" directive, it offers Member States considerable flexibility in setting objectives and national-level institutional arrangements for pursuing those objectives. What is does do is require a general structure and procedures, including reporting requirements and deadlines, that are intended to substantially improve water quality within the EU (Chave, 2001). The WFD continues a shift toward more systemic approach to tackling environmental degradation and protection by organizing action by river basin rather than political boundaries (Bourblanc et al., 2013). For Arctic countries that are a part of the EU system of law, this of course affects wetlands.

Following the Directive, the countries involved are required to develop implementation plans referred to as a "Programme of Measures (PoM)." From 2001 the European Commission has supported an informal effort called the Common Implementation Strategy, through which EU Member States' agencies responsible for water and environmental protection have worked with other stakeholders to address common challenges encountered in implementing the Directive, including measurement and assessment of ecological status, chemical and other pollution, and sharing practical experience in translating the framework into practical actions (Keto et al., 2015).

Here, as elsewhere, collaboration between the Nordic countries in their implementation of the WFD and includes considerable investment in sharing ideas and practices. As an example, an informative and succinct overview of the water status, implementation actions and plans of Iceland, Norway, Sweden and Finland based on Nordic collaboration (Denmark did not participate) is available (Bourblanc et al., 2013, p. 1449). This collaboration is especially important partly as a function of shared watersheds, where greater cross border cooperation is needed, and where comparability of indicators is critical to the success of the efforts. Identifying and refining ways of effectively supporting participation by the public and other types of stakeholders is also key, both as a means for properly engaging similar groups of stakeholders, and for managing shared watersheds.

While the WFD has been transposed into national law in each of the Nordic countries, there is significant variation between the countries in how it has been manifested in terms of its organization and implementation as illustrated below in figure 4.x (Carson et al., 2019; Land

& Carson, 2019). These differences are a product of historical trajectories and other political, economic and organizational factors specific to each national context. Norway and Iceland are implementing the WFD by virtue of their membership in the European Economic Area. Sweden is considering a restructuring of its WFD organization (SOU 2019:66, n.d.)

	RBDs Nat.(IRB)	Organisation structure	WFD coordination National Level	Regional level
Finland	8 (2)	Ministry group	Ministry of Environment and Syke	RBD Coordination: Competent ELY centres
Sweden	5 (3)	Water Board (Vattendelegation)	Swedish Agency for Marine and Water Management Swedish Geological Survey	The Competent Authorities (Vattenmyndigheterna) County Administrative Board Länsstyrelserna)
Norway	11 (6)	Ministry group Directorate Group County level-FK/FM/VRU Local project leaders	Monistry of Environment and Ministry of Energy and Petroleum DN	FK (County governor)
Iceland	4 (0)	Similar to Norway but execpt county level	Environment Agency of Iceland	Environment Agency of Iceland

Table 4.53 Organization of the WFD in Nordic Countries.

Several features of the WFD are especially relevant for wetlands protection. Its adoption of a systemic approach, broadly reconceptualizing inadequate water quality as the problem in focus rather than specific pollutants or disturbance, and due to a shift to defining geographic boundaries on basis of river basin ecosystems rather than political boundaries (Bourblanc et al., 2013). Yet, the ecosystem focus makes transnational cooperation a necessity in cases of a watershed that spans more than one country. In the case of the Nordic countries, collaboration on implementing the WFD has contributed to significant sharing of practical experience between those countries (Halleraker et al., n.d.). The participation of a diverse range of stakeholders is a key requirement of the WFD and is evaluated in periodic EU reviews of WFD implementation (European Commission, 2003).

A single instance of explicit EU guidance on wetlands protection under the WFD (EC, 2003) was identified although it makes no specific reference to the Arctic. Similarly, scientific publications highlight the importance of wetlands in the WFD context for climate and other considerations, but without specific reference to the Arctic (Ignar & Grygoruk, 2015). The authors highlight the potential ecosystem improvements that could be achieved by the WFD and explicitly take up the question of synergies and conflict between different Directives – in this instance between Natura 2000 and the WFD. One of its conclusions is "that in order to succeed with the adaptive management of wetlands facing climate change, social sciences should be more deeply involved in EU environmental policy inducing attitudes of managing authorities and users of valuable wetlands" (Ignar & Grygoruk, 2015, p. 3). ...

In addition to the WFD, other European Union directives and initiatives guide country activities impacting wetlands. A comparatively recent initiative (initiated in 2012), the Natura 2000 Biogeographical Process, follows a trend of integrating multiple elements that were

previously separate initiatives. The biogeographical process links the biodiversity strategy (EC, 2010, adopted in conjunction with EU countries' commitments within the Convention on Biological Diversity), the Habitats Directive (Council Directive 92/43/EEC, 1992) and the Birds Directive (Council Directive 2009/147/EC, 2010), management, monitoring, financing and reporting of the Natura 2000 network" (EC, 2012).

EU MEMBER STATE REGULATION, STATE & PROVINCIAL LEVELS

The next layer of regulation and management is implemented at the national level in the individual Nordic countries, and at the state or provincial level in the US and Canada. Russian regulation of wetlands remains at the national level/scale. In the Nordic countries, policy is developed within the broader context shaped by international agreements and EU directives. Nevertheless, they also take shape based on the complex social histories, institutional and political dynamics, and ecosystem and resource characteristics of the individual entities. These differences may contribute additional complexity to organizing the restoration, conservation and use of wetlands, yet the variety also offers insights that might be missed if not for the diversity of problem-solving efforts.

NORDIC COUNTRIES

While there are differences among the Nordic countries in exactly how the organization structures for water management are set up under the WFD, the complexities of the organizational structures, of managing participation, and of monitoring outcomes can be considered a challenge they all share. We can see that with transposition of the WFD at the national level through the parliamentary adoption of the necessary legislation, decision-making authority is delegated to key ministries and national-level implementation responsibility is delegated to multiple agencies or directorates. The exact combination of ministries varies; in each case the Environment Ministry has a lead role. For example, in the Norway example below, that lead role is shared by a "Committee of Ministries" chaired by the Ministry of Environment. In Finland, the Ministry of Environment steers in consultation with the Ministry of Agriculture and Forestry (Halleraker et al. 2013).

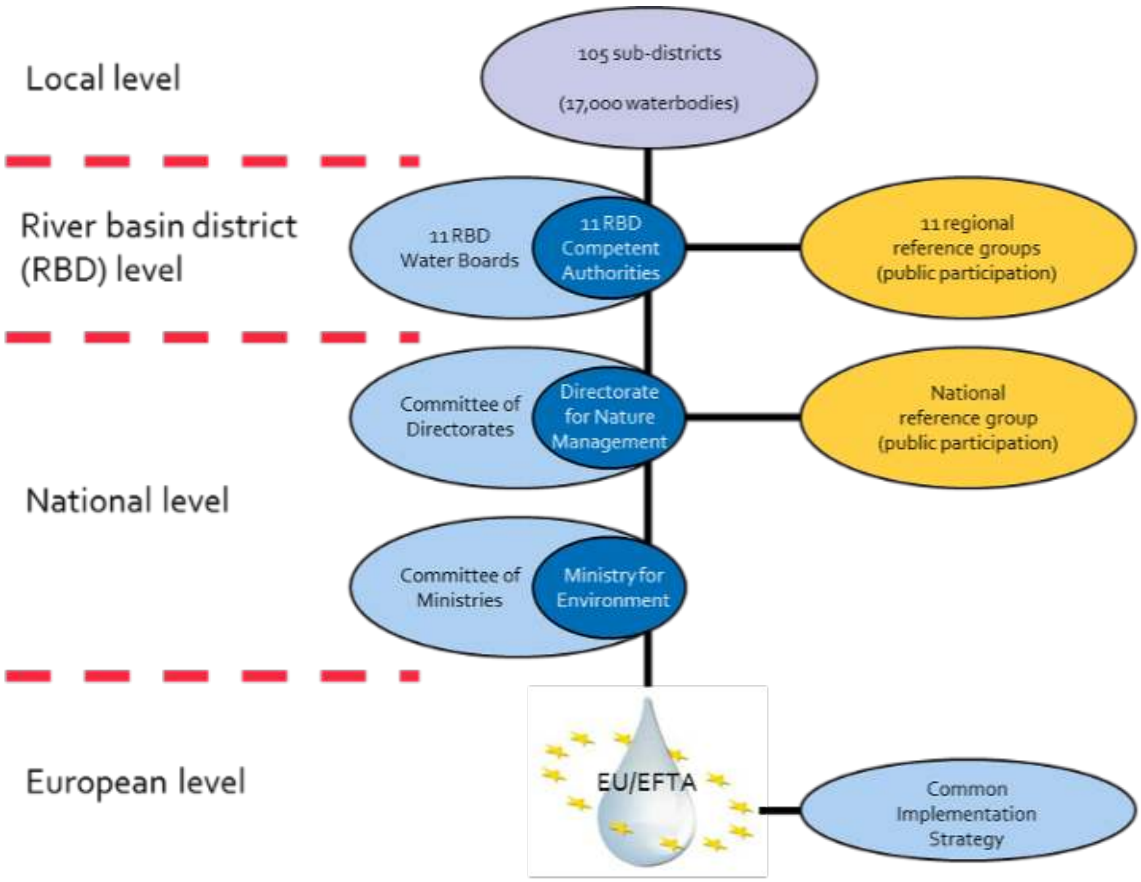

Figure 4.10 Organizational structure of Norwegian WFD implementation. Adapted from Halleraker et al 2013.

Also at the national level, a number of different governmental authorities share responsibility for implementation. In Sweden, the Swedish Agency for Marine and Water Management bears the lead responsibility with the Swedish Geological Survey, while other authorities such as Sweden's Environmental Protection Agency are also involved. In Iceland, the Environment Agency leads implementation efforts in collaboration with five other agencies/institutes, including the Icelandic Meteorological Institute, the Institute of Freshwater Fisheries; National Energy Authority; Institute of Natural History and Marine Research Institute (Halleraker et al 2013: 120). In Norway, national level responsibility is shared by the Ministries of Environment and of Energy and Petroleum. As illustrated in Table 3.1 below, the differences in lead responsibility in the respective countries illustrate the social, economic and policy intersections at which key social and economic priorities connected with water are to be managed – environment, renewable energy, agriculture, and natural resources – and highlight where essential priorities must be balanced.

	EU	Government	Central authorities	County Governments (Water District)	Municipalities	Branch Organizations	Professionals	Water organizations	General Public
Steering	■	■	■	■	■				
Guidance	■		■	■	■	■			
Supervision			■	■	■				
Implementation					■		■		
Water Conservation				■	■		■	■	■
Water Use					■	■	■		■

Table 4.5.4 illustrates the division of responsibilities and roles in the Swedish implementation of the WFD (adapted from Carson et al 2019).

While the Nordic countries engage in extensive collaboration on a variety of issues, including implementation of EU Directives, they also develop initiatives independently from one another. As one example, Finland's government recently approved investment in improving degraded habitats with its HELMI project, which aims to improve the condition of roughly 12,000 hectares of ditched mire by the end of 2023, much of it in or adjacent to protected areas. Much, although not all of the degraded area is sub-Arctic (Finland Ministry of Environment, 2020).

BOX 4.4.2.2. SWEDEN'S WETLANDS, POLICY AND INITIATIVES

With over 9 million hectares of wetlands area, Sweden is among the countries in the world with the largest proportion of its land area made up of wetlands – roughly 20 % of Sweden's total land area. Three-quarters of that land area (or 15% of Sweden's total land area) is peatland. In Sweden, the term "wetland" refers primarily to mires, wet forests and meadows, vegetated lakes and rivers and shore habitats.

An estimated 25% of Sweden's original wetlands area has been lost, mainly by drainage, converted wetlands to dryer land used mostly for forestry or farming (Naturvårdsverket, 2005) (Naturvårdsverket, 2005). Information from Sweden's wetlands inventory suggests that roughly 80% of Sweden's wetlands have been drained or otherwise disturbed by human activities to a varying point of degree. As recently as the 1980s, mires in Sweden were still being drained, often with government subsidies. Subsidies were ended in the early 1990s and changes in the legislation made drainage banned in parts of the country and a permission required in the rest.

In many cases the drained wetland ecosystems are changed, in ways that are sometimes un-natural and with reduced resilience. Drainage destroys the wetlands functions as carbon sinks and even worse, converts the sink to a carbon source as a result of peat decomposition. Degraded wetlands account for some 20 % of Sweden's greenhouse gas emissions (Barthelmes et al., 2015), in addition to impacts on biodiversity and water services.

In recognition of the social and ecological importance of wetlands, including peatlands, Sweden included "Thriving Wetlands" among its 15 environmental quality goals, adopted in 1999 (a 16th target was added in 2005). Sweden's wetlands strategy is also intended to contribute to fulfilment of Sweden's obligations under the Ramsar Convention and the Convention on Biological Diversity.

With these factors in mind, several initiatives have been set in motion. The Local Nature Conservation Program (LONA) (Naturvårdsverket, 2009) is intended to strengthen local support and engagement in nature conservation by providing partial funding for locally-developed projects that meet established criteria (Nordenstam et al., 2011). According to one evaluation, LONA has acted as a catalyst and an accelerator for nature protection programs, has strengthened interest among politicians and public servants, and the availability of financial support has helped reduce or remove barriers to carrying out projects. LONA has been an important factor in local engagement in nature conservation across Sweden. The program supports restoration of wetlands for increasing hydrological services to a higher degree than other kind of projects. Another program, LOVA, makes it possible to get funds for wetland restoration for retention of nutrients.

Restoring peatlands is considered an important contributor to achieving Sweden's greenhouse gas mitigation goals under the Paris agreement (SOU 2020:4). More recently, restoration of drained wetlands has been acknowledged as an important

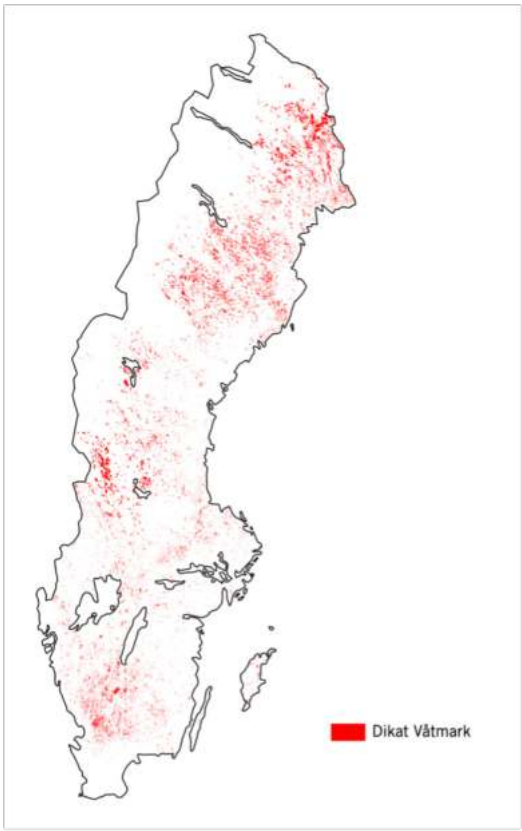

Figure 4.11 Drained wetlands in Sweden (NOTE: many drained wetlands areas in Sweden are not represented on the map due to their small size. Taken together, however, they represent a substantial area of damaged wetlands. The horizontal line represents CAFF boundary).

measure for regulating water flows. The investigation that developed the recommendations covers a variety of means for ensuring that Sweden reaches negative emissions after 2045 through active development of carbon sinks such as peatlands. Specific to wetlands, the report emphasizes the importance of initiating re-wetting of drained peatlands (a substantial portion of Sweden's drained peatlands are found in the Arctic and sub-Arctic), and recommends an increase in investment in wetlands restoration. The report also urges the relevant agencies to develop criteria for assessing and prioritizing different types of wetlands for re-wetting (SOU 2020:4, p93-96).

STATE AND PROVINCIAL LEVELS

In Alaska, the only US state in the Arctic, regulation must be compliant with national legislation; in Canada, where national legislation regulating activities impacting wetlands is limited, the provinces dominate. Nevertheless, Canada's national policy is often reflected in provincial policy. Due to the number of Canadian provinces with territory in the Arctic and the variation in policy, they are not covered here.

ALASKA

Some states view the regulation of wetland alteration as the foundation of a state wetland program, and build other components – e.g. mapping, wetland assessment methods, and mitigation – to address regulatory needs. In other states, regulation has been viewed as the culmination of program development, making use of state expertise to ensure protection of identified essential resources. There are examples of successful regulatory programs that have evolved from either direction (Alaska DEC, 2015).

Provisions in the CWA allow for states to take over key responsibilities under the law, although to date. only a couple of states have done so. Among the initiatives funded under the CWA, the US EPA initiated the Wetland Program Development Grant program in 1990 to support "assist state, tribal, local government (S/T/LG) agencies and interstate/intertribal entities in developing or refining state/tribal/local programs which protect, manage, and restore wetlands (EPA, 2017). With funding from this program, the Alaska Department of Environmental Conservation (DEC) initiated a wetlands planning program between 2016-2018 (Alaska DEC, 2015), which for the state of Alaska aimed to:

..... to establish a strategic statewide plan for assessing the state's wetlands, compile science-based information to identify wetland functions and values, and develop a framework for identifying, evaluating, and implementing efficiencies in wetland regulatory programs within the state. The Alaska Wetland Program Plan will be used to establish a cooperative and collaborative approach to manage Alaska's wetland resources for their recreational, economic, environmental and human health benefits. (DEC 2015).

Key goals for the state of Alaska encompassed several elements that are of particular interest for the goals of this report:

1. Establish baseline environmental data for wetlands
2. Develop criteria for assessing wetland condition and ranking
3. Develop wetland monitoring and assessment methodology
4. Support the existing permitting process
5. Develop a comprehensive mitigation strategy
6. Provide education and outreach
7. Identify long-term financial support

While the results that were achieved in this planning process await consolidation and publication, the experience and expertise and experience gained through the process of pursuing its detailed objectives are likely to be valuable as a shared resource.

Also, in Alaska and at a local level, EPA grants have supported development of wetlands management plans. As one example, the county of Matanuska-Susitna Borough (Mat-Su/MSB) developed their plan around nine key issues related to wetlands area, as highlighted in Fig 4.X. Also worth noting is how the plan emphasizes that "successful wetlands management requires a community-wide effort" (Mat-SU, 2012), calling on "residents, visitors, homeowners, businesses, educators, developers, local governments, trail users, outdoor recreationists, conservation groups, land trusts, state and federal agencies, and the MSB to work together to conserve and protect Mat-Su wetlands". This call for cooperation and collaboration highlights one of the gaps that needs further attention – an enumeration of the various kinds of interests and civil society organizations that have a stake in how wetlands are used and conserved.

Figure 4.12 Key wetland management issues. Source: Mat-SU, 2012

4.4.3 OVERLAPPING CONSERVATION ARRANGEMENTS

One notable feature of protected Arctic wetlands is that many of these areas have been placed under multiple programs and regulatory arrangements. In the Nordic Arctic, for example, it is not unusual for a wetland area to be a Ramsar site, to be designated as a Natura 2000 Area (a European Union protection designation) and to also be a national park or a UNESCO World Heritage site. One might initially assume that such layered arrangements provide greater protection. However, while there may very well be clear benefits, these extra layers also come with different purposes and specific regulatory and reporting requirements. While in some instances these programs may reinforce one another, their purposes and requirement may other instances align poorly, require additional effort, or at times conflict with one another (Buschman, 2019).

4.4.4 PUBLIC PARTICIPATION IN WETLANDS CONSERVATION

A broad movement toward seeking to engage stakeholders and rightsholders and an interested public is apparent in both the published literature and in regulations. As a result. public participation in wetlands conservation and use are increasingly common, expected, and often required. For example, public participation in the management of Ramsar sites is well developed, with an extensive range of publications to support methods that can be used. Participation is required under the EU WFD, although it is structured in different ways among the Nordic Countries. Calls for public participation in conservation planning and implementation is also a notable feature in the diverse literature on wetlands restoration and conservation (see, for example: Alaska DEC, 2015; Baker & Eckerberg, 2013b; Halldorsson, 2012). At the international scale, the Convention for Biological Diversity has had guidelines and expectations for indigenous participation for over a decade (UNEP/CBD, 2007).

The trend toward increased public participation in wetlands conservation planning and implementation is driven by both pragmatic and normative concerns. From a pragmatic perspective, conservation regimes are likely to be more appropriate and robust when local knowledge of wetlands ecosystems and their specific local uses are known and incorporated into planning and regulatory considerations (Buschman, 2019; Jonsson, 2005; Reed, 2008). Under the rapidly changing conditions experienced in the Arctic, appropriate changes are also more likely to be incorporated when local knowledge and observations of change can be used to inform ongoing conservation efforts. (Kasemir et al., 2003; Stringer et al., 2006). Nearby residents are also more likely to support and abide by protections where they have been involved in establishing them in the first place. And from a more normative perspective, it is important that indigenous and other local communities should be engaged in planning and decision making.

Both pragmatic and normative drivers carry a special significance in the Arctic, where local communities are in many instances indigenous communities. Traditional knowledge has proven to be an important resource (Davidson-Hunt & Berkes, n.d.; Johnson et al., 2015; Parsons et al., 2017), and the Arctic wetlands to be protected are often play a central role in traditional livelihoods, and therefore also are essential elements of indigenous communities' food security (Beaumier & Ford, 2010; Buschman, 2019; G. P. Kofinas & Chapin, 2009).

Given indigenous peoples' land rights and land management role in the Arctic, their engagement is especially important, and supported in part through guidelines agreed to through the CBD. It is important to note, however, that participation and engagement come in diverse forms. Buschman (2019:21) highlights what can be seen as a continuum of participation, ranging from "informing" and "consultation" on one end of the spectrum, to collaborative approaches such as co-production on the other (see Figure 4.x). It is important to note that the distinctions highlighted below are often muddied, and that as the strength of combination of pragmatic and normative drivers grows, participatory approaches trend toward co-management and production.

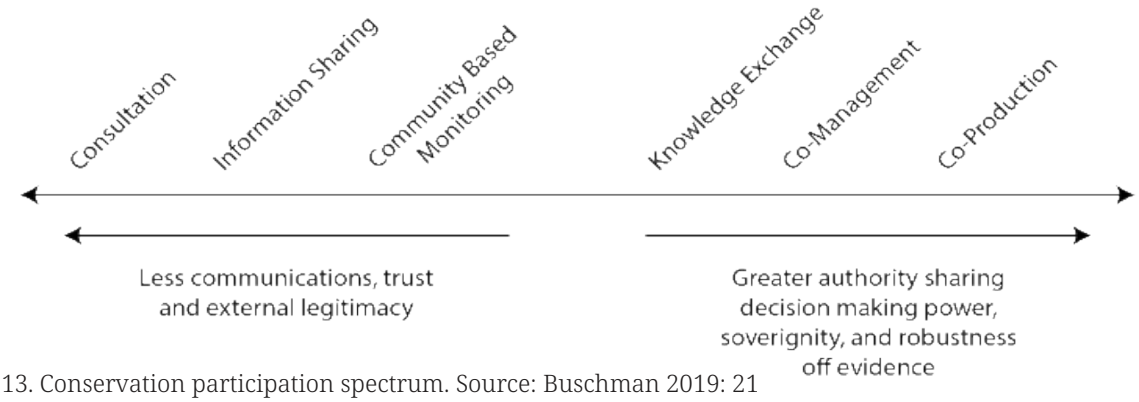

Figure 4.13. Conservation participation spectrum. Source: Buschman 2019: 21

Based on the publications reviewed that pertain to participation in wetlands management and stewardship, we can identify three key issues that merit further attention.

1. Public participation in wetlands management is widely recognized as an extremely important ingredient for successful efforts;

2. achieving high levels of public participation entails a variety of challenges, as does the balancing of potentially diverse goals and interests

3. "participation" covers several different levels of engagement and influence under the same heading, which in some can contribute to legitimate frustration and reduced incentive to participate.

4.5 MAPPING AND MONITORING

A considerable effort has been invested in mapping wetlands in order to highlight the extent and classification of wetland ecosystems and their condition and importance, both globally and regionally (Gunnarsson et al., 2014; Joosten et al., 2017; Rotherham, 2020). Phase 1 of this wetlands project found that while Arctic countries have conducted wetlands inventories at national and/or regional levels and most are not complete. The classification systems differ between countries and completing and keeping inventories updated is difficult (Land & Carson, 2019). The different classification systems impair comparability and increase the challenges in sharing insights and lessons. The large extent of wetlands in the Arctic makes keeping up-to-date wetlands inventories a challenge, and the rapid pace of change due to climate change or other types of disruption exacerbates that challenge, two important developments offer valuable opportunities for beginning to address both these issues. Mapping scale also plays a role in the utility of data for informing management and policy decisions.

First, the use of remote sensing and artificial intelligence to map wetlands promises more accurate inventories that can more easily be kept up to date. These efforts have accelerated over the course of the past decade. Initially focused on technical questions such as types of data layers, resolution, and accurately distinguishing between different wetlands features, the foundations are increasingly well-developed and steps toward such mapping are well underway (Bosma et al., 2017; Gorokhovich et al., 2014; Guo et al., 2017; Mahdavi et al., 2018; O'Connell et al., 2015; Pflugmacher et al., 2007).

Given that a knowledge of current and rapidly changing status of wetlands in remote areas is key to mitigating or compensatory actions, the development of inventories based on geospatial data and computer modelling is especially important. And at the same time the mapping develops, technology can be explored to develop data structures in ways that make country inventories comparable.

The second important opportunity is collaboration with the Arctic Spatial Data Infrastructure (ASDI). ASDI representatives participated in the spring 2019 expert workshop in Stockholm and indicated an interest in supporting wetlands mapping efforts through its ongoing collaboration with CAFF. The goal is to complete wetland inventories at "management level scale" and build a circumpolar database on the types and changes in coverage of wetlands in the Arctic. Such a tool would help facilitate more timely responses to changes in Arctic wetlands. This effort has agreed to focus initially on peatlands given their importance for climate mitigation, with a focus on types of peatlands that have characteristics that are relatively easily mapped.

4.6 DISCUSSION

The materials summarized above highlight the ways in which the complexity and diversity of Arctic countries' wetlands ecosystems are matched by the complexity and diversity of their efforts to steer activities within their respective borders to effectively balance conservation and use of their wetlands. Despite many significant social and ecological differences across the Arctic states, we can see recurring themes in efforts to balance conservation and long-term ecosystem health with what are often more short-term benefits to particular societal interests, local communities and societies at a national level. The diversity of wetlands, the need for balancing conservation and use, and a long history of degradation contributes to a complex array of policies for weighing interests, establishing priorities and adequately engaging societal interests. Geographic and political scale adds a further dimension of complexity that contributes additional potential for policy inconsistencies and competition among responsible authorities, both of which can easily be manifested in falling short of goals for wetlands conservation, biodiversity protection, and climate mitigation.

5. IMPORTANT KNOWLEDGE GAPS

As this Phase 2 report makes clear, there is an abundance of scientific and practical knowledge regarding restoration and management strategies for Arctic wetlands, even while there remain important areas where additional knowledge will be crucial to targeting and prioritizing specific degraded wetlands areas for special attention. In this section, we examine findings from the previous sections to identify 4 key types of gaps that if addressed, could provide important insights in support of efforts to restore, conserve and wisely use Arctic wetlands resources.

5.1 GAP 1- POLICY COMPARISON, COMPLEXITY AND COHERENCE

The overview of restoration initiatives, management strategies, and policy context in Section 4 illustrates a number of key issues that hold promise. Each of the areas identified below would entail gathering additional related to policies in effect that originate at different scales, but must still be implemented at the national and local levels. Further analysis of aspects of these policies and their implementation offers insights likely to be useful for considering how local, national and global ambitions for restoration and stewardship of Arctic wetlands might be more effectively realized.

COMPARATIVE ANALYSIS OF WETLANDS POLICIES

Significant benefits can be accomplished through systematic "horizontal" comparisons of national-level efforts to identify examples of effective policy and practice. While this practice is common and routinely practiced (for example, among the Nordic countries), no pan-Arctic comparisons based on countries' different wetlands policy frameworks and histories were found. Such analysis may provide unexpected insights that could include better understanding about what works well across Arctic systems, and could also highlight effective efforts or initiatives that are more developed in specific policy contexts. Such insights would be available with closer, systematic comparison of efforts across the Arctic states that were not possible in the context of this project.

POLICY COMPLEXITY & COHERENCE – MULTIPLE LAYERS OF LAW AND REGULATION AT DIFFERENT SCALES

A second and somewhat more subtle policy analysis focuses on coherence in the context of complexity. Such an analysis can be seen as "vertical" in that it analyses policy and practice in its broader, multi-scaled context. A variety of different studies have identified areas in which policies at one scale confuse or complicate those at another – the policies and practices set out for guiding and activities that impact wetlands and for ensuring effective implementation (Alaska DEC, 2015; Joosten, 2015).

ORGANIZATIONAL CONFIGURATION – ORGANIZATION OF RESPONSIBLE AUTHORITIES AND AGENCIES

An analysis of the distribution of policy authority would contribute to better understanding the extent to which a given architecture is consistent with Arctic states' goals and needs for Arctic wetland restoration and stewardship.

Multiple authorities and agencies involved in implementing programmatic efforts and these authorities and agencies often have quite different missions, involving goals that are incommensurable – or not comparable with one another. They also enjoy differing levels of authority and leverage within their respective governments, sometimes a function of mission, sometimes a function of the influence of important constituencies (Burns & Carson, 2002; Carson, 2003; Carson & Burns, 2009). As one example, the primary responsibility for food safety issues in the European Union was transferred in the context of the food safety crisis with so-called Mad Cow disease from the Directorate General (DG) responsible for Agriculture to the DG responsible for public health as a way of ensuring the prioritizing of food safety during a particularly difficult time for the EU. An analysis of the distribution of policy authority is likely to contribute significantly to better understanding the extent to which a given architecture is as consistent as it might be with the needs for Arctic wetland restoration and stewardship

5.2 GAP 2 - ORGANIZATIONAL INTERESTS AND POLICY NETWORKS AND CONSTELLATIONS:

As with other issues, multiple societal interests need to be taken into account in decisions about balancing conservation and use of Arctic wetlands. Societal interests frequently organize themselves to represent and promote specific preferences, and align themselves in networks and constellations that have been characterized in a variety of descriptive terms, among them epistemic communities (Haas, 1992), policy advocacy coalitions (Paul A. Sabatier, 1987; Paul A. Sabatier & Weible, 2014) and policy networks (Meek, 2013; Ylä-Anttila et al., 2018). As these constellations are dynamic, minor changes can sometimes lead to major shifts in policy and practice as interests realign to put their weight behind adjusted priorities (Burns & Carson, 2002; Carson & Burns, 2009, 2009). While there are many commercial, governmental and civil society organizations at the international, national and local levels that pursue a diverse and wide-ranging array of goals related to Arctic wetland. In addition to government agencies, many of these organizations are listed in this report, including Wetlands International, the U.S. Association of State Wetlands Managers, the Worldwide Fund for Nature (WWF), Canadian Sphagnum Peat Moss Association, Fuglavernd/BirdLife Iceland, the Society for Ecological Restoration, the Finnish Board for Ecological Restoration, and more. However, our review did not identify any analysis of such organizations' networks or constellations and their engagement with wetlands issues. Such analysis could go a long way to sharpening the picture of organized societal interests, their relative influence, the issues they care about, and how they might be enlisted to support ambitious efforts to restore and conserve Arctic wetlands.

5.3 GAP 3 - PUBLIC AND POLICYMAKER PERCEPTIONS OF WETLANDS

The challenges that arise from a negative or inaccurate public perception of Arctic wetlands as wastelands are noted previously in this report. There is anecdotal evidence that this perception has been undergoing a fundamental change over the past several decades – both on the part of the public, and among policymakers. Nevertheless, many of the warnings continue to go unheeded, at least in part due to inaccurate perceptions. A country by country evaluation of public and policymaker perceptions of wetlands' role and importance would provide valuable knowledge, but here we suggest going beyond perceptions to an analysis of how wetlands are problematized in the context policy, including not only regulations governing how the balance between use and conservation is managed, but also resource allocation that enables restoration and conservation. The ways in which issues are defined as policy problems define the level of priority, who is consulted for relevant knowledge, which authorities have lead responsibility for implementation and monitoring, and how trade-offs are structured (Carson & Burns, 2009; Coleman et al., 1996; Hall, 1993). Such problem definitions are often contested, and the literature on agenda setting suggests that societal actors who are successful in shaping problem definitions enjoy an increased likelihood of prevailing on their issues of concern (Adger et al., 2002). Yet there is generally unexploited potential to define policy problems in win-win terms that facilitates more robust action.

5.4 GAP 4 - REAL-TIME STATUS ASSESSMENTS:

While the first three gaps identified pertain to policy development and implementation, the fourth focuses on policy feedback and knowledge about status change in Arctic wetlands. This project's Phase 1 report noted that while each of the Arctic states has wetlands inventories that include the Arctic, the extent to which they are complete and up to date varies considerably, as does the logic with which wetlands are categorized and information organized. While this represents a serious challenge, several initiatives (one directly linked to this project) promise to deliver data on Arctic wetlands status that is not only more current, but is also more comparable across Arctic states, and being up-to-date is at least as important as comparability. These projects make use of the increasing capacity of AI tools, as well as satellite imagery, to distinguish formations and wetlands structures that were until quite recently discerned by individual scientists scouring photo images for tell-tale signs. While accuracy remains an issue to be resolved, the speed with which cutting edge technology promises to provide information and insight is encouraging, and would enable more fine-tuned analysis of not only what is eroding due to climate change and other human impacts, but also provide crucial feedback on whether restoration efforts are having the desired effects and to what extent. More up-to-date feedback on the condition, location and type of Arctic wetlands areas is important for tracking the rapidly changing conditions in the Arctic and their consequences, and also important for assessing how well restoration and stewardship initiatives are progressing in achieving their hoped-for outcomes.

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6. CONCLUDING REFLECTIONS AND THE WAY FORWARD

The third phase of this Arctic wetlands project will develop actionable recommendations for policy initiatives and management strategies to improve the status and condition of Arctic wetlands. While some of these recommendations are likely to be new, previous efforts have produced a variety of important suggestions and recommendations that remain valid. Here we summarize some of the common themes found among previous recommendations from North American context, the Scandinavian context, and Russian Federation, as well as general recommendations (Alaska DEC, 2015; Bonn et al., 2016; Joosten, 2015; Joosten et al., 2017). The literature reviewed in this report echoes many of these recommendations.

COMPOSITE OF PREVIOUS RECOMMENDATIONS ON ARCTIC WETLANDS? (ALASKA DEC, 2015; BONN ET AL., 2016; JOOSTEN, 2015):

- Mapping and monitoring: Establish baseline environmental data for Arctic wetlands, develop methods for monitoring and criteria for assessing wetland condition, develop methods for prioritizing areas for restoration and conservation;
- Expanding restoration & conservation efforts: Strengthen wetland restoration, including restoration of damaged tundra and peatland rewetting. Promote restoration as a means of meeting national and international policy targets for biodiversity conservation, water quality and climate mitigation. Use pilot and demonstration projects to test methods and strategies for Arctic wetlands restoration and conservation. Share results widely with practitioners, policymakers and the public.
- Education and outreach: to communicate the societal benefits of wetlands ecosystems – for both publics and policymakers;
- Engage indigenous and local knowledge: Indigenous communities have balanced conservation and use of wetlands areas for generations. The expertise and capacity developed in the course of that use is invaluable;
- Public participation, local engagement: as a means of education and outreach, tapping into local expertise, tailoring restoration and conservation to mesh with local needs and also strengthening the eventual outcomes of restoration and conservation efforts;
- Finance: Identify approaches to financing restoration and conservation, while also abolishing or reducing subsidies that drive wetlands degradation;

Photo: Oleg Senkov, Shutterstock.com

[13] For an example of such an effort, see English abstract in (Aapala et al., 2020)

The compilation of recommendations summarized above focuses on what can be seen as four separate and interrelated categories of effort. The first category, mapping and monitoring, is important for understanding current status, rates of change, and identifying priority areas for action[13] . Improvements in mapping are needed to effectively target areas for restoration and monitor the success of those efforts. The second, restoration, speaks to recovering the multiple ecosystem and human benefits provided by Arctic wetlands, and can be pursued through using established and newly developed methods for repairing damage already done. The third is addressed to securing, respecting and sharing knowledge, and ensuring meaningful opportunities for people who have a stake in wetlands to be fully engaged – and in particular, the Arctic's indigenous peoples. The fourth is about ensuring that resources are available for financing restoration and stewardship, including identifying creative approaches to securing those resources. In addition to these recommendations, section 5 identified policy-related additional areas which if better understood, could contribute to more successful stewardship of Arctic wetlands.

This report has summarized what amounts to fifty years of insight and policy responses aimed at addressing wetlands degradation, with the Arctic in focus. It is quite apparent that as with other wide-ranging environmental issues, enough is known about the urgency of ecosystem status to take decisive action. But as with climate change, biodiversity loss, the omnipresence of plastics, and other pressing questions, the key limitations lie in understanding of the social forces that influence policy and action options. Phase 3 of the Resilience and Management of Arctic Wetlands project will review the gaps identified and priorities urged in previous publications with the aim of developing concrete, actionable recommendations that can help improve the condition of Arctic wetlands, and in doing so contribute to shared goals for ensuring water benefits for communities, help protect biodiversity, and support climate related goals.

Arctic wetlands represent an urgent ecosystem challenge for a variety of reasons ranging from their role in climate regulation, to their role in supporting biodiversity, to their role in supporting the cultural practices and livelihoods of people living in the Arctic, especially Indigenous communities. We are optimistic that as this project heads into its third and final phase, that a suite of constructive options for accelerating restoration and conservation of Arctic wetlands is within reach.

Photo: Incredible Arctic, Shutterstock.com

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