Stockholm Environment Institute

Arctic wetlands: time bomb or saving grace?

SEI project brief
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- **Project:** Resilience and Management of Arctic Wetlands
- **Duration:** Winter 2018 to spring 2020
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Wetlands areas have often been thought of as wastelands – areas believed to be largely useless, even hazardous, due to their waterlogged or water-covered condition through significant periods of the year. This widespread misunderstanding led to wetlands often being drained, landfilled, even paved over, depriving both people and nature of wetlands' many critically important ecosystems functions and benefits to people. Among these functions are support for biodiversity – bird, animal, plant and other life – and storing carbon. Historically wetlands have helped people survive, producing fish and game, and, during early agrarian periods, hay for livestock. But during the industrial revolution and until recently, demands for more intensive land use, including forestry and agriculture, led to wetlands being destroyed. This disturbance of wetlands' important functions, and the fact that thawing in Arctic wetlands has already begun to release toxic mercury,[1] makes wetlands a potential time bomb[2] – or, if protected, a saving grace.

Wetlands come in a variety of forms and different ecosystems and produce different ecosystem services. Peatlands, for example, constitute the largest terrestrial storehouse of carbon on the planet – roughly one-third of the carbon stored on land.[3] Another word for a peatland ecosystem is mire, and many mires (if not drained) still produce peat and store carbon as a result of decomposition of plant material in a wet and oxygen-poor environment. Mires are a type of wetland and, in turn, differ based on their water flows and sources, on their chemistry and, on the plant species that live in them. The chemistry of these subtypes is important in its influence on plant and animal life – or more generally, biodiversity – and on the ways and intensity with which they cycle or store carbon. Bogs are mires with their water supply coming only from direct precipitation. Fens get additional water from their surroundings, and with it, dissolved minerals. Wooded mires are often called wet forest or swamps. Each mire type has unique ecosystems and species compositions.

Don't drain that swamp!

Familiar phrases such as "drain the swamp" originated with the desire to increase available space for food or wood production, to reduce pests and make local environments more comfortable. As a metaphor it has enjoyed political popularity on and off for many decades.

Photo (above):

Table 1. Peatland areas, total country CO_2 emissions in 2012 (without LULUCF), and CO_2 emissions from peatlands in Denmark, Greenland, Faroe Islands, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden and selected Oblasts from Northwestern Russia.

	a. Total peatland area	b. Drained peatland area		c. Total CO_2 emissions without LULUCF	d. Total peatland CO_2 emissions	
	km^2	km^2	% b of a	Mt CO_2 yr^{-1}	Mt CO_2 yr^{-1}	% d of c
Estonia	9150	6619	72.3	17.08	8.04	47,1
Latvia	11 143*	7978*	71.6	7.43	13.53	182.0
Lithuania	6460	4679	72.4	14.84	7.70	51.9
Finland	83 198	64 931*	78.0	50.70	20.68	40.8
Sweden	85 023*	15 458*	18.2	45.71	10.58	23.1
Norway	46 211*	4348*	9.4	52.70	6.26	11.9
Iceland	5777*	3665*	63.4	3.32	7.66	230.4
Denmark	2029*	1892*	93.2	38.03	3.34	8.8
Greenland	75*	3*	4.0	0.60	0.00	0.3
Total	**249 066**	**109 573**	**44.0**	**230.42**	**77.79**	**33.8**

* Peatland data were not available or considered to be unreliable. Therefore, organic soil data have been used.
Source: Barthelmes, A. et al. (2015).

However, drainage of wetlands, especially peatlands, causes naturally stored peat to oxidize into CO_2, and often, also nitrogen oxide – both greenhouse gases – contributing significantly to climate change. Drainage also increases fire risk and, ultimately, causes loss of productivity and biodiversity through soil subsidence, erosion and increased nutrient loads into surface waters. The IPCC 2013 Supplemental Wetlands Report highlights the lingering effect of drained peatlands. Carbon storage is a slow process and rewetting leads to temporarily higher emissions of methane (CH_4), a short-lived greenhouse gas. However, decomposition of former peatlands and wetlands areas releases even more carbon into the atmosphere, so the net effect of wetlands restoration is an important overall reduction of greenhouse gases (see Table 1). Rewetting wetlands and peatlands delivers benefits for biodiversity, water balancing, groundwater replenishment, and nutrient reduction.

Clearly, the "drain the swamp" metaphor is outdated. There is increasingly widespread understanding that not only is draining wetlands harmful and counterproductive, there are also huge social and ecosystems benefits can be achieved by restoring and/or protecting wetlands areas.

Widespread misunderstanding led to wetlands often being drained, landfilled, even paved over, depriving both people and nature of wetlands' many critically important ecosystems functions and benefits to people

Wetlands in the Arctic

There is much about Arctic wetlands that is unique – for example, much of the Arctic wetlands area is frozen for part of the year – yet as elsewhere, human interventions have caused and may continue to cause enormous damage. Wetlands International estimates that wetlands make up as much as 60% of all Arctic ecosystems and include a complex mix of peatlands, shallow open waters, wet tundra and seashore areas. These areas provide a variety of crucial ecosystems functions and serve as forage and breeding habitats for sensitive wildlife, especially migratory birds and numerous fish species. They play a vital role in supporting the livelihoods and traditional lifestyles of Indigenous Peoples across the Arctic through their role in supporting wildlife and their use for herding, harvesting food and extracting raw materials for a diverse range of products. And lands to which Indigenous Peoples exercise rights are especially important in conservation.[5,6] Arctic wetlands also store large amounts of carbon, but in peat and soil that is frozen for all or most of the year.

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However, these crucial ecosystems are changing at a perilously fast pace, with Arctic wetlands becoming drier due to permafrost degradation driven by climate-change, long term effects from earlier drainage, damming for hydropower and growing pressures from increased human presence. Permafrost thaw caused by a warmer climate is expected to increase greenhouse gas emissions from peatlands, and recent research also suggests it may become a source of hazardous mercury emissions, because mercury from two centuries of burning coal has been stored in frozen soils and peat.[1]

At the same time, effective management of Arctic wetlands, including restoration and conservation, holds enormous potential to contribute significantly to climate adaptation and mitigation, protect biodiversity and produce other benefits for Arctic residents and for societies. Moreover, Arctic wetlands are globally important, through their links with climate regulation, and as bird habitats and migration pathways, and for water purification and flood regulation as well as other ecosystem services.[4]

Governance and management of wetlands

There are various efforts by Arctic states and others to govern and manage human activities that impact on wetlands. The Ramsar Convention, an international treaty originally signed in the 1970s to protect migratory bird species, now focuses on the wetlands areas that provide habitat, food and nesting areas for birds and other species. At the regional level, the Water Framework Directive, the Habitats Directive, and other EU Directives influence the condition of wetlands areas by regulating human activities that affect wetlands ecosystems. In the US, the Clean Water Act regulates activities that impact water resources, including many wetlands areas.

These regulatory institutions inspire a wide range of local action to manage, restore and/or protect wetlands, yet much more needs to be done – especially in the face of rapid environmental change. In particular, there is a need for:

- more comprehensive inventories of wetlands areas that are comparable across countries to more effectively guide and assess policy measures
- a better understanding of which regulatory and management activities are most successful, and in which contexts, to multiply or scale up those activities, and
- comparative analysis of the strengths and weakness of current strategies and practices, which can help make efforts already under way more effective.

Doing so would make important contributions to mitigating climate change, protecting plant and animal species that depend on wetlands areas, and ensuring that communities continue to benefit from the wide range of ecosystem services that Arctic wetlands provide.

PROJECT OVERVIEW: RESILIENCE AND MANAGEMENT OF ARCTIC WETLANDS

The project aims to strengthen engagement around the roles and functions of Arctic wetlands as a resource to support sustainable development and resilience in the Arctic. The overall goal is to make policy recommendations based on scientific analysis and further develop management strategies to conserve wetlands' biodiversity and the ecosystem services they provide.

The project has three phases:

Phase 1 (December 2018)
In the first stage the team examined wetlands inventories across the Arctic. Inventories provide important information for management and policy-making and serve as a baseline for future policies. Phase one reviewed scientific research on Arctic wetlands to understand their importance for biodiversity and hydrology, and to understand how climate change will affect wetlands and their capacity for carbon storage. The first phase also included a preliminary mapping of ways in which wetlands are central to indigenous livelihoods. Incorporating local and indigenous knowledge is essential in the management of wetlands. Knowledge gaps and needs were also identified.

Phase 2 (January 2019 to autumn 2019)
The second and current stage of the project uses case studies as a way to examine regulatory efforts and management approaches aimed at maintaining important wetlands functions. The insights gained will lead to recommendations for policy and management actions that will be developed in the third phase. The second phase will continue to compile wetland inventories and further explore how wetlands support the livelihoods of Arctic Indigenous peoples. This will be carried out in collaboration with the Sámi Council and other Permanent Participant organizations of the Arctic Council.

Phase 3 (autumn 2019 to spring 2020)
The third stage will draw on scientific analysis, indigenous knowledge and practical experience to develop recommendations for policy initiatives and management strategies.

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