

Understanding patterns of biodiversity and ecosystem functioning of forested wetlands in Atlantic Canada: implications for conservation¹

Karen A. Harper and Cynthia A. Staicer

Herein we present a selection of papers highlighting the importance of forested wetlands in Atlantic Canada. This special issue is a product of a research program on forested wetlands conducted from 2016 to 2019 and funded in part by the Atlantic Ecosystems Initiative of Environment and Climate Change Canada, Government of Canada. Although forested wetlands in Atlantic Canada have been relatively understudied, the little research available suggests these are biodiverse ecosystems supporting rare species. Cameron (2009) found high structural complexity and diversity of vascular and nonvascular plant species in red maple (*Acer rubrum* L.) swamps in Nova Scotia. Hurlburt (D. Hurlburt, Nova Scotia Department of Lands and Forestry, personal communication) found high diversity and many rare species of odonate and tabanid insects in spruce bogs in western Nova Scotia. Others showed that forested wetlands are important to breeding populations of three landbirds at risk and identified stand-scale vegetation types (Nova Scotia Forest Ecosystem Classification; Neily et al. 2010) and structural features important to those bird species (Staicer et al. 2015; Westwood 2016).

The main goal of our research program was to increase knowledge about forested wetlands across the Atlantic provinces and to increase capacity for conservation of this habitat and its biodiversity under threat from various human impacts. Research projects focused on forested wetland biodiversity, habitat for species at risk, and ecosystem functioning in the four Atlantic Canada provinces. This research program involved many partners including Dalhousie University, Nova Scotia Department of Lands and Forestry, Bird Studies Canada, Port Hawkesbury Paper, other universities, non-governmental organizations, researchers, and students across Atlantic Canada. The geographic locations and research focus of partner projects were compiled by Rigolot (2019). Papers presented at the final workshop on 12 March 2019 in Halifax, Nova Scotia, were invited for submission to this special issue.

Papers in this special issue confirmed that forested wetlands have greater diversity of epiphytic lichens compared with adjacent upland forests (Padgett and Wiersma 2020), greater diversity of bumble bees compared with clearcut areas (Brooks and Nocera 2020), and are biodiversity hotspots for birds (Brazner and MacKinnon 2020). The greater abundance of bumble bees, important pollinators currently in decline, may be due to the greater variety of flowering plants in wet coniferous forests with high cover of herbaceous plants compared with harvested sites (Brooks and Nocera 2020). Avian biodiversity was higher in treed bogs, shrub swamps, and treed swamps than in mature and regenerating upland forest

(Brazner and MacKinnon 2020). In contrast, Harper et al. (2020) found that vegetation structural diversity was not a reliable indicator for forested wetlands and that tree structural diversity was lower at the edge of forested wetlands compared with both interior forested wetlands and upland forest; such variation suggests that entire forested wetland landscapes should be considered for conservation.

Forested wetlands provide important habitat for lichen and bird species at risk and play an important role in carbon cycling. Padgett and Wiersma (2020) found different community composition of epiphytic lichens in forested wetlands including a lichen of conservation concern, *Erioderma pedicellatum*. Compared with upland forests, forested wetlands, particularly treed swamps, have a greater abundance of bird species of conservation concern (Brazner and MacKinnon 2020). Concurrent studies related occupancy of bird species at risk to vegetation structure and composition (Zahavich 2020; Staicer 2021). Forested wetlands also act as a carbon sink; swamp soils receive greater inputs of carbon from litterfall than upland soils do and consequently store more carbon (Kendall et al. 2021). These treed swamps will continue to act as a carbon sink even with a doubling of greenhouse gas emissions (Kendall et al. 2021).

Conservation of forested wetlands in Atlantic Canada is currently hindered by a lack of knowledge about their spatial and size distributions, and how variation in their characteristics influences their biodiversity. The distribution and abundance of treed wetland types has been recognized as a knowledge gap in the Southwest Nova Scotia Natural Area Conservation Plan (The Nature Conservancy of Canada 2015). Our studies can be used as a baseline for future monitoring, and our georeferenced forested wetland data set will be ideal for testing any new provincial classifications that are developed. Our project will provide support to Provincial Maritime wetland policies (Government of New Brunswick 2002, Government of Prince Edward Island 2003, Government of Nova Scotia 2011), which all have goals related to increasing the awareness of wetland function in the landscape and identifying methods for classifying wetlands with exceptional biodiversity or hydrologic characteristics. Perhaps the greatest impact of our research program has been raising the profile of forested wetlands in both the science and conservation communities.

References

- Brazner, J., and MacKinnon, F. 2020. Relative conservation value of Nova Scotia's forests: forested wetlands as avian diversity hotspots. *Can. J. For. Res.* 50(12): 1307–1322. doi:10.1139/cjfr-2020-0101.

Received 29 June 2021. Accepted 12 July 2021.

K.A. Harper. School for Resource and Environmental Studies, Dalhousie University, Halifax, Nova Scotia, Canada.

C.A. Staicer. Biology Department, Dalhousie University, Halifax, Nova Scotia, Canada.

Corresponding author: Karen A. Harper (email: Karen.Harper@dal.ca).

¹This is the introduction to the virtual collection entitled “Biodiversity and ecosystem functioning of forested wetlands across Atlantic Canada”.

Copyright remains with the author(s) or their institution(s). Permission for reuse (free in most cases) can be obtained from copyright.com.

- Brooks, D.R., and Nocera, J.J. 2020. Bumble bee (*Bombus* spp.) diversity differs between forested wetlands and clearcuts in the Acadian forest. *Can. J. For. Res.* **50**(12): 1399–1404. doi:10.1139/cjfr-2020-0094.
- Cameron, R. 2009. Red maple, *Acer rubrum*, wetland composition and structure in Nova Scotia. *Can. Field-Nat.* **123**: 221–229. doi:10.22621/cfn.v123i3.968.
- Government of New Brunswick. 2002. New Brunswick Wetlands Conservation Policy. Available from <http://www2.gnb.ca/content/dam/gnb/Departments/nrn/pdf/Wetlands-TerresHumides.pdf>.
- Government of Nova Scotia. 2011. The Nova Scotia Wetland Conservation Policy. Available from <http://www.novascotia.ca/nse/wetland/docs/Nova.Scotia.Wetland.Conservation.Policy.pdf>.
- Government of Prince Edward Island. 2003. A Wetland Conservation Policy for Prince Edward Island. Available from <http://www.gov.pe.ca/photos/original/2007wetlands-po.pdf>.
- Harper, K.A., Gray, L., and Dazé Querry, N. 2020. Spatial patterns of vegetation structure and structural diversity across edges between forested wetlands and upland forest in Atlantic Canada. *Can. J. For. Res.* [Online ahead of print.] doi:10.1139/cjfr-2020-0247.
- Kendall, R.A., Harper, K.A., Burton, D., and Hamdan, K. 2021. The role of temperate treed swamps as a carbon sink in southwestern Nova Scotia. *Can. J. For. Res.* **51**(1): 78–88. doi:10.1139/cjfr-2019-0311.
- Nature Conservancy of Canada. 2015. Southwest Nova Natural Area Conservation Plan. NCC Nova Scotia Program, Halifax, N.S.
- Neily, P., Basquill, S., Quigley, E., Stewart, B., and Keys, K. 2010. Forest ecosystem classification for Nova Scotia — Part I: Vegetation types. Report FOR 2011-1. Nova Scotia Department of Natural Resources, Renewable Resources Branch, Nova Scotia. Available from <https://novascotia.ca/natr/forestry/veg-types/>.
- Padgett, T., and Wiersma, Y.F. 2020. Importance of boreal forested wetlands for epiphytic macrolichen communities. *Can. J. For. Res.* **50**(12): 1333–1339. doi:10.1139/cjfr-2020-0042.
- Rigolot, C. 2019. Atlantic Canada forested wetlands projects story map. Available from <https://arcg.is/fSe1y>.
- Staicer, C. 2021. Conservation of high quality habitat for landbird species at risk in Nova Scotia. Final Report to the Nova Scotia Species at Risk Conservation Fund.
- Staicer, C., Ferrari, C., and Westwood, A. 2015. Habitat modeling for landbird species at risk in Southwestern Nova Scotia. Final report to Nova Scotia Habitat Conservation Fund and Nova Scotia Species at Risk Conservation Fund.
- Westwood, A. 2016. Conservation of three forest landbird species at risk: characterizing and modeling habitat at multiple scales to guide management planning. Ph.D. thesis, Biology Dept., Dalhousie University, Halifax, N.S., Canada.
- Zahavich, J. 2020. Characterizing habitat for threatened forest birds in Prince Edward Island, Canada. M.Sc. thesis, Environment and Management, Royal Roads University, Victoria, B.C., Canada.