To: Vermont Legislative Committee on Wetlands
From: Adrian Wiegman, M.S.
Re: Changes to Wetland Statute
Date: November 20, 2019

I am a third year Graduate Fellow at the Gund Institute for Environment at the University of Vermont[i]. For context, the Gund Institute supports research and mobilizes scholars like me from across the University of Vermont to understand and solve critical environmental issues. For example, Last spring I was part of a Gund institute group that developed Payment for ecosystems services plan for Vermont, which was published as an issue paper[ii].

I'm here today to provide testimony based on my own technical expertise and do not speak on behalf of the Gund Institute or UVM.

Wetlands are ingrained in my professional and academic experience. My PhD dissertation is focused on phosphorus dynamics in historically drained and farmed wetlands in Vermont. I have spent the past 6 years studying the management, restoration, and functions of wetlands and aquatic ecosystems, and have written three peer reviewed research publications and two edited book chapters papers on wetlands[iii].

Testimony Overview

It is my understanding that the committee's purview is to consider changes to the wetland statute that affect agricultural exemptions and the amount of permitting required for wetland uses, and the criteria for recognition as a "class II" wetland. Based on my expertise I can speak to how wetlands function and why they are important, especially with respect to water flow regulation and water quality. In this testimony I will present considerations for three aspects of wetland law and policy:

1. Exemptions to wetland status and permits
2. Prioritization of wetland protection and restoration
3. Size and type of class II wetlands

1. Considerations for exemptions to wetland status and permits

It is important to remember that an estimated 51% of natural wetlands in the conterminous US have been lost to agricultural and urban development. In Vermont, approximately 35% of natural wetlands have been lost due to development[iv]. This represents an incredible loss of important ecosystems. From an ecological perspective, it is critical that remaining natural wetlands be protected from further encroachment by development of any kind, including agriculture, urban/suburban development, and renewable energy projects. Losing remaining natural wetlands would be counterproductive to the state's environmental goals. For example, a 2016 Gund Institute study estimated that if the Otter Creek wetland complex between Rutland and Middlebury was lost, the cost of annual flood damages to Middlebury alone would increase by at least $126,000 on average[v]. For these reasons, I advocate against any expansion of exemptions or exclusions to wetland permitting that would allow for further alteration or destruction of wetlands.

I want to be clear to distinguish between the aforementioned "remaining natural wetlands" and former wetlands that have already been converted to another land use - for example, historically drained and farmed lands. It is important, to restore former wetlands help reinstate ecological functioning over time. However, wetland restoration has a considerable cost

and relies on limited public resources, and food production and agriculture are an important part of the Vermont's economy and culture. Therefore, should the federal definition of wetlands be adopted[vi], – and by doing so remove the exclusion for food production from wetland status – I think it is reasonable to allow permits for continued private uses in historically drained and farmed areas that work towards state environmental goals: such as continued agriculture following best management practices to limit environmental impacts, or alternative land uses that couple production of energy or food with wetland functioning and environmental protection. The best use of former wetlands that were historically drained and farmed will depend on location, site characteristics, land use history, economics, and other factors. If we encourage creativity, I believe that alternative uses of former wetlands can help Vermont achieve goals of providing clean water, air, food and energy for its citizens.

2. Considerations for prioritization of wetland protection and restoration

There is a rich history of wetland creation and restoration in the United States and around the world, and Vermont has seen a net gain in wetlands since the 1980's. Numerous studies show that created and restored wetlands can provide similar types of ecosystem services to their natural wetland counterparts. However, it takes time for a restored wetland to provide the same levels of these ecosystem services. In other words, trading 100 acres of natural wetlands for 100 acres of restored wetlands will not necessarily yield the same amount of ecosystem services (such as wildlife habitat, carbon storage, or nutrient retention) right away. For example, if a wetland is converted to a farm and amended with manure for many years its soils may continue to leach soluble phosphorus to waters for years after restoration, rendering the wetland less effective at retaining phosphorus than a natural counterpart[vii]. The time it takes for a restored wetland to deliver ecosystem services at a similar level to a natural wetland varies depending on the type of restoration activity and the initial conditions at the restoration site. In the best cases a created or restored wetland can deliver ecosystem services at levels that rival natural wetlands within 5 years. In other cases, it may not be possible to regain the same level of ecosystem services even after some time has passed[viii]. Therefore, it is critical for the state to prioritize protection of remaining natural wetlands, while also working to restore wetlands and enhance the ecological functioning of floodplains.

3. Considerations for the size and type of class II wetland

Wetlands provide important ecosystem services, regardless of wetland size. Large wetland complexes, such as the one along Otter Creek, support biodiversity, mitigate severity of droughts and floods and can help prevent sediment and nutrients from reaching downstream ecosystems[ix]. However, smaller wetlands are also critical sources of ecosystem services. Smaller wetlands play an important role in headwater stream networks with greater slopes and flashier water flow - helping to slow down water, trap sediments, and remove nutrients. Removal of wetlands, even small ones, close to stream networks compromises important ecosystem services (biodiversity, flood control, nutrient retention) and allows surface waters to gain momentum, causing erosion as well as stream incision that further reduces connection between the stream and its floodplain and the associated ecosystem services[x].

Larger parcels connected to wetland complexes have been prioritized in wetland restoration and conservation efforts in Vermont for several reasons[xi]. Smaller wetlands have preferentially been lost from the landscape in North America since they are generally more difficult to regulate and more easily drained[xii]. There are new geospatial techniques to rapidly identify and map small wetlands[xiii]. Given the value of smaller wetlands, the higher risk of their

destruction, and the new feasibility of their identification, I advocate for a smaller rather than larger area threshold for Class II wetland distinction, especially in headwater regions where flooding and water quality problems get started.

Summary

Water quality in many Vermont lakes is declining[xiv], while extreme rainfall and floods are becoming more frequent[xv], mitigating these issues is costing Vermonters millions of dollars. Current science indicates the severity of the aforenoted problems that can be decreased by wetland and floodplain restoration and be increased by further degradation of wetlands and floodplains[xvi]. Therefore, I advise the state to steadfastly protect Vermont's remaining natural wetlands by not allowing agriculture or renewable energy, or any development on existing class I or II wetlands, while also pursuing wetland restoration as a method to meet environmental goals.

Given the limited resources available for restoration, it is reasonable to allow permits for agriculture and renewable energy development on degraded non-functioning wetlands, such as those that were drained for agriculture. I advocate that the state enforces protocols, such as required agricultural practices, to ensure that continued use of these areas does not further degrade ecosystem functioning, or better yet improves ecosystem services.

Historic trends in wetland restoration indicate that larger wetlands are more likely to be conserved and restored, while smaller wetlands, which can now be identified with relative ease using geospatial information systems, are more likely to be lost to development. I advocate that wetlands near streams receive Class II status regardless of size, or the smallest size practicable.

Thank you for inviting me to testify. I encourage the state to continue to call on scientists when making complex decisions about agricultural economic development and natural resource management.

Sincerely,

Adrian Wiegman

---

[i] https://www.uvm.edu/gund/profiles/adrian-wiegman

[ii] Hammond Wagner, C., Gourevitch, J., Horner, K., Kinnebrew, E., Maden, B., Recchia, E., … Koliba, C. (2019). Issue Paper Payment for Ecosystem Services for Vermont. Retrieved from www.uvm.edu/gund

[iii] C.V. linked here: https://arhwiegman.github.io/cv/

[iv] Dahl (1990) estimates that 340,000 acres of wetlands existed in VT in 1780 and only 220,000 acres of wetlands existed in 1980.

Dahl, T.E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service, Washington D.C., 13pp.

[v] Watson, K. B., Ricketts, T., Galford, G., Polasky, S., & O'Niel-Dunne, J. (2016). Quantifying flood mitigation services: The economic value of Otter Creek wetlands and floodplains to Middlebury, VT. Ecological Economics, 130, 16–24. https://doi.org/10.1016/j.ecolecon.2016.05.015

[vi] *"Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."* - Definition of wetlands as used by the U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) since the 1970s for regulatory purposes.
https://www.epa.gov/cwa-404/how-wetlands-are-defined-and-identified-under-cwa-section-404

[vii] Hoffmann, C. C., Kronvang, B., & Audet, J. (2011). Evaluation of nutrient retention in four restored Danish riparian wetlands. *Hydrobiologia*, *674*(1), 5–24. https://doi.org/10.1007/s10750-011-0734-0

[viii] Moreno-Mateos, D., Power, M. E., Comín, F. A., & Yockteng, R. (2012). Structural and Functional Loss in Restored Wetland Ecosystems. *PLoS Biol*, *10*(1), 1001247. https://doi.org/10.1371/journal.pbio.1001247

[ix] Mitsch, W. J., & Gosselink, J. G. (2015). Wetlands. In *Aging* (Vol. 5). https://doi.org/10.1017/CBO9781107415324.004

[x] Ameli, A. A., & Creed, I. F. (2019). Does Wetland Location Matter When Managing Wetlands for Watershed-Scale Flood and Drought Resilience? JAWRA Journal of the American Water Resources Association, 55(3), 529–542. https://doi.org/10.1111/1752-1688.12737

[xi] The median parcel area in the Regional Conservation Partnership Program wetland restoration prioritization map is 6.4 acres, with a total area of 86,200 acres (source: http://geodata.vermont.gov/datasets/VTANR::wetland-restoration-model-site-prioritization-lake-champlain-2017)

The median area in the Vermont Significant Wetlands Inventory "class layer" is 1.5 acres with a total area of 293,600 (source: http://geodata.vermont.gov/datasets/VTANR::vswi-wetlands-class-layer)

[xii] Serran, J. N., Creed, I. F., Ameli, A. A., & Aldred, D. A. (2018). Estimating rates of wetland loss using power-law functions. *Wetlands*, *38*, 109–120. https://doi.org/10.1007/s13157-017-0960-y

[xiii] Serran, J. N., & Creed, I. F. (2016). New mapping techniques to estimate the preferential loss of small wetlands on prairie landscapes. Hydrological Processes, 30(3), 396–409. https://doi.org/10.1002/hyp.10582

[xiv] Personal communication with DEC Kellie Merrell on the Spring Phosphorus Program, unpublished data, https://anrweb.vermont.gov/dec/_dec/SpringPhosphorus.aspx

[xv] Archfield et al. 2016 find that "New England shows a large, significant increase in the frequency of events per year, with increases from an average of two events per year over a base period from 1940 to 1970 to about five events per year during a more recent period from 1971 to 2013"

Archfield, S.A., Hirsch, R.M., Viglione, A. and Blöschl, G., 2016. Fragmented patterns of flood change across the United States. Geophysical research letters, 43(19), pp.10-232.

[xvi]Kiedrzyn´ska, E., Kiedrzyn´ska, K., Kiedrzyn´ski, M., Kiedrzyn´ski, K., Zalewski, M., Kiedrzyn´skakiedrzyn´ska, E., … Kiedrzyn´ski, M. K. (2015). Sustainable floodplain management for flood prevention and water quality improvement. 76, 955–977. https://doi.org/10.1007/s11069-014-1529-1