

**MNPhrag responses to questions following the webinar,
“A framework for strategic response to invasive *Phragmites australis* in Minnesota”**

May 28, 2019

Webinar hosted May 22, 2019

Engagement and Response Planning

Q1: Common Reed is presently on the MDA Noxious Weed list but is not in the eradicate or control group. It is under Restricted Noxious Weeds - may not be sold, transported without permit or intentionally planted in MN. Is there a recommendation to MN Noxious Weed Advisory Committee to move Common Reed into the control or eradicate classification?

A: We've presented to the Noxious Weed Advisory Committee, and we also sent a letter in to suggest that its classification be revisited. I'm far from an expert in the listing status. I think the highest tier, the eradicate, I think tends to be reserved for species that are not really established in the state. Those that maybe occur, like Palmer amaranth, where there are few, if any populations. And so it would depend on the nature of law and statute, where would be most appropriate. But we think a change to either those (control or eradicate) would provide increased support and incentive for control efforts. There's some interesting history around the listing, where the last risk assessment for invasive *Phragmites* resulted in it being listed as restricted. A lot of that reasoning was due to not knowing a lot about distribution of *Phragmites* in the state. So now that we have better information about that, that can be reevaluated. A major motivation for this project overall was to address some of those knowledge gaps and uncertainties that were identified in 2016, the last time it was assessed through this process. (Transcribed from answer provided in webinar.)

Q2: We have stands of invasive *Phragmites* on city-owned land but also on private owned property. Any advice with controlling *Phragmites* on private land?

A: The cost estimates in our assessment assume organizations from the federal-to-local levels would work with private landowners to gain permission to access invasive *Phragmites* populations for control and would provide the funding for the control. While gaining access to populations on private lands will require significant coordination and outreach, it's essential to supporting a landscape-scale response. Any population on the landscape is a source for further spread, potentially making control efforts elsewhere futile. A framework of organizations working toward cooperation with private landowners is more likely to result in comprehensive control of populations than relying on individual landowners to fund and conduct the work themselves. Individual landowners also are unlikely to have the necessary training needed to conduct control effectively and responsibly. Addressing this issue at the organizational level could also reduce overall control costs, as populations on private lands could be grouped with populations under other ownership categories, making contracts more efficient. While elevation of invasive *Phragmites* Noxious Weed Classification to prohibited status would allow access for control efforts, it would still be ideal for organizations to explore sources to fund the work to avoid placing undue stress on private landowners.

Q3: Are highway and railroad maintenance educated on how they might be spreading this organism with their mowing equipment?

A: While awareness has been growing in recent years, because invasive *Phragmites* is not yet widespread in the state, many highway and railroad maintenance personnel may not be aware that their equipment and operations can contribute to its spread. Further outreach and potential changes in policy are needed to support cooperation and adoption of best practices by highway departments and railroad companies. If invasive *Phragmites* had a higher regulatory classification, MnDOT would have to respond to it differently in their maintenance operations. For more information regarding MnDOT's operations, contact Dave Hanson. From our conversations with regional groups already mounting landscape-scale response efforts in some areas of the state, we understand that some railroad companies have cooperated in controlling invasive *Phragmites* on their properties, while others have been less cooperative.

Q4: Do you have suggestions as to WHO to contact in DOT for *Phragmites* at a specific location?

A: MnDOT's website includes regional contacts for Roadside Vegetation Management (<https://www.dot.state.mn.us/roadsides/vegetation/contacts.html>). You can determine which MnDOT District the population of interest is located in to select the appropriate local staff contact. We have also been in communication with Dave Hanson at the statewide level regarding invasive *Phragmites* along MnDOT-managed roadsides. He may also be able to assist with finding local contacts.

Q5: Our city has populations of *Phragmites* that are among reed canary grass and hybrid cattails. I cannot see a reason to treat patches such as these.

A: The reproductive and dispersal abilities of invasive *Phragmites* allow it to spread over long-distances, such that any populations out on the landscape, even if cohabiting with other invasive plants, present risks to valuable natural areas in Minnesota. We've described that invasive *Phragmites* may be experiencing a lag phase in Minnesota due to there being relatively few populations, few nearby populations in neighboring states and provinces, and low genetic diversity. Allowing a stand like this to continue to expand could cause control efforts in other areas to be futile and lead to a missed opportunity to protect the state's wetlands and lakeshores.

Control Approaches and Permitting

Q6: Is a DNR IAPM permit required to treat wetland and storm pond populations?

A: Typically, destruction of emergent vegetation requires a permit from the Minnesota DNR. Coordinators of control activities should consult with DNR staff regarding control of invasive *Phragmites* at "wet" sites. DNR maintains a directory of public waters used to guide permitting decisions. Depending on size of the treated area, the purpose of control, and control methods, DNR staff will determine whether an IAPM or APM permit is needed.

Q7: How do you balance the need to use round up vs. reported concerns about its impact on human health?

A: There aren't any mechanical ways that are effective at controlling *Phragmites*. So what we propose is that if you use the optimal treatment times that are recommended - fall treatment - then you can minimize those impacts by having to apply chemicals less frequently. So one application at the appropriate time should be effective to knock the plant back or kill it. And then you would do the follow up treatment the following year, at the appropriate time again, and thereby minimize your impacts by minimizing your inputs of chemicals to the environment.

That's also why we think it's really critical to identify populations early and respond quickly because then we'd be dealing with the majority of populations that we've identified that are less than 500 square feet. So the raw amount of chemicals being put on the landscape will be lower. And there's also a greater probability of successful control. And so, we would like to see minimal use of herbicide and we think that's best served by rapid response. In other places that have had invasive *Phragmites* longer - they're much larger populations, acres and acres - that's when you're using herbicide at a really large scale and are going to have more potential for non-target impacts, as well as lower efficacy. And it's also critical to account for aquatic environments in terms of making sure that formulations that are safe for use in aquatic environments are used. (Transcribed from answer provided in webinar.)

Q8: Is treatment earlier in the year when plants are at a more manageable height (in July and early August) not as effective? Why or why not?

A: No, it should be treated at the end of August into September. It can be treated up until shortly before the first killing frost. So mostly through September. Our typical frost, the last couple years, our first hard frost was around October 10th. So generally, all the way through September is an appropriate time to apply herbicides. July is not an appropriate time because at that time, the plant is still actively growing and it's not sending resources down into its rhizomes. And you want to have the chemical transported from the leaf tissues down into the rhizomes where it can be active and kill the rhizomes. (Transcribed from answer provided in webinar.)

Q9: What is your thinking on August 15 to begin spraying...when it's as big as possible and before the flowers?

A: August 15 would be about the earliest time-frame for treatment, but later in the month is likely to be more effective. Please see our answer to question 8.

Q10: Why do the first mow in January/February as opposed to the growing season to reduce vigor and height prior to fall spray (reducing chemical and exposure to applicator)?

A: You could mow in summer but accessibility for some of the populations will be difficult because the ground is soft and wet, because it's a wetland plant. There are some sites where a summer mow would be possible but owing in winter allows you to mow on frozen ground so that would be one reason to do it. Summer mowing also poses a risk to potential nesting birds. (Transcribed from answer provided in webinar.)

*Additional note following webinar: If you mow in summer, you should allow 6-8 weeks for regrowth before treating with herbicides. Whenever you mow, equipment will need to be decontaminated.

Q11: Can apparently dead stems (that were cut in the winter) start to grow now that it is spring?

A: No, dead stems will not be able to regrow once they've died over the winter. They don't have a capacity to grow roots or shoots. (Transcribed from answer provided in webinar.)

Q12: How is equipment decontaminated?

A: Some equipment is more difficult to clean than other equipment. If you don't have the means to appropriately clean your equipment, then you probably shouldn't take it into a stand. There are protocols, for example the DNR has operational order 113, that describes how equipment should be cleaned and handled going in and out of sites that are contaminated with invasive species. Anybody can pull up that document and use it and apply it themselves. So you could be a commercial applicator and you can use those protocols. But again, if you have equipment that is likely to pick up seed or live plant fragments, you should perhaps just reassess how you are going to approach managing that population if you don't have means to decontaminate your equipment. Mowing facilitates the herbicide treatment and increases efficacy, but it's not really worth it to mow in certain situations or with certain equipment, if doing so will add to the risk of spread. (Transcribed from answer provided in webinar.)

Q13: What constitutes "control"? Is the level of control established after 3 years of treatment and follow-up observation?

A: For most populations in Minnesota, we believe it will require 2-3 years of treatment to achieve control. After 2-3 years of control, we'd hope you're just monitoring the site where the population was controlled. After adequate control you can begin think about revegetation, if it will be needed. If you've applied your treatments appropriately, I think that control is definitely achievable with the size of populations that we have in Minnesota. Obviously elimination is the goal and we think it's achievable with many of our populations and with appropriate protocols for control. There are some larger populations in the state as well as in other states, and there can still be benefits of control short of full elimination. So, particularly if you have high quality habitat that perhaps has a species of concern in it, you can see the benefit of reducing the abundance of *Phragmites*, even if it's not eliminated. (Transcribed from answer provided in webinar.)

Q14: Are there contractors out there to do this work?

A: Yes. All of the contractors that provided cost information to assist us with developing the control cost estimates in our response assessment indicated that they have performed or were equipped to conduct control of invasive *Phragmites*. While certainly not exhaustive, the acknowledgements section of the assessment lists these contractors, and there are likely to be others around the state as well. Depending on equipment availability and conditions at the targeted sites, some contractors may be better-suited to conduct control on some populations than others.

Q15: Have you worked with or heard of any contractors in MN that are successfully controlling invasive *Phragmites* at this point?

A: Please see our answer to question 14. Since invasive *Phragmites* is not yet widely distributed in Minnesota, most contractors we spoke with had limited experience conducting invasive *Phragmites* control. They also noted, however, that they were equipped to do so and had implemented similar control approaches on other invasive plants.

Restoration

Q16: Do the cost estimates for *Phragmites* control include replanting those areas with native plants? What do you recommend for restoring those areas?

A: The cost estimates include only herbicide treatment and mowing costs, the cost of implementing those two actual control actions. Since we didn't know and it's site-specific which sites will actually need revegetation and restoration, rather than assuming that in the cost estimates we did not attempt to estimate those costs. In the full report, we do go into more detail on this and note sites where we think revegetation or restoration may be more necessary based on the characteristics of the *Phragmites* population or the site. And so, in some cases, it may not be necessary. It may be a small enough patch and allow for recolonization of other vegetation. In other cases, active approaches are more likely to be needed. And there's some good research on that with *Phragmites*. There's a paper that just came out of Karen Kettenring's group at Utah State that addressed this issue of *Phragmites* patches of different size and the fates of those patches after control. The paper shows that it does depend on patch size.

(Transcribed from answer provided in webinar.)

Q17: Following treatment, what kind of follow-up is recommended, i.e. soil/seedbank scraping and planting/seeding with natives?

A: Scraping is not likely to be a feasible or necessary treatment option for most populations in Minnesota. Permits would be needed to transport and dispose of any scraped soil, and those may be difficult or impossible to obtain. Appropriately timed treatments should adequately kill the rhizomes. Most of the populations in Minnesota are relatively young and have had less time to develop an intense seed bank and, our work on seed viability shows that many populations still have relatively low seed set, so scraping should not be needed to deal with a seed bank in most situations. A more feasible solution will likely be ongoing monitoring and revegetation to provide competing vegetation. It may be desirable to use a less expensive seed mix in the short

term in case additional herbicide treatments are required to control any re-establishment from the seed bank.

Invasive *Phragmites* at wastewater treatment facilities

Q18: How do you anticipate the efforts to curb the spread of *Phragmites* will affect WWTPs that have invested in *Phragmites*-based treatment? Are there any solutions or efforts to help them recoup some of this investment?

A: It is unclear at this point how partners in Minnesota will choose to respond to invasive *Phragmites*, and how that will affect the wastewater treatment operations using this species in their biosolids dewatering processes. From preliminary discussions with agency staff, transportation of biosolids for land application of biosolids has been temporarily put on hold until further investigation suggests land application does not present risks for further invasive *Phragmites* spread (for more information about land application, please see the section in our response assessment related to wastewater treatment facilities). This could present unexpected costs for some facilities. MNPhrag staff will be conducting surveillance at land-applied sites in the next month and reporting results to agency staff. Further, there are uncertainties and/or high costs associated with alternative biosolids dewatering methods. It is critical that implementation of alternatives supports sound wastewater treatment. We hope that policy and funding can be directed to support this as well as invasive *Phragmites* response. Pilot projects testing the efficacy of alternative plant species in reed beds are needed, as is development of best practices for containment, surveillance, and control of "escaped" plants.

Q19: In Minnesota non-native *Phragmites* is used by 15 to 20 municipal wastewater treatment facilities for treatment of biosolids. What is the feasibility of converting to native *Phragmites*?

A: There are other plant species used for this process in wastewater treatment facilities around the world, though it has not been determined which species would perform similarly and present fewer environmental risks in Minnesota's climate. Invasive *Phragmites* is the most commonly used plant in Minnesota and Wisconsin (but note that the use of plants for biosolids dewatering is relatively uncommon among Minnesota's wastewater treatment facilities - only 16 of the roughly 280 facilities in the state use or have used invasive *Phragmites* - other facilities use different methods entirely). Native *Phragmites* has been used at a few facilities in the Midwest for the past few years; one facility in Minnesota installed native *Phragmites* in 2015 and three northern Wisconsin facilities just installed the native subspecies last year. It is too early to assess the efficacy of the native subspecies at the Wisconsin facilities. Operators at the facility in Minnesota with native *Phragmites* report that they have had difficulty getting it established and describe it as being higher maintenance than the invasive. Studies have yet to formally assess the efficacy of alternatives to invasive *Phragmites* at various facilities in Minnesota, though this type of investigation is sorely needed if using alternative plants are to be deemed the optimal solution for supporting sound wastewater treatment and invasive *Phragmites* response efforts. We are in the process of conducting a literature review that will suggest potential alternatives for pilot testing at a subset of the facilities (for more information, please see our answer to question 21).

Q20: Why are wastewater treatment plants using invasive *Phragmites*? Does the native species not work as well?

A: Invasive *Phragmites* is used at wastewater treatment facilities to dewater biosolids, which are residual organic materials that remain following sewage treatment. The biosolids and invasive *Phragmites* are contained in a “reed bed,” where invasive *Phragmites* removes water through evapotranspiration. Invasive *Phragmites* is a wetland plant with large stature. It effectively transpires a lot of water, so it is pretty efficient at assisting in the dewatering process. In addition, *Phragmites* is able to withstand the regular addition of sewage over its root system. Native *Phragmites* has a smaller stature than the non-native subspecies. It also senesces earlier in the season and so, it may not be as effective at removing water. Please see our answer to question 19 regarding the effectiveness of native *Phragmites* for biosolids dewatering.

Q21: Who can I contact about plant selection at waste water treatment plants?

A: We are unaware of experts on this topic. However, we are currently conducting a literature review to investigate potential alternative plant species for biosolids dewatering at wastewater treatment facilities. The review focuses on physiological characteristics as well as evaluations of efficacy within reed beds when available. While all need further evaluation, possible alternatives include native *Phragmites* (*P. australis* subsp. *americanus*), broadleaf cattail (*Typha latifolia*), narrow-leaved cattail (*T. angustifolia*; non-native but already ubiquitous), hybrid cattail (*Typha x glauca*; hybrid but already ubiquitous), river bulrush (*Bolboschoenus fluviatilis*), prairie cordgrass (*Spartina pectinata*), or others. We will communicate the results of the review broadly once they are available.

Q22: How many of the non-native *Phragmites* populations were found within a mile of wastewater treatment plants that have used non-native *Phragmites* in reed beds?

A: It would be a small percentage of the populations that are within those boundaries or very close boundaries of the treatment plants. I would say that a stronger factor would be roadsides. So the ability to move along those corridors, which are characterized by disturbance, is greater than what we're finding around treatment plants. We certainly are finding it around treatment plants but there are other stronger correlations. We have drawn a buffer around those and so I could actually pull that number up but off the top of my head, I don't know the number, but we have a mile buffer around the treatment plants (in our spatial analysis software).

You can go to the distribution map on the MNPhrag website and you can see where the wild populations are in proximity to the wastewater treatment facilities. The website has a Google Earth embedded in it and you can click on the locations of the wastewater treatment facilities with non-native *Phragmites*, and as you zoom in on some of those, there are certainly a number of them where there are wild populations in close proximity.

In northern Wisconsin, they actually did genetic sourcing to trace wild populations to wastewater treatment facilities and were able to document that they were related to the wastewater treatment populations. I don't think it's really that critical that we do that type of sourcing here. We know that there are a variety of means of spread and that it's already

established in the state. And we think what's needed now is a multi-faceted approach of addressing those different risk factors. (Transcribed from answer provided in webinar.)

*Additional note following webinar: 40 of the 389 verified invasive *Phragmites* populations (~10%) are found within one mile of the wastewater treatment facilities which are using or have used invasive *Phragmites* in their dewatering operations.

Q23: What are the water treatment plants doing to prevent the spread from their facilities?

A: There is some variability in how each facility manages their reed beds. Up until the beds freeze in late fall, there is not a lot that can be done to prevent seed spread. Most facilities cut the standing dead stems in winter after the beds have frozen. Generally, they windrow the reeds in the bed and burn them in place. Sometimes they are removed from the beds and burned on the grounds nearby. One facility composts the material. We are currently communicating with facilities' operators to better understand their processes and needs, so that best practices to aid in preventing spread from reed beds can be developed. Surveillance in the vicinity of the facility is a good first step and other best practices may be recommended upon learning more from the operators about how the facilities function.

Invasive *Phragmites* biology

Q24: With all the populations in MN, are they all the same genetic variations or are they different? Do different genetic variations react differently to the different chemicals?

A: We don't know about the second half of that question about susceptibility to chemical. I don't know if there are any papers about that. If there are, we're not aware of them. Regarding genetic diversity, we have sampled populations in Minnesota and our samples are still being processed. We anticipate having those results by the end of our grant period, so within about a month and we'll be able to report back and we'll have a summary of that information up on the website. But we don't have a good sense of the genetic variability in Minnesota at this time, but that information is coming and we will be able to characterize genetic diversity, both within populations as well as among populations across the state. (Transcribed from answer provided in webinar.)

Q25: Do you have a theory why the MN sites are so small in area as they are?

A: It's likely that they're still small because it's a relatively new invasion in Minnesota. There is some evidence that it's been here since the early 90s. It started to be used in some of the treatment plants in the mid-90s. Relative to other states, I think it's a pretty new invasion, so the populations are therefore smaller.

It's a really common phenomenon in biological invasions in general to have a lag phase, where there's sort of a period, often multiple decades, of build up before there's an inflection point and the species is able to take off. I think we can look to nearby areas in the upper Midwest: to our neighbors to the east in Wisconsin, I used to work out of the Chicago area and did research on *Phragmites* in southern Lake Michigan. And people who had worked in those areas over a period of time in natural resources described seeing this change on the landscape over the course of their careers, over a 15 or 20-year period, they had just really seen an increase in

abundance and population size. So that's why we think there's a real opportunity here because we can learn lessons from other states where that invasion is further along. And we can look to them as the potential future of what *Phragmites* invasion might look like in Minnesota and can gain from what they've already learned through their research and through their management effort. This development of best practices for control approaches for example comes from 40 years of management effort, largely in the east coast. And so we can gain from that knowledge to keep the populations in Minnesota in check and hopefully even reverse the spread so that we don't get to the point where we see those really abundant and larger populations.

I might add too that we may have smaller populations because we may have less genetic diversity as well. Some of those populations are not expanding because we don't have high seed viability in some of those populations and that may be factoring into why we have smaller populations as well.

And disturbance could also be a factor. Particularly as you go further north in Minnesota, we have a relatively more intact landscape and so *Phragmites*, like many invasive plants, is really following human disturbance. So we might benefit from that as well. There has been research showing differences in native and non-native *Phragmites* in terms of response to global change, things like increases in nitrogen availability and carbon dioxide. And so we can expect non-native *Phragmites* to really be opportunistic under our future world that we're heading towards, by being able to benefit from eutrophication and increases in atmospheric carbon dioxide. (Transcribed from answer provided in webinar.)

Q26: Many asters and other weeds such as garlic mustard are able to continue developing mature viable seed after cutting and herbicide treatment. Is non-native *Phragmites* able to continue developing mature seed after cutting and/or herbicide treatment?

A: I don't know if there's any research to that effect. But it's possible that it could do that as long as some of the stems remain green and don't dry down and die very quickly. They seem to develop their seed over a short period of time in late fall from mid-September to mid-October. So I think that's a possibility. But we don't know that for sure. That's also a potential risk of treating with herbicide too early in the season. If you knock the plant back but give it plenty of time to rebound and recover and have mature seed by the end of the season. (Transcribed from answer provided in webinar.)

Q27: What are the *Phragmites* look-alikes, if any?

A: We had a couple submissions of *Miscanthus* or banner grass from our observers. *Miscanthus* is a rather tall grass, but it tends to be much shorter than *Phragmites* and it generally grows in more upland settings. Sometimes it can be quite prolific and form large stands, which is probably what caught the attention of those who submitted it. If you are driving the roads looking for *Phragmites*, *Typha* in the distance can sometimes cause you to pause and take a second look. Obviously, on closer inspection, it is quite easy to distinguish cattails from *Phragmites*. In southeastern MN, I've seen wild rice with broad leaves and tall stature that could be mistaken for *Phragmites*. The inflorescences of wild rice are very different from those of *Phragmites* however. In more southern states, *Arundo donax* (giant reed) could also be mistaken for *Phragmites*.

Q28: Flowering culms die each year but the roots and crown continue to live, right?

A: That's correct. The above-ground biomass is annual, dying back each year. The rhizomes are perennial and give rise to new growth each season.

Q29: Are there any *Phragmites* that reproduce without a male/female counterpart (Ex: AIS Starry Stonewort)?

A: *Phragmites* is monoecious, which means that both male and female flowers occur on the same plant. The plants are self-incompatible though, and need to have individuals of different genetic make-up in proximity to them to cross-pollinate; otherwise, viable seed cannot develop. Of course, *Phragmites* is also capable of vegetative propagation. It can propagate via rhizomes (below-ground stems), stolon (runners), or stem fragments.

Hybridization

Q30: I heard mention of hybridization in another presentation earlier. Have there been reports of that?

A: At this point we're still awaiting the finer-resolution genetic results that would allow us to identify potential hybrids. In past research throughout the Midwest that I've been involved in, we analyzed about 500 plants and found no evidence of hybridization. That said, hybridization does occur, it's been documented in the literature, both in the greenhouse experimentally, as well as identification of wild hybrids. So that's a real area of need for additional research.

One possibility is that molecular tools that have been used traditionally to look for hybrids may have low power to detect hybridization. So it's possible that we're missing a greater prevalence of hybridization that could be out there. There's also been relatively little search effort in places like Minnesota where there's a lot of native *Phragmites* native still left. Places like the Chesapeake Bay or southern New England, native *Phragmites* is now scarce, so you might be just unlikely to have hybridization. The upper Midwest and the Great Lakes region has really been identified as an area where more searching for hybrids needs to be done, because that's where it's most likely to occur.

So hybridization can happen, it would certainly be a complicating factor. That said, despite the fact that its different lineages of the same species, documented hybrids are rare to date. So again, whether that's a methodological limitation, search effort limitation, or an underlying genetic or biological reason (has not been determined).

Regarding the biological reason, based on my observations in the field, the timing of flowering is off for the two subspecies. Native *Phragmites* seems to be done flowering before the invasive *Phragmites* begins flowering. So there may be some particular ecotypes that overlap but in large part, it seems like they don't overlap in their flowering time in Minnesota based on my observations over the last couple years. (Transcribed from answer provided in webinar.)

Q31: What is your plans for potential hybrid stands identification and eradication?

A: Please see our answer to question 30. As a research team based at the University of Minnesota, the MNPhrag team will not be conducting control efforts. Genetic testing would be needed to confirm populations as hybrids and groups coordinating control would need to decide

how to manage hybrid stands. However, we would recommend treating potential hybrid populations similarly to invasive populations in terms of response, as the hybrid could be more likely to behave invasively than native *Phragmites*.

Surveillance and data collection

Q32: Given *Phragmites*' relatively new attention, is it likely that the spread is much greater than what we've observed or is it likely the observed populations are representative of the spread in MN?

A: While there are undoubtedly invasive *Phragmites* populations in the state that have not yet been documented, we feel that surveillance efforts thus far provide a reasonable representation of invasive *Phragmites* spread in the state sufficient to support an effective landscape-scale response. Capacity for surveillance has increased statewide as a result of MNPhrag's outreach and will continue to improve with a concerted response effort from partner organizations. For more information about MNPhrag's surveillance efforts, please see the Methods appendix in our invasive *Phragmites* response assessment.

Q33: I don't see any reports from most of the northcentral area. Is this because you have looked for it and not found it there, or have there just not been any surveys or reports from much of the region? I live in Bemidji and have not seen it as far as I recall, but I haven't been specifically looking for it either.

A: MNPhrag staff have done only a very limited survey of some roadways through the northcentral region of MN. We did recruit and provide resources for a handful of observers in the area as part of our effort to document invasive *Phragmites* throughout the state. And we have done a training with Region 4 DNR Wildlife Managers. We hope that awareness has increased such that local citizens and agency staff will recognize it if they do see it. At this time, it is likely that there is not a significant presence of invasive *Phragmites* in the region, but we should be vigilant and not assume that it cannot get there.

Q34: What criteria were used to classify individual populations? For instance, how far apart did the patches have to be to be considered separate?

A: For our purposes, patches did not have to be very far apart to be considered separate populations. They could be as close as 100-200 hundred feet. If two patches were distinctly separated by a short distance and other vegetation, they were typically considered separate populations. I particularly attempted to document small patches in areas where I thought they might be overlooked if they were not tagged as their own population.

Questions about other studies

Q35: Hi, I am Karuna from UW-River Falls. I did some preliminary microbiome work on invasive *Phragmites* when I was in Delaware. Now I am planning to compare the microbiome of native and invasive *Phragmites* in White Bear Lake, MN. Do you know anyone who works in this area? My goal is to find what microbes are helping invasive *Phragmites* to spread and prevent the survival of native *Phragmites* or other plants. Basically trying to find signaling molecules.

A: We are not aware of other researchers evaluating *Phragmites*' microbiomes or the effects of the microbiome on its ability to spread. It would be interesting to know if the microbiome were

contributing to the invasive's spread. Please contact us directly if you would like more specific information regarding individuals that you can connect with for your research.

Q36: During the slide looking at high vs low potential areas, the quantity of devegetated area played a large role. Have you seen if there is a percentage threshold in devegetated area that is a tipping point to *Phragmites* infestation?

A: This is another interesting question. Invasive *Phragmites* is associated with disturbed sites. However, we have not investigated if there is a threshold of disturbance or devegetation at which it colonizes a site.

Biocontrol of invasive *Phragmites*

Q37: What is the potential for developing biocontrol for common reed? Has any research been done on biocontrol?

A: Research and regulatory processes are underway related to the use of biocontrol for invasive *Phragmites*. While our research did not include investigating biocontrol, Dr. Bernd Blossey at Cornell University recently presented a webinar describing next steps and a recording is expected to be available on the Great Lakes *Phragmites* Collaborative website.

Q38: Will MNPhrag participate in the use of biocontrols when they become available?

A: MNPhrag is a research team out of the University of Minnesota, it will not be implementing any control actions. We hope to be able to continue supporting education, outreach, and training toward invasive *Phragmites* response in the future. While biocontrol, if proven safe and effective, could be an optimal management approach for reducing abundance in parts of the country where invasive *Phragmites* is widespread, the approach likely will not be approved within the critical stage of invasion we're facing in Minnesota. We're recommending mounting a landscape-scale approach using available methods now to keep invasive *Phragmites* from becoming a major problem for the state's natural resources.