

The *Phragmites* Adaptive Management Framework Implementation Guide

2017

Version 1



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Context

Non-native *Phragmites australis* is one of the most aggressive plant species invading North America. It is already well-established in the Great Lakes basin, along the Atlantic, Pacific, and Gulf Coasts, and in wetlands across the interior of the continent. More about *Phragmites* can be found at <http://www.greatlakesphragmites.net/phragbasics/>.

Non-native *Phragmites* is managed using a suite of conventional approaches (e.g., herbicides, cutting/crushing, flooding, burning), but these approaches aren't making a lasting impact at the landscape scale. They are resource-intensive and differ in effectiveness, largely because there are uncertainties about how the plant responds to treatment given site-specific conditions and variations in how managers apply treatments. In addition, it is difficult to coordinate management efforts across the landscape and learn from every treatment made.

To address these challenges, the Great Lakes *Phragmites* Collaborative is developing an adaptive management strategy called The *Phragmites* Adaptive Management Framework (PAMF). This framework will change the way *Phragmites* management is done throughout the Great Lakes basin and lead to approaches that maximize the effectiveness and efficiency of *Phragmites* management.

How it works

PAMF has three components: a monitoring protocol, a model that predicts how *Phragmites* will respond to different management alternatives, and a central database with an associated web hub where the results from all management efforts are reported.

PAMF runs on an annual cycle. Participants join PAMF by registering in the PAMF web hub. After enrolling a management unit, participants implement the PAMF monitoring protocol and upload those data to the central database through the PAMF web hub. The predictive model will combine and analyze user-collected data and provide site-specific treatment guidance every year. Participants implement the treatment suggested by the model or a different treatment of their choice, and the cycle repeats until *Phragmites* no longer grows on the site. Data provided by all of the participating land managers across the basin fuel the adaptive management process.

The key to PAMF's success is long-term and widespread participation by you – our partners – from around the Great Lakes basin.

Benefits of PAMF

This management strategy for non-native *Phragmites* provides a number of benefits to land managers participating in PAMF.

Services provided by PAMF

- Free data analysis that provides treatment guidance based on best current knowledge
- Standardized monitoring protocol, scalable to different management areas
- Development of site-specific best management practices that can be shared across the Great Lakes basin and throughout North America
- Free database to store *Phragmites*-related information that is accessible from anywhere, at any time

Outcomes of using PAMF

- Cooperative, transparent decision-making to reduce uncertainty regarding the effectiveness of management
- Cost- and time-efficient way to address a widespread problem

Adaptive management

PAMF is the first basin-wide application of adaptive management to address the issue of non-native *Phragmites*. The term adaptive management refers to management that involves planning, implementing, and evaluating management activities as a repeating cycle. It also includes predictions about how a resource is expected to change in response to management efforts. We use adaptive management when we need to make repeated management decisions over time because it allows us to learn from our results and improve future management.

This definition of adaptive management is used by the U.S. Department of the Interior and is based on the fundamentals of decision science where learning from management outcomes can improve management over time. With the assistance of a predictive model, PAMF can learn scientifically about the response of *Phragmites* as the order and timing of treatment combinations change due to site conditions and/or management constraints. This sort of large-scale effort benefits from many management activities taking place around the Great Lakes basin that speed up the learning process. This means that treatment guidance is constantly improving, and leads to more effective and efficient management.

For more information on adaptive management:

- [Adaptive Management: The U.S. Department of the Interior Technical Guide \(PDF\)](#)
- [Adaptive Management: The U.S. Department of the Interior Applications Guide \(PDF\)](#)

Overview

This overview outlines what you can expect as a PAMF participant.

Before you start

To participate in PAMF, you will begin by registering through the PAMF web hub found at

<http://www.ismtrack.org/pamf/>. The web hub is the communication portal between you and the PAMF database, and you will use this portal regularly during the annual PAMF participation cycle.

Annual participation cycle

After registering as a PAMF participant, you can expect to take 3 unique steps during each annual PAMF participation cycle (Figure i). Detailed instructions for each step are described within the chapters of this guide.

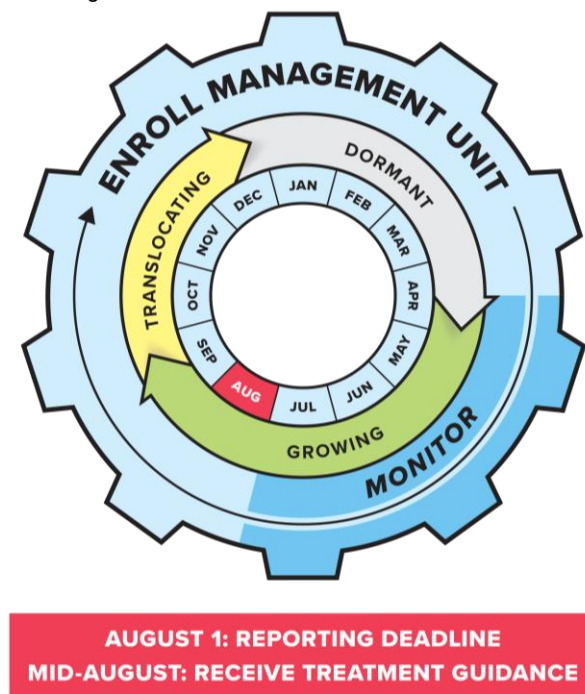


Figure i. The annual PAMF participation cycle helps to visualize the timing of PAMF activities, which are based on three temporal phases of *Phragmites* biology: translocating, dormant, and growing. Reporting is due August 1st so that PAMF can provide treatment guidance through the web hub based on the reported information by the middle of August.

Step 1: enroll a management unit

After registering as a PAMF participant, you can enroll one or more management units (MUs) into the PAMF web hub. A MU is the area where *Phragmites* treatment(s) will occur. This step is only done once for each MU and can occur at any point during the year.

To enroll a MU, the perimeter must be established and some details on the MU must be entered into the PAMF web hub ([Chapter 1](#)).

Step 2: monitor

Monitoring is a key element PAMF. As a PAMF participant, you agree to monitor live *Phragmites* once per year during the growing phase and use the web hub to submit a monitoring report by August 1st for every MU enrolled. To most accurately characterize the MU, monitoring should be completed as late in the growing season as possible while still giving enough time to report the information ([Chapter 2](#)).

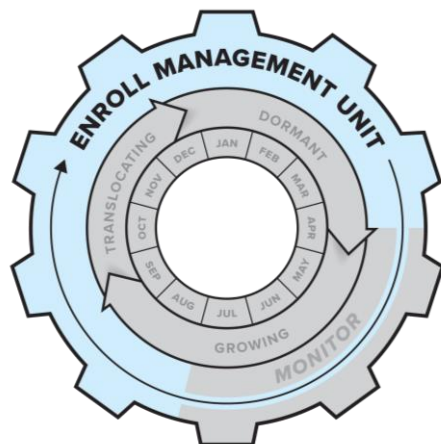
Step 3: manage *Phragmites*

Treatment guidance will be provided for each MU through the web hub by the middle of August each year. As a PAMF participant, you are urged to consider the data-driven treatment guidance (i.e., the treatment most likely to achieve management objectives given site conditions) provided by PAMF but are free to implement any treatment you choose ([Chapter 3](#)).

You will report on actual treatment activities using treatment reports ([Appendix D](#)) found in the web hub. Treatment reports can be completed immediately after each of the three treatment phases or at one time when all treatments are finished. All treatment reports must be submitted before the reporting deadline of August 1st.

Chapter 1. Enrolling a management unit

This chapter provides information on how to enroll a management unit into PAMF.



What is a management unit?

For PAMF, a management unit (MU) is defined as the area where a PAMF participant treats non-native *Phragmites*. The determination of size and shape of the MU is left to each participant, but we recommend defining your MU as the smallest area surrounding the *Phragmites* that you plan on treating and are able to apply the same treatment to at one time.

These are three specific guidelines participants should keep in mind when enrolling a MU:

1. **Treat across the whole unit.** Any treatment applied to *Phragmites* within a MU should be applied consistently to all *Phragmites* growing within the MU-- therefore, your available resources may help determine MU size.
2. **Use one treatment type per phase.** Only use one treatment to manage *Phragmites* in a given MU per treatment phase (i.e., translocating, dormant, and growing). If you plan on using more than one type of treatment on your land during the same treatment phase, you should enroll more than one MU.
3. **Keep the boundary consistent.** The boundary of each MU will not change while enrolled in PAMF regardless of landscape changes from year to year. Create your MU perimeter knowing that your treatment will be applied within the same location every year-- this consistency will allow for the evaluation of long-term treatment success.

Field equipment for enrolling

- Clipboard (and copy of [Appendix B](#))
- Pencil
- Marking tape
- Handheld GPS and/or smartphone or tablet with ViewRanger app

ViewRanger app

The mobile device app we suggest for recording a track around the perimeter of your MU is ViewRanger, although any app that creates tracks, saves them as GPX (a standardized output file structure for GPS data which uses the WGS84 datum), and allows you to navigate to waypoints will work. This app works well with iPhone and Android devices, can be downloaded for free, and will allow track collection offline if the participant is in a remote area. See [Appendix A](#) for instructions on how to record a track on ViewRanger. PAMF has no affiliation to ViewRanger and their developing company Augmentra; therefore, we cannot assure this app will be on the market with the same capabilities and under the same user conditions in subsequent years. For additional help with this app or for other options, please contact Karen Alexander at kalexander@glc.org.

Mapping a management unit

The first step in enrolling a MU into PAMF is establishing the perimeter. The preferred method for establishing the perimeter for your MU is on the ground, but this can be done by drawing, too.

On the ground

Use a handheld GPS or a smartphone (with ViewRanger app or app of your choice) to mark the boundary of your MU. You may choose other methods that you are more familiar with-- just make sure that the coordinates of your MU can be downloaded as a GPX file.

To map your MU, walk or drive its perimeter and log your path with a GPS or smartphone. It may be a good idea to mark your starting spot with flagging tape or other object that will help you remember where you started. We recommend navigating as close to the *Phragmites* you plan on treating as possible (rather than leaving a buffer of uninvaded area). Your file should be saved as GPX to be uploaded in the web hub. If you are recording a track using ViewRanger you can follow the guide on [Appendix A](#). If you are using a handheld GPS, obtain the perimeter for your MU according to your device's instructions.

By drawing

If you are unable to establish the perimeter of your MU on the ground (e.g., you do not have a handheld GPS or smartphone, you cannot obtain good GPS signal, etc.), you will have the option to establish the perimeter by drawing it in the web hub.

Marking the perimeter

However the perimeter of your MU is established (on the ground or by drawing), you may want to mark the perimeter upon enrollment to help ensure it is easy to find in subsequent years. You will be revisiting the MU each year, with the original file you generated on your GPS or smartphone if possible, to assess whether *Phragmites* has spread from the MU. Marking can be done with flagging tape and/or stakes.

Enrollment questionnaire

The second step in enrolling a MU in PAMF is to answer a series of questions about the MU ([Appendix B](#)). Begin by looking for gradients across your MU. Look first for a live *Phragmites* stem-density gradient, where a section with more densely-growing *Phragmites* clearly transitions to less dense live *Phragmites* within the MU (Figure 1.1). If a live *Phragmites* stem-density gradient is observed, note the cardinal direction for this gradient.

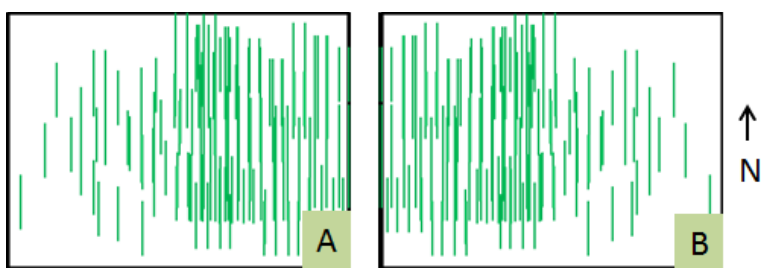


Figure 1.1. A stem-density gradient is where a section with more densely-growing *Phragmites* transitions to less dense live *Phragmites* within the management unit (MU). Both A and B have a stem-density gradient in an east to west (or west to east) direction.

If no stem-density gradient is observed, look for a hydrologic gradient, where there is a clear transition within the MU from drier to wetter - if this is observed, please note the cardinal direction for the hydrologic gradient (Figure 1.2).

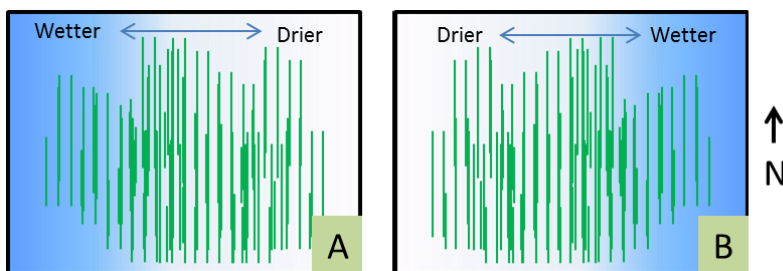
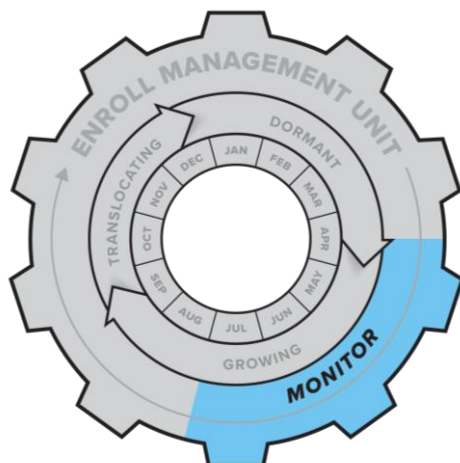


Figure 1.2. A hydrologic gradient is where there is a transition from drier to wetter within the management unit (MU). Both A and B have a hydrologic gradient in an east to west (or west to east) direction.

We recommend reading through [Appendix B](#) before heading into the field so that all questions can be answered with the greatest accuracy in the web hub. You can easily make a copy of the questionnaire for each unit you intend to enroll. The enrollment questionnaire needs to be filled out for each MU but only has to be filled out once.

Chapter 2. Monitoring

This chapter provides details on how the PAMF monitoring protocol should be applied to collect data for each management unit (MU). Monitoring is done once per year for every MU enrolled in PAMF.



When to monitor

Monitoring occurs in the growing season, which typically starts in April/May and lasts through August/September in the Great Lakes, varying annually due to factors such as location and weather. You should see completely green *Phragmites* stems during the growing season. These stems may be mixed in with completely brown standing dead stems from previous years, but any green stems should be entirely green, and new growth should be emerging from the ground. Monitoring can occur any time in the *Phragmites* growing season up to August 1st, the deadline for reporting your monitoring data to the web hub. This deadline will allow the delivery of guidance specific to your MU by the middle of August. We recommend monitoring toward the end of the growing season (but before August 1st) to ensure that the monitoring data best represent the MU.

Supplies

Monitoring equipment

- Field sheet ([Appendix C](#))
- Clipboard
- Pencil/pen
- 0.25 m² quadrat ([Appendix A](#))

- Handheld GPS and/or smartphone or tablet app (app must allow input and navigation to waypoints using latitude and longitude in decimal degrees format)
- Ruler or Vernier caliper

Monitoring locations

Web hub-established locations

You will upload the GPX file you generate of the perimeter of each MU ([Chapter 1](#)) into the web hub and select the direction of the gradient you observed. The web hub generates five monitoring locations for each MU. Monitoring locations are where you will collect the stem diameter, live stem count, and other data for your field sheet. These monitoring locations will differ from year to year, as the web hub generates new random points for every year that the MU is in PAMF. Navigate to each monitoring location using a hand-held GPS device, a tablet, or a smartphone app. Latitude and longitude coordinates will be provided in decimal degrees (WGS84) format. Because GPS directions are often accurate to a range of 1-3 m, use your best judgement when placing your quadrat and make sure that all your monitoring locations fall within the MU. If no *Phragmites* is found in a particular monitoring location generated by the web hub, use a "participant-established" method to create a replacement monitoring location.

Participant-established locations

You will establish monitoring locations yourself only when *Phragmites* is not found at one or more of the five monitoring locations generated by the web hub. If one or more of the web hub-generated monitoring locations does not contain any *Phragmites*, you are responsible for establishing an alternative monitoring location for each plot that does not contain *Phragmites* to ensure that a total of five locations are monitored in each MU. Coordinates for participant-established locations do not need to be recorded.

In order to have the most accurate data for your MU, participant-established monitoring locations should be established using a stratified-random methodology, meaning that a location is established randomly where there is known *Phragmites*.

Example: After navigating to all five monitoring locations generated by the web hub, a participant only finds *Phragmites* growing at three of these locations. Therefore, two additional participant-established locations are needed. These two additional monitoring locations can be established anywhere the *Phragmites* is growing within the MU. These monitoring locations should be established in a way that minimizes bias by following one or more of the stratified-random methods suggested under participant-established methods.

If possible, try to establish locations in different areas of growing *Phragmites* within the MU to better characterize the entire MU (Figure 2.1). This can be done by going to different locations where you see *Phragmites* growth within the MU (as needed for a total of five monitoring locations) and then choosing a stratified-random method to establish a monitoring location.

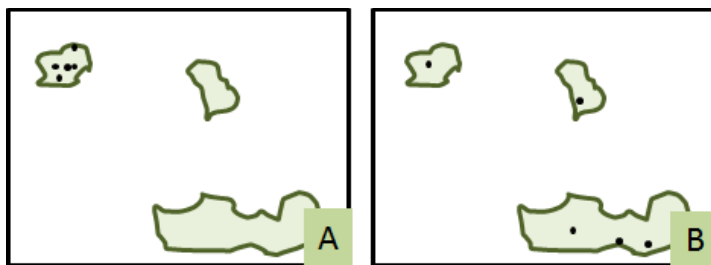


Figure 2.1. Assume each of the black boxes is a MU and the green clusters are *Phragmites* patches. If possible, any needed participant-established monitoring locations should be spread evenly among the *Phragmites* growing within a MU, as in B, rather than clustered in one *Phragmites* growth, as in A. After locating the *Phragmites* growth (different areas, if possible) within the MU, participant-established monitoring locations should be placed using stratified-random methodology as described below, in participant-established methods.

Here is a list of a few different stratified random methods you could use to randomly select a monitoring location within *Phragmites* growing in your MU:

Participant-established methods

- **Zero to Sixty** – This method requires a watch with a second hand. Face the *Phragmites* growing within the MU. Look at your watch, noting the number the second hand or the seconds digits are on. Take the same number of steps as the number noted previously – where you stop is a monitoring location. Repeat as needed, aiming to walk at different angles and still stop where *Phragmites* is growing within the MU, until a total of five monitoring locations is reached (including those generated by the web hub where *Phragmites* is growing).
- **Nearest Town** - Determine the nearest town or city to the MU. Use the letters of the town, starting with the first, to determine the number of steps to take from the edge of and into the *Phragmites* growing within the MU (A=1, B=2, C=3, etc.). Repeat this process for each participant-established location.
 - **Example:** A participant needs two participant-established monitoring locations within a MU near Toronto, ON. The first location would be found by walking 20 steps into the *Phragmites* growing within the MU; the second location by walking 15 steps from the edge of and into the *Phragmites* growing within the MU.

Collecting monitoring data

Stem count

At each of the five monitoring locations where live *Phragmites* is found, count the number of **live** *Phragmites* stems within the 0.25 m². Make sure that your monitoring locations are as undisturbed as possible-- do not place the quadrat where you have been walking or where there is clear disturbance from other factors (e.g., wind damage, muskrat holes). Count the live *Phragmites* stems inside the quadrat. To be counted, a stem must be emerging from the ground on the inside of the quadrat, not leaning over into it. See [Appendix A](#) for instructions on how to properly create a quadrat and place it at your monitoring location.

Stem diameter

At each of the five monitoring locations where live *Phragmites* is found, measure the diameter of three live *Phragmites* stems to the nearest millimeter (mm). Measure the live stem closest to each of the two marked corners of your quadrat and the live stem that is closest to the exact middle of the quadrat. The live stem diameter measurements should be taken as close to the ground as possible. We recommend using a manual Vernier caliper for measuring stem diameter. For information on how to use a caliper, see [Appendix A](#).

Phragmites stress

Within each of the five monitoring locations where live *Phragmites* is found, assess the *Phragmites* growing within the quadrat for signs of non-treatment stress. For the purposes of PAMF, there are three categories of non-treatment stress - environmental, pathogen, and insect. If you observe signs of any of these stressors on the majority of live *Phragmites* growing within a quadrat, record "Y" for yes. Otherwise, record "N" for no, or "U" for uncertain. For any quadrats where "Y" is recorded, you will indicate the type(s) of stress observed - "E" for environmental, "P" for pathogen, and/or "I" for insect. If you observe non-treatment stress, we encourage you to take a picture of the stressed *Phragmites* within each quadrat where stress is observed. You will be able to upload these photos to the web hub while reporting monitoring data.

Environmental

Determine if the majority of live *Phragmites* at your monitoring location (growing inside the quadrat) is showing signs of environmental stress, such as wilting, yellowing, and/or fading leaves. Only record environmental stress if the majority of live *Phragmites* growing inside the quadrat are showing one or more of these signs of environmental stress. If possible, take a picture of the *Phragmites* showing signs of environmental stress within each quadrat where this is observed.

Pathogen

Determine if the majority of live *Phragmites* at your monitoring location (growing inside the quadrat) show signs of disease, such as dark spots or other indication of fungal growth (Figure 2.2). Only record pathogen stress if the majority of live *Phragmites* growing inside the quadrat are showing these signs of pathogen stress. If possible, take a picture of the *Phragmites* showing signs of pathogen stress within each quadrat where this is observed.



Figure 2.2. Visible black spots on *Phragmites* leaves can be an indication of fungal infection, an example of pathogen stress.

Insect

Determine if the majority of live *Phragmites* at your monitoring location (growing inside the quadrat) show signs of insect stress. Signs of insect stress include irregular holes on the leaves, torn or missing leaves, holes in the stem, and leaf or stem galls (Figure 2.3). Keep in mind that the presence of insects does not necessarily stress the *Phragmites*-- if there are insects such as aphids or ants present but there are no signs of physical damage to *Phragmites*, do not indicate insect stress. Only record insect stress if the majority of live *Phragmites* growing inside the quadrat are showing one or more of these signs of insect stress. If possible, take a picture of the *Phragmites* showing signs of insect stress within each quadrat where this is observed.



Figure 2.3. Examples of insect stress. (A) A cigar gall, a type of stem gall, gives live *Phragmites* irregular spacing between new leaf-growth and causes truncated vertical growth. (B) Insect herbivory leaves small holes in the leaves of live *Phragmites*.

Percent establishment

Percent establishment is an estimate of the extent to which live *Phragmites* exists throughout the MU. Establishment is selected from three percent ranges of total area taken up by live *Phragmites*: 0-10%, 11-50%, and 51-100%. Select the range that suits your MU according to your best judgement. This estimate should only be made for live *Phragmites* (stems that are still green). Percent establishment is observed in relation to the total area of the MU-- two patches of *Phragmites* would have the same percent establishment (i.e., take up equal percentages of the MU) if they cover the same area, even if one has a lower density of live stems than the other (Figure 2.4).

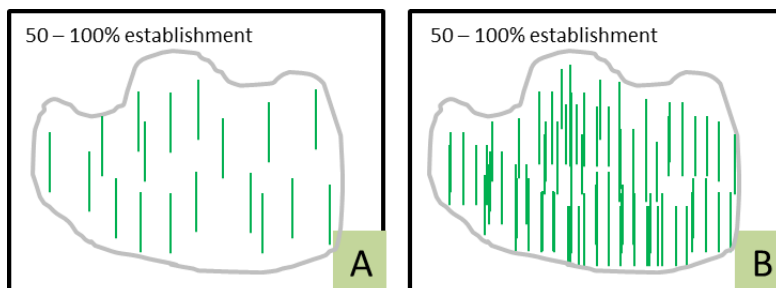


Figure 2.4. Assume each of the black boxes is a MU and the green lines represent live *Phragmites* stems. Percent establishment refers to the proportion of the MU where *Phragmites* is growing, regardless of *Phragmites* density. Example A and Example B would both likely fall into the 51-100% category, even though there is a clear difference in stem density between the two.

Percent establishment is not the same as percent cover. Percent establishment is an estimate of the extent to which live *Phragmites* is growing above-ground within the MU-- in other words, the proportion of the MU where live *Phragmites* above-ground growth occurs. Therefore, we are only estimating the area of the MU where live stems grow, regardless of their density. Conversely, when measuring percent cover you take into account the percent of incident light obscured by the plant's leaves, stems and flowers.

There are a variety of methods to estimate percent establishment. A participant can use up-to-date aerial imagery showing the MU during the current growing season as long as no treatments have been made between image collection and the evaluation for percent establishment. Alternatively, a participant can estimate the percent establishment of live *Phragmites* within their MU from the ground, from the air (by using drone imagery or estimating from a helicopter), or by combining these methods.

Whichever method(s) is used, it is important to remember that the estimation of percent establishment should be made in the growing season, and like all monitoring data, no treatments should occur within the MU between data collection and subsequent reporting to the web hub.

Phragmites spread

This question is to address the potential for *Phragmites* to spread beyond the perimeter (boundary) of the MU (even if it is reduced within the MU). Only evaluate this question after the initial year enrolled. Note that the perimeter of the MU stays constant, so you will need to check "yes" if the *Phragmites* has spread outside of the perimeter even if it has been diminished or eradicated from the MU itself.

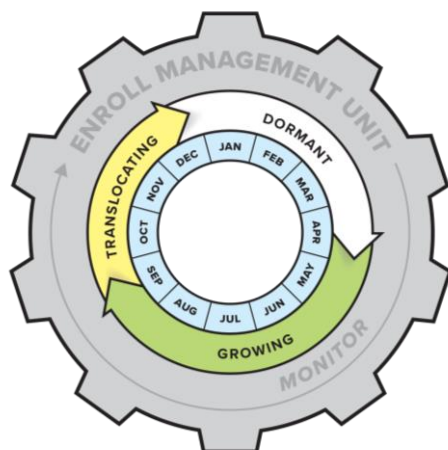
It may be difficult to remember exactly where the perimeter for a MU is following successful *Phragmites* treatment(s). Therefore, it is recommended that you walk the perimeter of the MU (by using the smartphone or GPS device and file originally used to enroll the MU) in each subsequent year before answering this question.

Reporting monitoring data

All monitoring data need to be reported by August 1st of each year in order to receive treatment guidance specific to each MU by the middle of August. This will be done through the PAMF web hub by logging in, selecting the MU(s) for which you collected monitoring data, and entering the monitoring data. Remember to upload any photos taken of *Phragmites* showing signs of stress within any of your quadrats while entering monitoring data to the web hub.

Chapter 3. Managing *Phragmites*

This chapter provides details on PAMF *Phragmites* management.



PAMF participants will receive treatment guidance for each management unit (MU) by mid-August for each year the MU is a part of PAMF. This guidance is applied to the year following its receipt. For example, guidance provided August 15th, 2017 would be considered for the period of August 15th, 2017 - July 31st, 2018. To access treatment guidance for a particular MU, log in to the web hub and click on "Treatment Guidance."

Receipt of updated treatment guidance for each MU is dependent upon timely entry of monitoring information (before the August 1st deadline).

How will it look?

PAMF treatment guidance is separated into three distinct phases based on the annual biological cycle of non-native *Phragmites* - translocating, growing, and dormant. Annual treatment guidance provided for each MU will consist of three treatment methods, one for each treatment phase.

The PAMF Technical Working Group identified sixteen potential combinations of the treatment phases and methods included in PAMF (Table 3.1). Each MU will receive the combination most likely to achieve the best result at the lowest cost.

Table 3.1. PAMF annual treatment guidance will be provided for each management unit as one of sixteen potential combinations of treatment phases (i.e., translocating, dormant, and growing) and treatment methods (e.g., Glyphosate, Spading, Flood, etc).

	Translocating	Dormant	Growing
1	Glyphosate	Pre-flood Clearing	Flood
2	Glyphosate	Mechanical (and remove biomass)	Rest
3	Glyphosate	Flood	Flood
4	Glyphosate	Mechanical (and leave biomass)	Rest
5	Glyphosate	Rest	Glyph
6	Glyphosate	Rest	Rest
7	Glyphosate +	Mechanical (and remove biomass)	Rest
8	Glyphosate +	Flood	Flood
9	Glyphosate +	Mechanical (and leave biomass)	Rest
10	Glyphosate +	Pre-flood clearing	Flood
11	Glyphosate +	Rest	Rest
12	Imazapyr	Rest	Rest
13	Rest	Pre-flood clearing	Flood
14	Cut underwater	Rest	Cut underwater
15	Spading	Rest	Spading
16	Rest	Rest	Rest

PAMF treatment phases

PAMF treatment phases are used for treatment guidance because effectiveness varies more with the biological cycle of *Phragmites* than by the calendar date. *Phragmites* biological processes occurring in a northern Ontario MU may be very different than those occurring in a southern Ohio MU on the same date. Furthermore, *Phragmites* within the same MU may be in different treatment phases on the same calendar date of two different years due to differences in weather from one year to the next.

Because differences in climate and weather make depending solely on calendar dates difficult, it is important to know how to recognize the treatment phases for the *Phragmites* within your MU.

Translocating

The translocating treatment phase refers to the period when *Phragmites* is sending an increased amount of carbohydrates and nutrients from above-ground tissue (leaves, stems) to below-ground tissue (rhizomes) as the plant prepares for dormancy. This typically occurs in late summer to early fall, but the timing can vary with climate and weather.

What to look for

Phragmites within your MU (or at a nearby location) will begin to turn brown from the bottom-up. This means that you will notice growing *Phragmites* which had previously been completely green will begin to have stems and leaves turning brown to brownish-yellow - this browning typically starts toward the bottom of the stems and gradually moves upward (Figure 3.1).



Figure 3.1. During the translocating phase, *Phragmites* leaves and stems will begin to turn from green to brown.

Another indication of translocation is when the inflorescence (*Phragmites* flowers) begin to mature and set seed. Seed-set in *Phragmites* can be recognized as the inflorescence begins to look more “fluffy” (Figure 3.2).



Figure 3.2. During the translocating treatment phase, the *Phragmites* inflorescence will begin to appear more “fluffy” as the seeds mature.

Dormant

The dormant treatment phase refers to the period when *Phragmites* above-ground tissues (leaves, stems) are deteriorating and below-ground tissues (rhizomes, roots) are mostly inactive. This treatment phase typically begins in late fall and lasts into mid-to-late spring - however, the start and end dates will vary with climate and weather.

What to look for

Previously growing (green) *Phragmites* within your MU (or at a nearby location) will have turned mostly or completely brown (Figure 3.3), and green *Phragmites* shoots have not yet begun emerging from the ground.



Figure 3.3. The above-ground portions of non-native *Phragmites* (stems, leaves) will be mostly to entirely brown during the dormant treatment phase, and there will be no new growth (green stems) emerging from the ground.

Growing

The growing treatment phase refers to the period when *Phragmites* above-ground tissues (leaves, stems) are growing and new shoots are emerging from the ground. This treatment phase typically begins in mid-to-late spring and lasts into late summer or early fall - however, the start and end dates will vary with climate and weather.

What to look for

Phragmites within your MU (or at a nearby location) will be emerging from the ground as green shoots. During the growing treatment phase, live *Phragmites* will be mostly to completely green (Figure 3.4). As the growing treatment phase progresses, *Phragmites* above-ground tissues will continue to grow until the translocating treatment phase begins.



Figure 3.4. During the growing treatment phase, live *Phragmites* is mostly to entirely green (A), and new stems emerge from the soil (B). There may or may not be new inflorescences, as these typically start later in the growing phase.

PAMF treatment methods

Annual treatment guidance consists of one treatment method for each of the three treatment phases. There are three specific guidelines participants should keep in mind when considering PAMF treatment guidance:

1. Multiple applications of one treatment method are allowed within each treatment phase, as long as the same method is used and applied consistently to all *Phragmites* within the MU.
 - i. **Example:** A recommended herbicide may be applied several times during the translocating phase, or spading could occur several times within the growing phase, as long as each application is made to all the live *Phragmites* within the MU.
2. It is possible for the same treatment method to be applied in different ways, with the decision-making on how to apply a particular method left up to the PAMF participant.
 - i. **Example:** “Remove biomass” could be accomplished with a controlled burn or by cutting and removing *Phragmites*, and “Glyphosate” could be accomplished by helicopter application and/or by hand, as long as the herbicide is applied consistently to all live or translocating *Phragmites* within the MU (to the best of a participant’s ability).
3. The PAMF treatment recommendation is only a suggestion. To continue participating in PAMF, it is only necessary to report up-to-date monitoring information ([Appendix C](#)) and which treatments, if any, have been made ([Appendix D](#)) by the August 1st deadline. In

other words, participants who choose not to apply the PAMF treatment recommendation are welcome to continue participation as long as they report what they did, how well it worked, and why they chose another option in a timely fashion, returning the treatment reports and monitoring report by August 1st.

- i. **Example:** A PAMF participant receives a treatment recommendation for their MU and decides to use different treatment methods (or none at all) during the three treatment phases. This is acceptable if the participant monitors during the growing season and reports these monitoring data and what they did over the previous year's treatment phases by August 1st.

Below, we provide a brief overview of all the methods that may be recommended for a MU involved in PAMF.

Glyphosate

If glyphosate is recommended as a treatment method, follow label instructions for suggested rate of application. Be sure to add a surfactant if one is recommended on the glyphosate product label. **It is imperative to only use products labeled for aquatic use if your MU has standing water or is near a waterbody and/or wetland.** Specific restrictions are listed on the product label for all herbicides and surfactants. For in-depth assistance on mixing and comparing herbicides as well as additional resources, see the Great Lakes Phragmites Collaborative's Herbicide Quick Guide at <http://greatlakesphragmites.net/files/HerbicideQuickGuide.pdf>.

This treatment method can be applied in many ways, so be sure to decide which is most appropriate for your MU. These techniques include aerial application (helicopter, boom-sprayer, etc.), ground application (backback sprayer, hand sprayer, glove wicking, etc.), and/or other techniques that may work for your unique situation. This treatment method should be applied to all live *Phragmites* within the MU.

Glyphosate +

Glyphosate + refers to a mix of two or more herbicide products - one with glyphosate as the active ingredient, and at least one other with imazapyr or imazamox as the active ingredient. If glyphosate + is recommended as a treatment method, follow label instructions of all herbicide products used. Label instructions will provide guidance for rate of application, and whether or not a surfactant should be added to the mix (or if it is included in the product). **It is imperative to only use products labeled for aquatic use if your MU has standing water or is near a waterbody and/or wetland.** Specific restrictions are listed on the product label for all herbicides and surfactants.

This treatment method can be applied in many ways, so be sure to decide which is most appropriate for your MU. These techniques include aerial application (helicopter, boom-sprayer, etc.), ground application (backback sprayer, hand sprayer, glove wicking, etc.), and/or other techniques that may work for your unique situation. It is key to remember that this treatment method should be applied to all live *Phragmites* within the MU.

Imazapyr

If imazapyr is recommended as a treatment method, follow label instructions for the suggested rate of application. Be sure to add a surfactant if one is recommended on the imazapyr product label. **It is imperative to only use products labeled for aquatic use if your MU has standing water or is near a waterbody and/or wetland.** Specific restrictions are listed on the product label for all herbicides and surfactants.

This treatment method can be applied in many ways, so be sure to decide which is most appropriate for your MU. These techniques include aerial application (helicopter, boom-sprayer, etc.), ground application (backback sprayer, hand sprayer, glove wicking, etc.), and/or other techniques that may work for your unique situation. It is key to remember that this treatment method should be applied to all live *Phragmites* within the MU.

Remove biomass

This treatment method involves removing all aboveground *Phragmites* (stems, leaves) from within a MU. This can be accomplished by a variety of techniques, including burning and/or cutting and removing the *Phragmites*. It is up to the participant to determine the best technique for their MU.

Mechanical (and leave biomass)

This treatment method involves leveling all above-ground *Phragmites* (stems, leaves) within a MU. This can be accomplished by a variety of techniques, including cutting, rolling, or crushing the above-ground *Phragmites* and then leaving the *Phragmites* material inside the MU. It is up to the participant to determine the best technique for their MU.

Pre-flood clearing

This treatment method involves one of two general techniques to be done in preparation for a controlled flood:

1. **Level and leave**-- Cut, roll, or crush all aboveground *Phragmites* (stems, leaves) within a MU and then leave this material inside the MU
2. **Completely remove**-- Cut, roll, or crush all above-ground *Phragmites* (stems, leaves) within a MU and then remove above-ground material; or burn all above-ground *Phragmites* (either while standing or after cutting, rolling, or crushing).

It is up to the participant to determine the best technique for their MU.

Flood

This treatment method refers to putting water over all *Phragmites* within a MU a period of time within a treatment phase. This can be accomplished by using existing water-control structures such as weirs, pumps, and/or floodgates to allow water into a MU. Using temporary or earthen cofferdams to retain water is another option. In addition, a flood that occurs naturally can be counted for this treatment method, as long as flooding occurs wherever there is *Phragmites* within the MU and achieves complete coverage over all *Phragmites*.

Spading

This treatment method refers to the cutting of *Phragmites* stems just below the soil surface and removing the cut *Phragmites* from the MU. We suggest using a sharp, flat-edged spade and minimizing below-ground disturbance to the rhizomes. An effective technique is to make a quick, angled insertion of the spade and immediately remove it along the same path. If done correctly, the stalk can be easily lifted from its position and surrounding soil will fill the hole. If it does not, use the surrounding soil to fill in the hole where the *Phragmites* stem was. Remove all the live stems from within the MU.

Additional information on the spading treatment method, including instructional videos, can be found at: <http://www.greatlakesphragmites.net/resources/webinars-and-presentations/>.

Cut underwater (and remove biomass)

This treatment method refers to the cutting of *Phragmites* stems beneath the water level and as close to the substrate as possible. The cut *Phragmites* should be removed from within the MU. Many techniques can be used to accomplish this treatment method, including cutting with hand tools (e.g., clippers, rice sickles) or using heavy equipment within the MU. All cutting techniques should be followed by removal of the newly-cut *Phragmites*.

It is up to the participant to determine the best technique for their MU.

Rest

In a “rest” treatment, no *Phragmites* treatments are made within the MU.

More information

If you will be treating *Phragmites* with herbicide, make sure you know the regulations of your state or province and have any required herbicide application permits.

Additional information on state and province ordinances, as well as details on some of the effective techniques for PAMF treatment methods, can be found by visiting the Great Lakes

Phragmites Collaborative website at GreatLakesPhragmites.net or by contacting the agencies and organizations tasked with invasive plant management near you.

Treatment reports

PAMF participants will report on the treatments made within their MU by the reporting deadline of August 1st each year. This reporting will be for all treatments made during the preceding year and are in addition to the monitoring reports due August 1st. For example, a PAMF participant would report the treatment methods used between the time treatment guidance was received in mid-August and July 31st, 2018 by August 1st, 2018.

An enrolled MU will need three treatment reports for every year involved in PAMF - one for the translocating phase, one for the dormant phase, and one for the growing phase. This reporting is done inside the PAMF web hub and can occur at the end of each treatment phase or all three at once toward the end of the growing season (before the August 1st deadline).

This reporting step will be completed by answering questions about the specific treatment method used during each treatment phase ([Appendix D](#)). We recommend reading through these questions before management occurs to anticipate what treatment details will be requested.

Frequently asked questions

Enrolling

Can we enroll a unit that has been managed before?

Yes. The goal of PAMF is to provide the best treatment guidance possible for any land that has *Phragmites*. Unless the unit has been completely eradicated of *Phragmites*, we encourage its enrollment.

What should I do if I consider my *Phragmites* patch to be too small for enrolling?

If you plan on managing an area of non-native *Phragmites* but think it is too small to enroll, we encourage you to enroll it anyway - PAMF will provide site-specific treatment guidance and use your treatment efforts to improve guidance for everyone within the Great Lakes basin.

Is there value in using a measuring tape to get accurate size of MU?

No. The only information that will be used for each MU is the perimeter in GPX format.

I manage a fen ecosystem that has multiple patches of *Phragmites* spread out. Where would I establish the perimeter of my MU?

We always suggest defining your MU as the smallest area surrounding the *Phragmites* that you plan on treating. If these patches are very spread out, then we suggest you enroll multiple small MUs-- one per patch of *Phragmites*. However, there are instances where a participant may prefer enrolling a large MU around all *Phragmites* they plan to treat.

Keep in mind the three guidelines when establishing a MU:

1. **Treat across the whole unit.** Any treatment applied to *Phragmites* within a MU should be applied consistently to all *Phragmites* growing within the MU - therefore, your available resources may help determine MU size.
2. **Use one treatment type per phase.** Only use one treatment to manage *Phragmites* in a given MU per treatment phase (i.e., translocating, dormant, and growing). If you plan on using more than one type of treatment on your land during the same treatment phase, you should enroll more than one MU.
3. **Keep the boundary consistent.** The boundary of each MU will not change while enrolled in PAMF regardless of landscape changes from year to year. Create your MU perimeter knowing that your treatment will be applied in the same location every year-- this consistency will allow for the evaluation of long-term treatment success.

I use a Garmin GPS. Does that make GPX files?

GPS Exchange Format (GPX) files express points as latitude and longitude in decimal degrees and always use the WGS84 datum. Most Garmin GPS devices are able to export routes and points of interest as GPX files. Additionally, the monitoring locations that the web hub generates

can be loaded onto a Garmin device from a computer. For more information, visit <http://www.garmin.com/us/maps/poiloader>.

I don't have a GPX file to upload (e.g., don't have a GPS device or a smartphone, and/or unable to get good GPS signal). Can I still enroll a MU?

No problem! You are always able to enroll a MU by drawing the perimeter in the web hub. While the preferred method is uploading an accurate GPX file of the MU's perimeter, we understand that this is challenging in some cases. If you need to draw the perimeter using the web hub, please do your best to make it as accurate as possible - drawing the perimeter of your MU tightly around the *Phragmites* you plan on treating (rather than leaving a buffer of uninvaded area).

Will the web hub generate UTM's or a shapefile layer?

The web hub will generate the coordinates of your monitoring locations once you have uploaded your GPX file of the perimeter of your MU.

Monitoring

Should I always try to monitor in the same month every year, or can I monitor at any time in the growing season?

While we recommend that you try to monitor at the same time every year, you can monitor at any time in the growing season as long as you do so before the August 1st deadline. Growing conditions are never exactly the same from year to year, so a calendar date should serve as a guideline rather than a rule for knowing when to monitor. We do recommend the monitoring occur as late in the growing season as possible while still giving you enough time to report the monitoring data to the web hub.

How accurate do I have to be in navigating to my monitoring locations?

As GPS and smartphone directions may only be accurate to 1-3 meters, we do not expect great accuracy on the placement of the monitoring locations. However, all your monitoring locations need to fall within the MU.

Is percent establishment the same as percent cover?

Percent establishment is not the same as percent cover. Percent establishment is an estimate of the extent to which live *Phragmites* is growing above-ground within the MU-- in other words, the proportion of the MU where live *Phragmites* above-ground growth occurs. Therefore, we are only estimating the area of the MU where live stems grow, regardless of their density. Conversely, when measuring percent cover you take into account the percent of incident light obscured by the plant's leaves, stems and flowers. To best understand the percent establishment concept, please refer to Figure 2.4 in [Chapter 2](#).

I cannot enter my management unit on foot. Can I monitor from a helicopter?

You can provide information about percent establishment and treatment. However, without entering the MU on foot, you will be unable to count live *Phragmites* stems or measure stem diameter, which means PAMF cannot provide treatment guidance specific to your MU.

Do I need to collect information about any other plants (native and non-native) growing on my MU?

PAMF is a tool designed to learn from every non-native *Phragmites* treatment made in the Great Lakes basin and to ensure efficient management efforts for landowners. For the purposes of PAMF, you are not required to record any information unrelated to the monitoring protocol and treatments made for non-native *Phragmites*.

What happens if I manage *Phragmites* and get another invasive species instead of native plants?

We recognize the need to plan for site conditions after *Phragmites* removal, but PAMF is a tool that provides site-specific treatment guidance for non-native *Phragmites* and cannot provide assistance on restoration or management of other invasive species.

Treatment

I have enrolled a MU and applied a consistent treatment in year one. In year two, I want to apply different treatment methods within that unit. Can I report two different treatment methods, or should I split the MU?

We always encourage our participants to enroll a MU that will allow them to consistently apply only one treatment type during the same treatment phase to all *Phragmites* growing within the MU. If you plan to continue treating these two sections differently, you may want to enroll these two sections as two individual MUs.

I applied two different treatment methods within the same MU on a given temporal phase, how do I report that?

We suggest you apply one treatment method on one MU on a given temporal phase. If you have already applied different treatment methods within the same MU on a given temporal phase you will be able to report this activity as “Other” and describe these treatments. As the PAMF treatment guidance is only a suggestion, this will not exclude you from continuing to participate in PAMF. You may continue to monitor your MU and receive treatment guidance for each year, even if you never apply the exact treatment methods recommended by PAMF.

My MU is in a coastal wetland habitat, and a natural flood event (rising water levels) contributed to *Phragmites* mortality after I applied another treatment. Can I report two treatment methods in the same time period? How do I communicate that the water levels assisted with management?

You may only report what you have done (spading, herbicide, burn, etc.). You can report that the natural flood event seemed to contribute to *Phragmites* control in the “other comments” section on the treatment report.

I do not wish to follow the treatment the web hub recommended. What can I do?

You may have a number of reasons for not following the treatment the web hub recommends. It is important to remember that PAMF is designed to offer guidance based on the particular conditions of your MU, but does not force participants to apply particular treatments. You may apply whatever treatment you wish, but remember that only the suite of treatment combinations highlighted in the Treatment Methods section of this guide will contribute to region-wide learning. Please remember to note which treatments you have applied during the treatment reporting phase (details in [Chapter 3](#)).

What happens if I can't treat a MU on one given year or on any of the treatment phases?

If you are unable to do any *Phragmites* management within your MU during one or more of the temporal phases (translocation, dormant and growing), you will report a “rest” for the treatment phase.

This can be done for any treatment phase in which no action could be taken. As long as you continue to conduct monitoring during the growing season and report your monitoring data before the August 1st deadline, you will receive treatment guidance by the middle of August.

What happens if I forget to monitor or miss the August 1st deadline?

If you miss the deadline, you won't receive any treatment guidance for the following year. The web hub won't be able to generate treatment recommendations that best suit your MU for that year without the monitoring information. You can still treat your MU however you wish. As long as you monitor during the next growing season, you will then receive treatment guidance.

If I am not able to treat, monitor, and report information about my MU for a few years, do I have to re-enroll my MU?

If for some reason you were unable to treat, report, and monitor your MU for a long period of time, you won't need to enroll your MU again. You may resume monitoring during the growing season you are able in order to receive up-to-date treatment guidance.

I am unsure the *Phragmites* in my land is non-native, what should I do?

It is important to determine whether your stand is native or non-native before even enrolling. There are plenty of resources that can help you distinguish between the two haplotypes. For more information visit: <http://www.greatlakesphragmites.net/blog/native-vs-invasive-phragmites/>

Can I treat a MU that has both native and non-native *Phragmites*?

We suggest to prioritize the treatment of non-native *Phragmites* over the survival of native. You can treat a MU that has both native and non-native *Phragmites*, as long as you are very careful not to spray and/or remove and kill the native plants.

Who can I contact for further information about PAMF, monitoring protocols and guidance?

For any questions, concerns, or comments, contact Karen Alexander at kalexander@glc.org.

Appendix A. How-to guides

Table of contents:

A.1 ViewRanger app

A.2 Vernier caliper

A.3 PAMF quadrat




A.1 ViewRanger app

When installing the app and opening it for the first time, you must grant the app permission to use the device's location information (if this is not done automatically, the app will request it for you). You won't need to add or buy extra premium maps to use the app for PAMF purposes, so skip any suggested premium maps.

Recording a track on ViewRanger

You will record a track around the perimeter of each of your MUs. If you foresee using the app in a remote area with no cellphone reception, open the map of the area you will be recording a track at before leaving to the field (with reception or Wi-Fi connection). The track will be recorded without cellphone reception using the GPS on your smartphone.



To record a track around one MU:

1. Open the ViewRanger app.
2. Stand on your starting point of the track around the MU. Mark the starting point to remember the spot.
3. On the main map select the button at the top right of the screen with three dots , select "Settings," then select "Track," and then set the Track minimum distance to the lowest possible distance (m), and the Track minimum time to the lowest possible time (s). This ensures that your perimeter will be mapped with the greatest level of detail. Return to the main map screen.
4. On the main map select the "+" (Android) or "new" (iPhone), regardless of what the map is showing and continue to the next step.
5. Select "Record Track."
6. Select the red spot recording icon and stand there for a few seconds to allow the application to start recording .
7. Start walking around the perimeter of your MU.
8. Once you have reached the starting point again, stand there for a few seconds and proceed to select the "Trip time" icon on the lower right corner to return to the recording screen. If the track doesn't perfectly connect start and end points together, it is ok to save it like that, the web hub tool will connect those for you.
9. Select the stop square icon .
10. Save the track with a name that allows you to identify your MU.

Downloading a track from ViewRanger to your computer

For Android users:


You will be able to download your tracks as GPX once you have internet connection or cell phone reception.

1. Tap on your profile 
2. Select "Tracks"
3. Select the track you wish to download:
4. Select the more options button on the right corner of the screen 
5. Choose "Import/Export " from the drop down menu
6. Choose "Export GPX", then "Export" and finally choose "OK" without changing the file path the app has selected. The screen will show a confirmation that your file has been saved.
7. Choose "Send" to send your perimeter file via e-mail. This file will be uploaded in the web hub to generate the monitoring locations.

For iPhone users:

You will connect your phone to your computer and open iTunes.

On your phone:

1. Tap on your profile 
2. Select "Tracks"
3. Select the track you wish to download
4. Scroll down to the "Options" section and select "Edit"
5. Select "Export element as GPX", your file will be saved in the phone's memory

On iTunes (computer):

6. Select your device
7. Select "Apps" on the left hand menu
8. Scroll down the right hand menu to the "File sharing" section and select "ViewRanger"
9. In the "ViewRanger Documents" window, select the file you wish to download
10. Select "Save to"
11. Select the folder where you want the file downloaded on your computer and press "Save." This file will be uploaded in the web hub to generate the monitoring locations.
12. Eject your iPhone from the computer.

Entering waypoints on ViewRanger


For entering the monitoring locations suggested by the PAMF web hub as waypoints:

1. On the search icon 

2. Select "Coordinates."
3. Tap on the inverted arrow (Android) or scroll down (iPhone) to change coordinates to "Lon/Lat (decimal)."
4. Enter the latitude and longitude of the point.
5. Tap "View coordinates on map."
6. On the main map select the "+" (Android) or "new" (iPhone) icon on the lower right corner of the screen.
7. Tap on "Add POI"
8. Name your POI or waypoint according to your MU, you will have 5 waypoints per MU.
9. Select "Done."

Navigating to waypoints on ViewRanger

If you foresee using the app in a remote area, open the ViewRanger app while you have reception or a Wi-Fi connection and load the map of your area before heading into the field. You will be able to navigate to waypoints without cellphone reception by using the GPS on your smartphone.

1. Tap on the more options icon at the upper right corner 
2. Tap on "My Points of Interest."
3. Select the three vertical dots icon at the side of the POI or waypoint you want to navigate to.
4. Choose "Navigate to."
5. Follow the arrow, located on the lower right corner of the screen, to the waypoint (marked with a star).

A.2 Vernier caliper

A manual Vernier caliper will help you collect an accurate measurement of the *Phragmites*' stem diameter (Figure A.1). When looking directly at the main scale, this caliper has two main "jaws" pointing down, and two small jaws pointing up. For measuring the stem diameter we will use the main jaws, the main scale, and the Vernier scale (smaller on the lower side of the main scale).

For taking a measurement follow the next steps:

1. Select the lowest, most reachable section of the plant's stem.
2. Clean the stem from any debris.
3. Open the main jaws of the caliper so they fit snugly around the stem. Readjust the jaws if needed but do not apply pressure on the stem.
4. Find the last number on the **main scale** before the "0" on the **Vernier scale** and record it. This number is the stem diameter in millimeters. *Note: we won't be using the Vernier scale to record fractional numbers of stem diameter.*

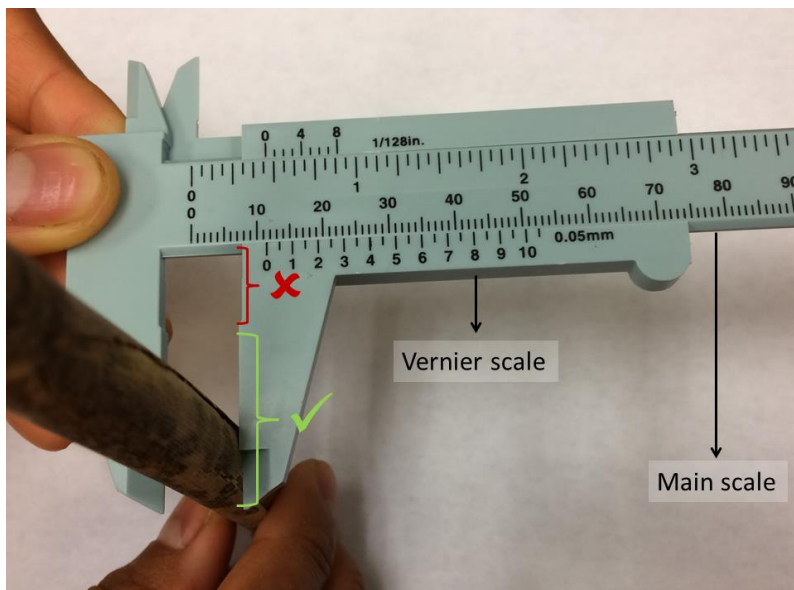


Figure A.1. Correct positioning of the stem in between the main jaws of the caliper. Note that the diameter of this stem is 11mm.

A.3 PAMF quadrat

We recommend using PVC to make your quadrat. Cut four pieces of PVC into 0.5 m (50 cm) pieces and attach them in a square using connecting elbows. In order to ensure that as much of the process as possible follows the same protocol, mark the top left and bottom right corners with permanent marker or tape. These corners will be used in the stem diameter measurement.

In order to get the most accurate measure of your monitoring location, the quadrat needs to be as low to the ground as possible. To ensure that you only measure the *Phragmites* whose stems are within the bounds of the quadrat, you will need to place it as close to the earth as possible. To do this, disconnect one side of the quadrat and use this open space to slide your quadrat into position on the ground around the *Phragmites*. Once you have laid the quadrat on the ground, reconnect the remaining side in order to enclose the *Phragmites* within your quadrat.

Appendix B. Enrollment questionnaire

Management unit _____

Date _____

1. Is there a gradient of stem density throughout the MU? If so, note the direction (N/S, W/E, NW/SE, SW/NE) and skip Question 1a.	_____
1a. Is there a gradient in the hydrology of your MU? If so, note the direction.	_____
2. Is there <i>Phragmites</i> present immediately outside the MU border at any point?	YES / NO
3. Is any portion of the MU boundary shared with a neighboring land manager or landowner? <i>If NO, proceed to Question 4.</i>	YES / NO
3a. If YES to Question 3: Do you observe non-native <i>Phragmites</i> growing on the property that borders your MU?	YES / NO
3i. If YES to Question 3a: Does <i>Phragmites</i> grow immediately across the border of your MU and onto a neighbor's property?	YES / NO
4. Has this MU been treated within the past 5 years using herbicide that contained glyphosate or imazapyr as the active ingredient? <i>If NONE, proceed to Question 5.</i>	GLYPH IMAZAP NONE
4a. For how many years was this MU treated with a glyphosate herbicide?	____ years
4b. For how many years was this MU treated with an imazapyr herbicide?	____ years
5. Which of the following hydrologic regimes would you classify your MU as? Wet: standing water present over the majority of the MU for most of the year Moist: occasional standing water, but for less than 50% of the year over the MU Dry: never any observed standing water over any of the MU	WET MOIST DRY
6. Would you have the ability to apply herbicide to your MU?	YES / NO
7. Would you have the ability to use prescribed burns on your MU?	YES / NO
8. Are the conditions ever appropriate to allow for cutting the <i>Phragmites</i> under water throughout all of your MU?	YES / NO
9. Can you control the water level over the entirety of your MU?	YES / NO

Appendix C. Monitoring field sheet

Commented [1]: This image is a place-holder until we convert this document to PDF. As a PDF document, there will be 2 pages (1 page with the Appendix C title, and another with just the field sheet - both pages will be in horizontal layout)

Date: _____ Participant Name: _____ Management Unit: _____

Quadrat	1	2	3	4	5
Live stem count (#)					
Live stem diameters (mm) *					
Stress visible on majority of live <i>Phrag</i> in quadrat? (Y,N,U)†					
If Y, indicate stressor (E, P, I) ‡					

* 3 measurements per quadrat – closest live *Phrag* stem to each black elbow and live *Phrag* stem in the center of quadrat
Y=yes, N=no, U=unsure
†E=environmental, P=pathogen, I=insect

% Establishment (Check one)		
0-10%	11-50%	51-100%

Has <i>Phragmites</i> spread from management unit? *	(Check one)
Yes	
No	

*Only answer after Year 1

Notes:

Appendix D. Treatment report

Read over this report before treating *Phragmites* in order to ensure that all points are addressed. You will enter this information into the web hub either at the end of each treatment phase (translocating, growing, and dormant) or at the end of the PAMF cycle by the August 1st deadline. In either case, each MU will have three treatment reports per year, one for each treatment phase.

Management unit _____

Date _____

Phase (circle one):	Translocating	Dormant	Growing
1. Did you treat your MU as recommended by the model?		YES / NO	
1a. If NO, could you explain why you chose not to follow the treatment guidance provided?			
1b. If you didn't treat your MU as recommended, which treatment did you apply? (circle one) Glyphosate; Imazapyr; Glyphosate +; Rest; Cut underwater; Spading; Pre-flood clearing; Remove Biomass; Flood; Mechanical (and leave biomass); Other			
If other, please explain:			

Please fill out the information according to the treatment you applied.

Glyphosate	
Product used:	% Concentration (by volume):
Surfactant used:	% Surfactant (by volume):
Number of applications during "time period":	
Technique used (circle one):	
Aerial broadcast Ground broadcast Spot treatment	
If "Ground Broadcast" or "Spot treatment", did the applicator the enter MU? YES / NO	
If YES, choose equipment type (circle one):	
Tracked vehicle Wheeled vehicle On-foot Tracked vehicle + on-foot Wheeled vehicle + on foot	
Additional Notes/Detail (specific equipment used, etc):	

Glyphosate +	
Glyphosate product used:	% Concentration (by volume):
Product added to Glyphosate:	% Concentration (by volume):
Surfactant used:	% Surfactant (by volume):
Number of applications during "time period":	
Technique used (circle one):	
Aerial broadcast Ground broadcast Spot treatment	
If "Ground Broadcast" or "Spot treatment", did the applicator the enter MU? YES / NO	
If YES, choose equipment type (circle one):	
Tracked vehicle Wheeled vehicle On-foot Tracked vehicle + on-foot Wheeled vehicle + on foot	
Additional Notes/Detail (specific equipment used, etc):	

Imazapyr	
Product used:	% Concentration (by volume):
Surfactant used:	% Surfactant (by volume):
Number of applications during "time period":	
Technique used (circle one):	
Aerial broadcast Ground broadcast Spot treatment	
If "Ground Broadcast" or "Spot treatment", did the applicator enter MU? YES / NO	
If YES, choose equipment type (circle one):	
Tracked vehicle Wheeled vehicle On-foot Tracked vehicle + on-foot Wheeled vehicle + on foot	
Additional Notes/Detail (specific equipment used, etc):	

Cut underwater (and remove biomass)
Name or description of the equipment used:
Please describe how you removed the cut <i>Phragmites</i> from the MU:

Spading
How many times did you spade?

Flood
Type of flood (circle one): Controlled (pumps, dykes, etc.) Natural (Coastal wetlands, riparian areas, etc.)
Did the flood last the entire treatment phase? YES / NO
If NO, please specify the duration of flood in months:
Was water over the top of all <i>Phragmites</i> within the MU for the duration of the flood?

YES	NO	UNKNOWN
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Pre-flood clearing
What technique did you use? (circle one) Burn Mechanical Mechanical then burn
If mechanical, what technique? (circle one) Mow and rake Digging/excavation Roll Other
If other, please explain:
Did the applicator enter the MU? YES / NO
If YES, choose equipment type (circle one):
Tracked vehicle Wheeled vehicle On-foot Tracked vehicle + on-foot Wheeled vehicle + on foot
Additional Notes/Detail (specific equipment used, etc):

Mechanical (and leave biomass)
What technique did you use? (circle one) Mow Crush/roll Till Mulch Other
If other, please explain:
Did the applicator enter the MU? YES/NO
If YES, choose equipment type (circle one):
Tracked vehicle Wheeled vehicle On-foot Tracked vehicle + on-foot Wheeled vehicle + on foot
Additional Notes/Detail (specific equipment used, etc):

Remove biomass
What technique did you use? (circle one) Burn Mechanical Mechanical then burn
If mechanical, what technique? (circle one) Mow and rake Digging/excavation Roll Other
Did applicator enter MU? YES/NO
If YES, choose equipment type (circle one):
Tracked vehicle Wheeled vehicle On-foot Tracked vehicle + on-foot Wheeled vehicle + on foot

Additional Notes/Detail (specific equipment used, etc):