

# Japanese knotweed in Minnesota

How to use phenology data to  
inform management decisions

April 2024



**This document describes:**

- 1) How recent research on the life cycle of Japanese knotweed in Minnesota can be used to guide management decisions, and
- 2) Where to access the research results.

The same [research project](#) also involved wild parsnip.

## What is Japanese knotweed?

Japanese knotweed, *Polygonum cuspidatum* (also known as *Reynoutria japonica* or *Fallopia japonica*), is a perennial, shrub-like plant that can grow up to 9 feet tall. It is one of four knotweeds that may be encountered in Minnesota, which includes a dwarf variety of Japanese knotweed (var. *compacta*), giant knotweed, and Bohemian knotweed (a hybrid of giant and Japanese knotweed).

All four knotweeds are regulated as [Prohibited-Control Noxious Weeds](#) in Minnesota. This means that no transportation, propagation, or sale of these plants is allowed in the state. For plants already present on the landscape, effort must be made to prevent their spread into new areas.



### More information

- [Knotweeds in Minnesota](#) (Minnesota Dept. of Agriculture)
- [Comparing knotweeds](#) (Minnesota Dept. of Agriculture)

## What is plant phenology?

Plant phenology is the study of cyclical (e.g., seasonal) events in a plant's life cycle and how they interact with factors like climate and weather. The word *phenophase* is often used to describe particular states or phases in the annual life cycle of a plant that can be observed and defined by a start and end point, such as flowering.<sup>1</sup>



Plants require a certain amount of heat to develop from one phenophase in their life cycle to another. The amount of accumulated heat needed for development is measured in units called *degree-days*. Scientists can calculate the average degree-days needed for different phenophases by building a degree-day model from observations of the plant's development in relation to the surrounding temperature.

<sup>1</sup> Source: USA National Phenology Network, <https://www.usanpn.org>

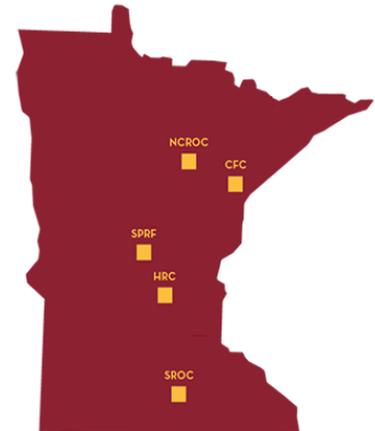
## More information

- [USA National Phenology Network](#)
- [Degree-days](#) (Univ. of California)

## Japanese knotweed phenology in Minnesota

Beginning in 2020, researchers at the University of Minnesota tracked the phenology of Japanese knotweed for multiple years on knotweed planted at 5 different locations in Minnesota: the UMN Research and Outreach Centers in Becker, Cloquet, Grand Rapids, St. Paul, and Waseca. Many plants were observed at each site, and for each individual plant, researchers collected data on the duration of the phenophases described below.

In addition, volunteers collected similar data through a participatory science program called [Pesky Plant Trackers](#).



### Initial growth (emergence)

New growth of the plant is visible after a period of no growth (winter or drought), from new shoots breaking through the soil surface. Growth is considered "initial" on each bud or shoot until the first leaf has fully unfolded.



## Leaves

One or more live, fully unfolded leaves are visible on the plant. Fully dried or dead leaves do not count for this phenophase.



## Flower buds and open flowers

One or more fresh, open or unopened flowers or flower buds are visible on the plant (*flower buds*). One or more fresh, opened flowers are visible on the plant (*open flowers*). Flowers are considered "open" when the reproductive parts (male stamens or female pistils) are visible between or within unfolded or open flower parts (petals, floral tubes, or sepals). The flowering phenophases will overlap and end at the same time (once wilted or dried). Wilted or dried flowers do not count for these phenophases.



## Lab testing and computer modeling

The researchers also tested plants in the laboratory to determine the lowest temperature at which Japanese knotweed development will occur. With this information and the field observations, researchers built a simple degree-day model. The model can estimate when phenophases like leaf emergence or flowering will occur based on the accumulated degree-days at a given Minnesota location.

## More information

- [Nature's Notebook Japanese knotweed phenophase guide](#) (USA National Phenology Network)
- [Minnesota Invasive Terrestrial Plants and Pest Center research project](#) (Univ. of Minnesota)
- [Pesky Plant Trackers](#) (Univ. of Minnesota)



## Access to Japanese knotweed phenology model

The Japanese knotweed degree-day model from the University of Minnesota research has been made available for free as an application on the [USPEST](#) website. This site is connected to a large network of weather stations around the country, including dozens within Minnesota.

Using the research-based models and some user-specified information, the application allows anyone to access a summary of Japanese knotweed phenology during a given year.

The following screenshot shows an example of what the website can provide.

**Online Phenology and Degree-day Models**  
for agricultural and pest management decision making in the US

Intro | Station | Model | Output | Graph

Japanese knotweed at HPN30, Falcon Heights MN, 2024

**Model Inputs**  
 show model inputs table

**Date Comparison**  
 show Date Comparison table  
Accumulation for HPN30 from 1-1-2024 through 4-15: 622 DDs(F)  
data quality is ok.

This year is about	versus	QA
20 days ahead	2023	ok
22 days ahead	2022	ok
NA	30-yr normal	ok

**Model Output**  
 show full table

Temperatures (and degree-days) are in F; rain in inches.

date	max	min	rain	DDs today	DDs cumu	QA	events
4-1	27	22	0.00	0.0	0		* START *
3-14	58	35	0.00	14.5	329		First emergence
3-25	36	33	0.00	2.5	359		50% emergence
4-15	66	48	0.00	25.0	622		First leaves
4-17	56	49	0.00	20.5	664	Nd	50% leaves
7-29	86	66	0.12	44.0	4247	Nm	First flower buds
8-6	86	66	0.13	43.8	4599	Nm	50% flower buds
8-12	85	65	0.15	42.8	4858	Nm	First open flowers
8-21	84	64	0.14	42.1	5239	Nm	50% open flowers
8-28	83	64	0.11	41.6	5531	Nm	First fruits (unripe)
9-2	81	61	0.10	39.2	5734	Nm	50% fruits

- To get this information by email, log in to or sign up for [USPEST.org](https://uspest.org) email notifications.
- To see the model output together with relevant weather inputs, go to [MyPest Page](#).
- To use this information in your a spreadsheet, download it in [CSV format](#).

In this example, the user has selected a particular Minnesota location (Falcon Heights) and time (2024) of interest. The **events** column lists different Japanese knotweed phenophases. The **date** column corresponds to when the phenophase is estimated to occur (“first”) and when ~50% of plants in the area would reach that phenophase (“50%”). The user has also toggled a table that shows how the degree-day accumulation for Japanese knotweed on the date of access compares to the two previous years.

The dates and corresponding degree-days displayed will update as time goes on. Meaning, if the above model is accessed on 4-1 (April 1, 2024) and then again on 8-15 (Aug 15, 2024), the dates and degree-day calculations that appear in the table may change. Estimates prior to the date of access will reflect the actual weather that occurred, whereas estimates on future dates will reflect the most recent weather forecasts.

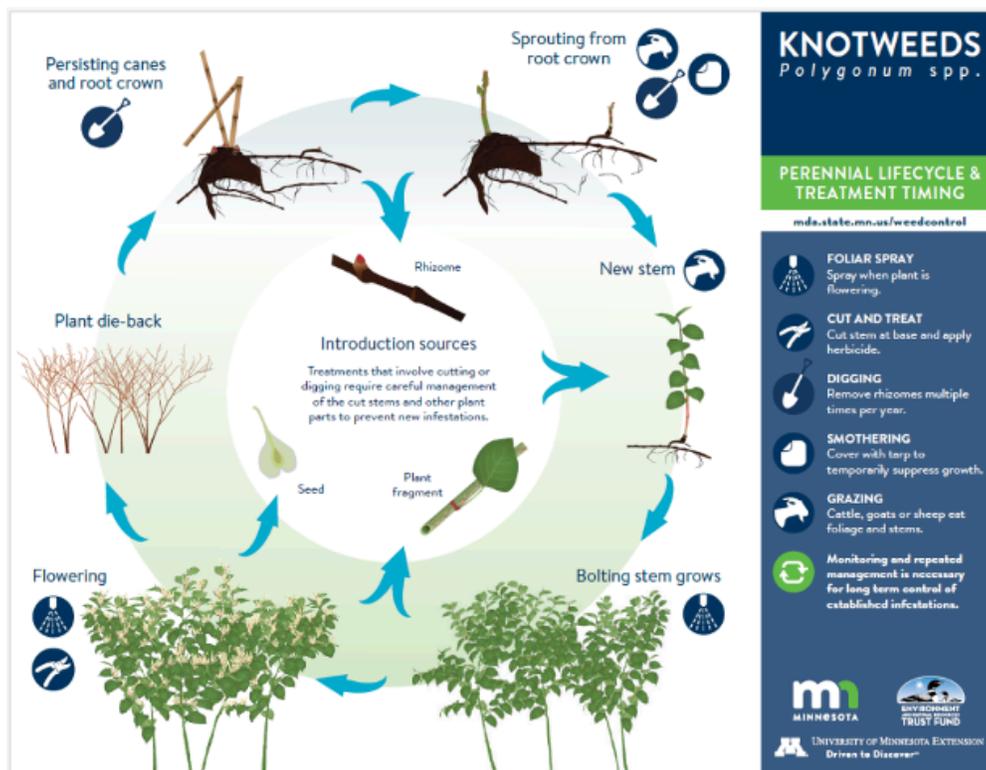
## More information

- [USPEST Japanese knotweed model app](#)
- [Guide for accessing USPEST model for Japanese knotweed](#) (Univ. of Minnesota)

## How does phenology connect to management?

Specific recommendations for knotweed management can vary and depend on multiple factors, like size and age of the population, location, management goals, etc. Importantly, selecting the right tactic will depend on where the plant is in its lifecycle. For example, the [diagram](#) below shows that grazing by animals is only recommended during the early states of plant growth (e.g., the initial growth phenophase).

Japanese knotweed phenology will follow the same pattern each year. However, the exact calendar dates over which these events occur can differ due to variations in environmental conditions each year, especially temperature. **Managers would benefit from the ability to track plant events and plan activities based on local conditions. This is what the models on the [USPEST](#) website can provide.**



### Example scenario

Manager Doe wants to send out a seasonal crew to apply herbicide when Japanese knotweed is flowering. They need to plan the crew's summer work schedule many months in advance. In the winter, they consult the USPEST phenology model to see when Japanese knotweed is forecasted to flower in the area they are managing. Manager Doe tentatively plans for the crew to apply herbicide near the forecasted date of "50% open flowers",

though they also use the model application to compare the timing of open flowers in previous years to see possible variation. As the year progresses, Manager Doe periodically checks the phenology model's updated forecasts. If it is a very cold or warm year, the exact time of open flowers may change and adjustments to the treatment schedule may be needed.

## More information

- [Knotweeds brochure](#) (Minnesota Dept. of Agriculture)
  - [Japanese knotweed management recommendations](#) (Midwest Invasive Plant Network)
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## Image credits

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  - Japanese knotweed (*Reynoutria japonica*). [Jan Samanek](#), Phytosanitary Administration, Bugwood.org, [CCBY 3.0](#). Cropped for use.
  - Tree phenology illustration by Domini Brown
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  - Minnesota map showing the locations of the 10 CFANS Research & Outreach Centers. <https://maes.umn.edu/rocs>. Edited for use.
  - Initial growth emergence of Japanese knotweed. Elizabeth Heeren for Pesky Plant Trackers.
  - Initial growth emergence of Japanese knotweed. Elizabeth Heeren for Pesky Plant Trackers.
  - Initial growth emergence of Japanese knotweed. Volunteer for Pesky Plant Trackers.
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  - Japanese knotweed seedlings. [Leslie J. Mehrhoff](#), University of Connecticut, Bugwood.org, [CC BY 3.0](#)
  - Green leaves with few yellowed on Japanese knotweed. Allyson Bergman for Pesky Plant Trackers.
  - Dried/wilted Japanese knotweed. Volunteer for Pesky Plant Trackers.
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- Page 6: Model screenshot from USPEST.org website
- Page 7: [Knotweeds lifecycle and treatment](#), Bugwoodcloud.org