Validating and Promoting a Phenology Model for the Japanese Beetle, a Major Threat to Oregon's Nursery Industry

Principal Investigator (PI) and Key Collaborators (C)
Brittany Barker[1,2] **(PI)**: Ph (505) 205-4251; Email brittany.barker@oregonstate.edu
Len Coop[1,2] **(C)**: Ph (541) 737-9321; Email len.coop@oregonstate.edu
Paolo Sotelo-Cordona[1] **(C)**: Ph (541) 737-5051; Email sotelocp@oregonstate.edu
Alice Formiga[1,2] **(C)**: Ph (541) 737-3483; Email alice.formiga@oregonstate.edu
[1]*Oregon IPM Center, Oregon State University (OSU), 2215 Cordley Hall, Corvallis, OR 973331*
[2]*Deptartment of Horticulture, OSU, 2750 SW Campus Way, Corvallis, OR 973331*

BACKGROUND

The Japanese beetle (JPB), *Popillia japonica*, is a highly polyphagous pest that feeds on >300 different types of important crops, including various fruits, vegetables, flowers, trees, field crops, and turf. Efforts to control the invasive species in the U.S. are estimated to cost more than $460M annually in damage to trees, crops, and grasses (USDA-APHIS 2015). To date, the beetle has been detected in three counties in Oregon and four counties in Washington. In Oregon, the pest status of JPB is Category 1, which classifies the state as a pest-free area due to continued surveys, eradication programs, and maintenance of a quarantine against the pest. However, the expansion of the beetle could change its Category 1 status and significantly impact Oregon's $1 billion nursery industry (Gibson 2024). An Oregon Department of Agriculture (ODA) analysis indicated an economic impact of >$45M if JPB becomes widely established in Oregon (ODA, 2017). Unfortunately, the Oregon legislature discontinued funding for the JPB trapping and eradication program in 2025.

Our team at the Oregon IPM Center (OIPMC) has developed a risk model for JPB to address a critical need for timely and comprehensive guidance on both where and when to expect this pest. The "site-based" version of the model predicts phenology (seasonal activities) at individual weather stations, whereas the "spatial" version integrates mapping of phenology and climate-based establishment risk (Barker and Coop 2024). Phenological maps are updated daily and can also be accessed at the USA National Phenology Network (Posthumus et al. 2025). Accurate predictions of adult emergence are particularly important for JPB because adults are targeted for surveillance. However, its performance for the Pacific Northwest hasn't been evaluated, which is important because an earlier version was reportedly inaccurate for Oregon (C. Benemann, pers. comm.). Additionally, the spatial model predicts phenology at a 4-km resolution, which isn't helpful for surveillance at small geographic scales, such as individual cities and counties.

Here we seek funding to validate and improve the JPB model for Oregon and Washington, deliver high-resolution (800-m) phenological maps for this region, and promote our modeling tools and forecasts to state surveillance teams, Extension agents, nursery managers, and the public. Accurate predictions of adult emergence will support early detection and rapid response programs, helping to reduce the beetle's expansion. Oregonians will need decision-support tools for JPB more than ever because the ODA may continue to lack funding for surveillance and eradication efforts.

OBJECTIVES

1) Validate and potentially update the JPB phenology model using data for the Pacific Northwest.
2) Deliver high-resolution phenological maps for this region using an interactive mapping tool.
3) Promote the JPB model, forecasts, and mapping tool via outreach events, a webinar, online videos, and a trade journal article.

METHODS

Obj. 1) We will use data derived from the ODA (2017–2024), Washington State Department of Agriculture (WSDA, years TBD), iNaturalist database, and literature to validate predictions of adult emergence for the Pacific Northwest. Precise dates of adult emergence were not recorded in most of these datasets; however, we can assess whether the model is over-predicting (emergence was predicted after adults were observed). Minimizing model overprediction is critical because JPB could potentially disperse to new locations if surveillance activities occur too late in the season. Model parameters (e.g., degree-day requirements) will be adjusted if overprediction occurs. ODA has already sent us their trapping data and WSDA recently agreed to send us theirs as well.

Obj. 2) Interactive phenological maps for JPB for Oregon and Washington will be delivered via an online tool and will be updated daily, similar to the OIPMC's risk mapping tool for boxwood blight. The maps will depict the predicted dates of adult emergence and egg hatch for the current calendar year (Jan 1–Dec 31). Climate data will include daily estimates of minimum and maximum temperature at 800-m resolution from the PRISM database. Forecast data will be derived from the NMME 7-month forecast database or from a recent 10-year average. Phenological maps for the previous year will be displayed for comparison with phenology in the current year. End users will be able to zoom, pan, and interact with maps to visualize and extract predictions for an area of interest.

Obj. 3) We will organize at least two outreach events to demonstrate the JPB model to state surveillance managers, Extension agents, nursery managers, and the public. Through lectures and hands-on activities, attendees will learn how to locate and utilize the model, access and interpret model forecasts, and utilize the mapping tool to focus on a specific area of interest. Our training will focus on implementing education and outreach strategies based on the Oregon Statewide Action Plan for Invasive Species 2024-2026. Additionally, we will create two short videos that present this information in a condensed format and post them at USPest.org and the OIPMC's YouTube channel. Project updates and results will be shared via the OIPMC's social media channels and monthly newsletter, a webinar, a *Digger* magazine article, and a peer-reviewed publication.

TIMELINE

Mar-2026 to Aug-2026	Validate and fine-tune the model; develop a mapping tool
Sep-2026 to Feb-2027	Complete models and tool; conduct outreach, writing, videos, etc.

BUDGET

Salary (FTE = 0.15) and benefits support for PI (Barker)	$17,900
Salary (FTE = 0.05) and benefits support for IPM Educator (Sotelo-Cardona)	$6,190
Salary (FTE = 0.07) and benefits support for videographer (Formiga)	$8,792
Computer server support (hosting fees, replacement hard drives, etc.)	$1,500
Travel (personal auto, 400 miles × 0.70/mile)	$280
Total (indirect costs disallowed for this program)	**$34,662**

REFERENCES

Barker, B. S., and L. Coop. 2024. Japanese beetle, *Popillia japonica*. Phenology/degree-day and climate suitability model analysis for USPEST.ORG. Vs. 1.0 (11/22/24). https://uspest.org/CAPS/Popillia_japonica_white_paper.pdf

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Posthumus, E. E., B. S. Barker, T. Crimmins, and L. Coop. 2025. Forewarned is Forearmed: Research-backed 'Pheno Forecasts' Help Growers Know When to Expect Pest Activity. *Digger,* June 2025, pp. 41−44. Online at: https://diggermagazine.com/new-tool-helps-nursery-growers-fight-pests