

Fish and Wildlife Habitat in Managed Forests

Final Report

Title: Development of native bee identification keys for the Pacific Northwest

Investigators: James W. Rivers and Lincoln R. Best

Objectives:

The overall objective of this project is to develop user-friendly materials that can be used by non-specialists to quickly and accurately identify wild bees of the Pacific Northwest (PNW, covering Oregon and Washington). Available identification aids used for bees in the PNW are specific to other areas and thus include groups that are irrelevant to this region and confuse identification, rely heavily on arcane taxonomic jargon unfamiliar to novices, and make use of idealized drawings to highlight features that are often unrepresentative of what is observed on real-world specimens. Therefore, our approach is to take existing information regarding bees and create identification materials that leverage ongoing work and expertise from the Oregon Bee Project to develop (1) a generic-level key for bees that are found within the PNW region, and (2) sex-specific species-level keys for all bumble bee (*Bombus*) species that are found within the PNW region.

Summary of Accomplishments toward Objectives:

During the last calendar year we completed study objectives by producing the following products:

1. Key to the bee genera of the PNW; 70 couplets diagnosing 60 genera (Modified from Michener, McGinley, and Danforth 1994. The bee genera of North and Central America).
2. Key to the female *Bombus* species of the PNW; 26 couplets diagnosing 27 species. (Modified from Williams *et al* 2014. Bumble bees of North America: An identification guide)
3. Key to the male *Bombus* species of the PNW; 26 couplets diagnosing 27 species (Modified from Williams *et al* 2014. Bumble bees of North America: An identification guide)

These keys have been vetted by participants in the OSU Master Melittologist program and by participants attending the intermediate and advanced offering of the Oregon Bee School taxonomy courses during the summer and fall of 2023. Language, figures, and key architecture were refined iteratively based on the thoughtful feedback of these students. Additional comments by Dr. Paul Williams (Natural History Museum, London) and other experts improved the overall quality and technical aspects of the resources.

In the course of creating the keys, we have co-produced 292 edited stacked images with Joshua Dunlap at the Oregon Department of Agriculture and August Jackson that are available to teachers, researchers, and extension personnel for use in teaching, research and outreach presentations.

Problems and Barriers:

Complications arising from COVID-19 produced significant barriers that initially impeded progress to our initial timeline. These barriers necessitated a no-cost extension to September 30, 2023, but no additional barriers were experienced in project completion.

List of names and brief overview of graduate and/or undergraduate engagement in project:

No graduate or undergraduate students were directly engaged in the project. However, Ph.D. student Scott Mitchell (Dept. Fisheries, Wildlife, and Conservation Sciences, Oregon State University) will be giving a workshop on pollinator ecology and natural history at for the February 2024 meeting of the Oregon Chapter of The Wildlife Society and will demonstrate use of the keys during his workshop.

List of Presentations, Posters etc.:

1. Best presented an overview of the keys to 30 students in the OSU Master Melittologist program Oregon Bee School intermediate and advanced courses, and to 22 online attendees to the Master Melittologist program monthly Out-of-State Seminar. Additionally, the resources were distributed via the Master Melittologist program listserv to 446 registrants.
2. Rivers is co-organizing a pollinator symposium for the February 2024 meeting of the Oregon Chapter of The Wildlife Society, and he will give a presentation focused on the construction and use of the keys. This will include having hard copies available at the Oregon Forest Resources Institute (OFRI) table, as this group will be helping with distribution of the keys. As noted above, the keys will also be incorporated into a workshop given by Ph.D. student Soctt Mitchell on bee ecology and natural history at the same event.
3. In addition to the 2024 meeting of the Oregon Chapter of The Wildlife Society, collaborators from ORFI will be sharing information about keys and disseminating hard copies at the Oregon Society of American Foresters Annual Meeting in May 2024 and at the Oregon Family Forests Convention in June 2024.
4. Rivers is working with the Society for American Foresters to organize a webinar series regarding bees in managed forests for the 2024 calendar year and he plans to share the keys via that venue.

List of Publications, Thesis Citations:

1. Best, L.R., Dunlap, J., Jackson, A., Rivers, J., & Williams, P.H. (2023). *Bees of the Pacific Northwest: Key to bumble bee (Hymenoptera: Bombus) species for females*. v1.0., October 2023. Fish and Wildlife Habitat in Managed Forests Research Program, Oregon State University, Corvallis, Oregon.
2. Best, L.R., Dunlap, J., Jackson, A., Rivers, J., & Williams, P.H. (2023). *Bees of the Pacific Northwest: Key to bumble bee (Hymenoptera: Bombus) species for males*. v1.0, October 2023. Fish and Wildlife Habitat in Managed Forests Research Program, Oregon State University, Corvallis, Oregon.
3. Best, L.R., Dunlap, J., Jackson, A., & Rivers, J. (2023). *Bees of the Pacific Northwest: Key to Genera (Hymenoptera: Anthophila)*. v1.0, October 2023. Fish and Wildlife Habitat in Managed Forests Research Program, Oregon State University, Corvallis, Oregon.

Copies of the identification keys can be accessed via [this link](#).