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Research Note

Community Scientists Survey and Assess Invasive *Rubus* spp. in Portland Natural Areas: Management Strategies against *Rubus armeniacus* Should Not Be Altered due to the Presence of the Congener *Rubus praecox*

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ABSTRACT

Dense thickets of invasive, exotic blackberries (*Rubus* spp.) are common in many disturbed sites throughout the western Pacific Northwest. Most of these blackberry brambles are widely accepted as *Rubus armeniacus*. Published accounts from the past decade however, have revealed a morphologically similar species, *Rubus praecox*, to be broadly distributed and it can occur in many of the same habitats as *R. armeniacus*. In this study, local community scientists were engaged to assess the distribution and relative abundances of these two *Rubus* species in 13 small- to mid-sized parks managed by the City of Portland. At all surveyed parks, *R. armeniacus* occurred in various quantities. *Rubus praecox* was only present in negligible amounts at four sites. A review of online herbarium specimens similarly supports this finding of broadly distributed but low quantities of *R. praecox*. Based on these results, we conclude that current management practices to control invasive *Rubus* spp. should not be altered due to the slight chance of encountering a less common exotic *Rubus* species. We also strongly support the engagement and training of local community members to actively learn about their native and exotic flora to support the conservation of local natural areas.

Index terms: community science; invasive blackberry; natural areas management; *Rubus* taxonomy

INTRODUCTION

The genus *Rubus* (family Rosaceae) has a long and intricate history in the Pacific Northwest. In this region—with a focus on Oregon and Washington states—there are about 20 *Rubus* species (Hitchcock and Cronquist 2018), with recognizable natives such as *Rubus spectabilis* (salmonberry), *Rubus nutkanus* (thimbleberry), and *Rubus ursinus* (trailing blackberry). The most visible *Rubus* brambles, however, are nonnative, invasive blackberries, and are largely assumed to be *Rubus armeniacus* Focke (Armenian or Himalayan blackberry) or to a lesser extent *Rubus laciniatus* Willd. (cutleaf or evergreen blackberry). *Rubus armeniacus* is very common and widespread, especially in riparian, roadside, or other disturbed sites (Bennett 2006; King County Noxious Weeds 2021; Figures 1A and 1B), and it is often simultaneously celebrated for its tasty, juicy fruits and reviled for its stout prickles and aggressive nature (Dornfeld 2016).

The taxonomy of the scientific name *R. armeniacus* is convoluted with several mistaken, misapplied, or synonymous names, including *R. discolor* Weihe & Nees, *R. procerus* auct. non P.J. Müll. ex Genev, and *R. ulmifolius* Schott. Additionally, the placement of this taxon as *R. bifrons* Vest in the online version of the *Flora of North America* (Alice et al. 2015) adds to the confusion, by ensuring that *R. bifrons* would be used in the most recent editions of our regional floras, the *Flora of the Pacific Northwest* (Hitchcock and Cronquist 2018) and the online OregonFlora (2023). In a short note by Rejmánek (2017), however, he contends that the *R. armeniacus* name should be retained, as it is notably distinct from *R. bifrons* as described by Trávníček and Zázvorka (2005). The Jepson eFlora (2023) treatment of *Rubus* maintains the name of *R. armeniacus* for California, and we do so here.

The common name for *R. armeniacus* is also muddled. The horticulturalist and botanist Luther Burbank initially introduced and promoted this "Himalaya Giant" for its large and plentiful fruits in the late 19th century. He believed that the plant was sourced from the Himalayas, but it has since been determined to have origins from the Caucasus Mountains, which includes Armenia, Georgia, and Azerbaijan. *Rubus armeniacus* is now frequent as an introduced species across much of north and central Europe (Kurtto et al. 2010), and in the Pacific Northwest what was previously called Himalayan blackberry is now referred to as Armenian blackberry (Dornfeld 2016).

Adding to this perplexity in naming *R. armeniacus* in the Pacific Northwest has been the recent documentation of another morphologically similar nonnative *Rubus* species. The detection and subsequent identification of this new taxon was tied to the discovery of the exotic rust *Phragmidium violaceum* (Schultz) G. Winter, first detected in southern Oregon in 2005 and studied as a potential biological control agent against invasive blackberries

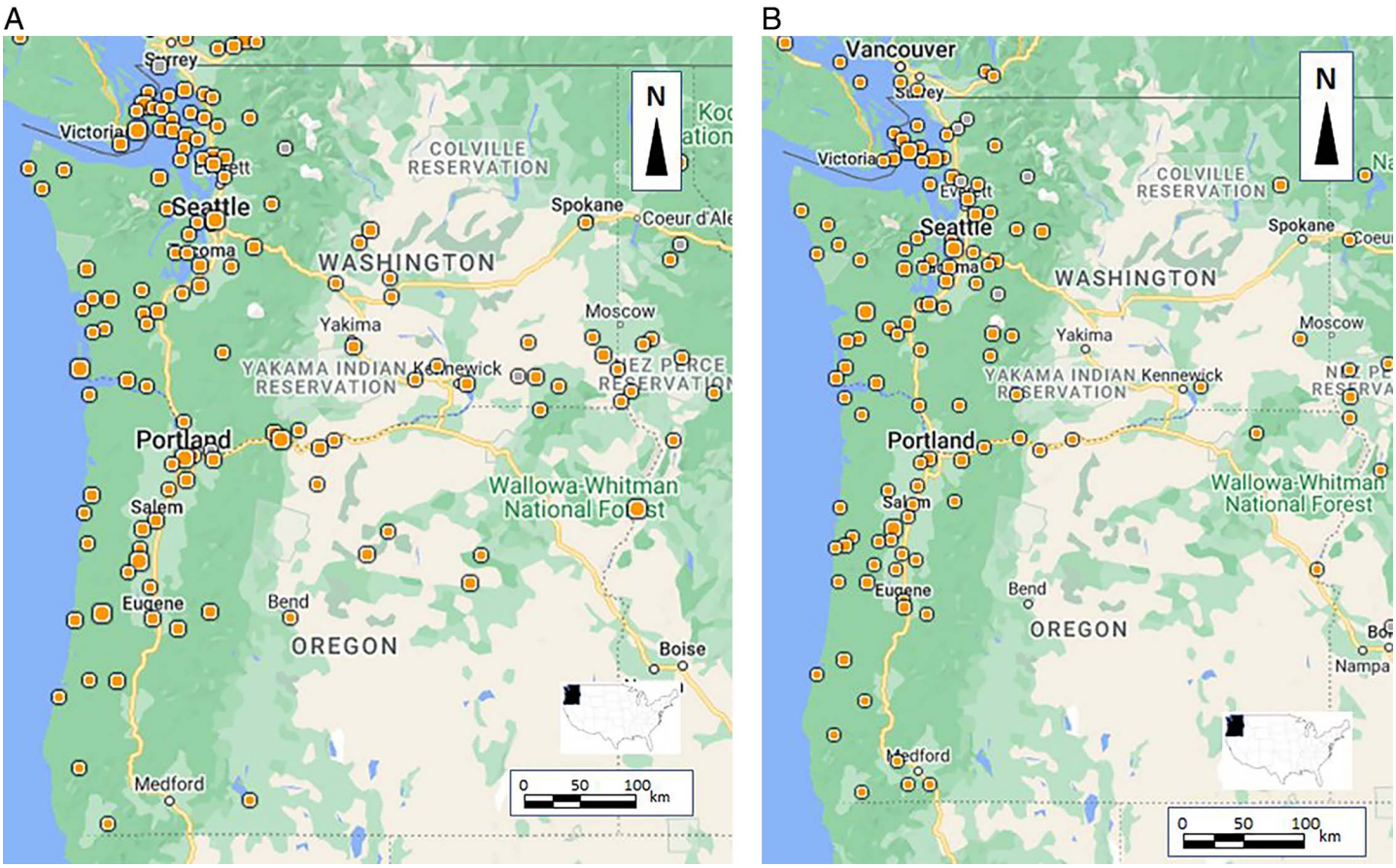

Figure 1.—Maps showing the widespread distribution and locations of nonnative *Rubus* spp. as documented by herbarium specimens in Oregon and Washington states: (A) *Rubus armeniacus* (listed in CPNWH as *R. bifrons*) and (B) *Rubus laciniatus.* Maps produced from the Consortium of Pacific Northwest Herbaria (2023).

(Osterbauer et al. 2005; Callan et al. 2011; Peters 2012; Morin et al. 2013). Clark et al. (2013) investigated the origins of exotic *Rubus* in the western U.S. and concluded that in addition to the widespread *R. armeniacus*, there was an unaccounted member of the *Rubus fruticosus* L. aggregate, and tentatively named this *Rubus anglocandicans* A. Newton. Based on morphological characteristics outlined by Trávníček and Zázvorka (2005), Bruckart et al. (2017) resolved the previously unidentified species to be *Rubus praecox* Bertol., a species primarily documented from south-central Europe (Kurtto et al. 2010) and established that it was present across at least the western portions of Oregon and Washington. Rejmánek (2017) also supports this claim by documenting *R. praecox* from Butte County in northern California. Bruckart et al. (2017) additionally studied the distribution and potential hosts for the invasive *Phragmidium* rust and concluded that it only infects *R. praecox* and the less common *R. laciniatus*, and therefore is not effective at controlling the widespread *R. armeniacus*.

For this study, we were intrigued by this account of an unidentified exotic *Rubus* species lurking amongst the large quantities of *R. armeniacus* brambles and wanted to further investigate this intersection of plant taxonomy and invasive plant ecology, and its potential implications for natural areas management. We also wanted to involve local community members in our inquiry. Bruckart et al. (2017) and others did not look closely for the presence of *R. praecox* in the Portland area, and we were curious to determine where it occurs, and what impact, if any, the presence of *R. praecox* and the *Phragmidium* rust may have on our local parks and natural areas.

Involving local community members in engaging science projects often works to support larger organization-wide goals of education and conservation. The Hoyt Arboretum (Arboretum) in Portland, Oregon, is jointly managed by the City of Portland and the nonprofit Hoyt Arboretum Friends, and many of our regular volunteers are involved in Arboretum-led community science projects that serve larger-scale objectives, such as the early detection of regional insect pests or documentation of plant phenology changes over time. Several of our volunteers cite wanting to learn more about plants and nature, contributing their time to conservation, and meeting new people as their main reasons for becoming involved in community science projects. Here, we report on a relatively straightforward project involving local community members to survey and map the distribution and abundance of exotic *Rubus* species at select natural areas in City of Portland parks. These

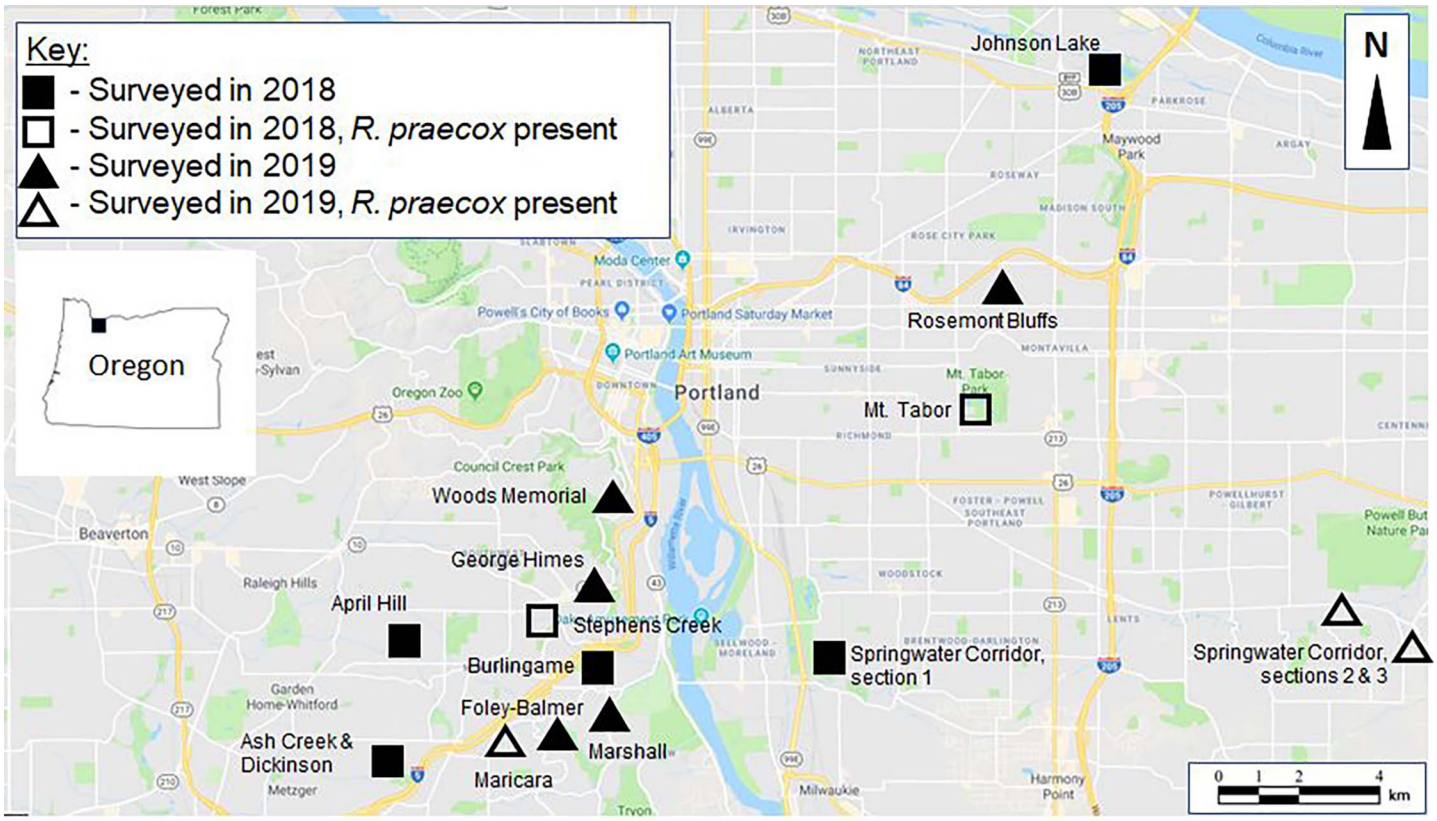

Figure 2.—Map of City of Portland parks surveyed in this study. Base map provided by GoogleMaps, with all notations produced by the author using Microsoft PowerPoint.

community scientists were eager to volunteer for a project that not only fills a regional knowledge gap, but may additionally inform and influence local on-the-ground management decisions. This brief study therefore sought to determine the distribution and extent of *R. praecox* as compared to *R. armeniacus* and *R. laciniatus* in a subset of natural areas in City of Portland parks, and to assess if on-the-ground management approaches to exotic *Rubus* should be altered due to the possibility of the rust having an impact as a biological control agent. Finally, a few benefits and drawbacks for engaging local volunteer community members in meaningful science projects are discussed.

METHODS

Survey of Portland Natural Areas for Exotic *Rubus* spp. by Community Scientists

Volunteer community scientists recruited from the Arboretum were trained to identify and distinguish between the nonnative blackberries *R. armeniacus*, *R. praecox*, and *R. laciniatus*, and to visually estimate vegetative quantities. To assist in species identification in the field, an initial workshop led by Arboretum staff included fresh plants and dried herbarium specimens of the target *Rubus* species for examination with loupes and guides to distinguishing characters. Volunteers were also trained to map the extent of *Rubus* populations by converting their step length to distance, or by sketching the outer boundaries of *Rubus* brambles on detailed paper maps printed from GoogleMaps. Since most *Rubus* brambles were monoculture thickets, it was easy to determine when brambles were 100% vegetative cover. In instances where *Rubus* was mixed in with other vegetation, volunteers were instructed on how to recognize trace amounts, 25%, 50%, or 75% vegetative cover. Total vegetative cover amounts were calculated by area estimates multiplied by vegetative percent cover. Volunteers were also instructed how to complete data sheets.

Community scientists were then each assigned one or two small- to medium-sized City of Portland park site(s) to survey and assess quantities of the three exotic *Rubus* species, tallying up to 13 parks in total (Figure 2, Table 1). The parks chosen are representative of sites and vegetation across the Portland metropolitan region, with most having moderate to high levels of public visitation; they all contain disturbed natural areas and therefore have an elevated likelihood of containing exotic *Rubus* species. Park sites selected are easily accessible and safe for volunteers to visit.

Community scientists walked the perimeter and all trails within each park site, identifying and documenting the presence or absence of all exotic *Rubus* species, and recorded visual estimates of abundance for each *Rubus* species per park. Any questionable *Rubus* species were photographed

Table 1.—List of City of Portland, Oregon, parks surveyed, including the presence and abundances of exotic *Rubus* species per park; na = not applicable.

Park property name	Survey year	Park area surveyed[a] (ha)	*R. armeniacus* (ha)	*R. praecox* (ha)	*R. laciniatus* (ha)	% park, exotic *Rubus*
West side						
April Hill Park	2018	4.1	0.0525	–	–	1.28%
Ash Creek Natural Area	2018	2.28	0.015	–	–	0.66%
Burlingame Park	2018	1.89	0.13	–	–	6.88%
Dickinson Park & Woods	2018	7.55	0.1825	–	–	2.42%
Foley-Balmer Natural Area	2019	3.9	0.002	–	0.0002	0.06%
George Himes Park	2019	14.56	0.1232	–	–	0.85%
Maricara Natural Area	2019	6.98	0.6249	0.0002	–	8.96%
Stephens Creek Nature Park	2018	1.91	0.62	0.0002	–	32.47%
Woods Memorial Natural Area	2019	18.61	0.6836	–	–	3.67%
East side						
Johnson Lake Property	2018	6.15	0.0005	–	–	0.01%
Rosemont Bluff Natural Area	2019	0.87	0.375	–	–	43.10%
Springwater Corridor[b] - Hwy 99 to 37th	2018	3.8	3.724	–	–	98.00%
Springwater Corridor[b] - 145th to Circle Dr.	2019	5.6	0.345	0.0001	–	6.16%
Springwater Corridor[b] - 252nd to 267th	2019	5.6	0.675	0.0001	–	12.06%
Mt. Tabor[c]	2018	na	present	present	–	na
TOTAL		**83.80**	**7.5532**	**0.0006**	**0.0002**	

[a] Park area surveyed is typically the entire size of each small- to mid-sized park, from data supplied by the City of Portland, Park Finder (https://www.portlandoregon.gov/parks/finder/). The only exceptions are from the portions of the linear park.

[b] Springwater Corridor is a 33.8 km (21 mile) long linear park. The park size in the three sections surveyed was estimated by the distance surveyed for each section assuming that the vegetated trail corridor is approximately 30 m wide.

[c] Mt. Tabor is a large park (79 ha in size). Only presence/absence of *Rubus* was recorded here, as an entire survey was not completed.

and fresh specimens brought to the author for species verification.

Evaluation of Online Herbarium Specimen Images from Oregon and Washington

Due to COVID-19 related restrictions that limited in-person visits in 2020 and 2021, herbarium specimens from the Consortium of Pacific Northwest Herbaria (CPNWH) were viewed and assessed online. This CPNWH includes specimen data from 74 member herbaria in the Pacific Northwest, representing over 3.5 million specimen records.

From the CPNWH specimen search, collection data for all voucher specimens of exotic *Rubus* spp. from Oregon and Washington states were reviewed and specimens with images evaluated. It was also noted which online specimens displayed flowers or fruits, which is necessary for distinguishing between species.

RESULTS

Survey of Portland Natural Areas

Nine volunteer community scientists visited 13 small- to mid-sized City of Portland parks in the summer months of 2018 and 2019 (Figure 2, Table 1). From these 13 parks, approximately 84 ha was surveyed and all sites reported the presence of exotic *Rubus* species. Every park surveyed contained *R. armeniacus*, four sites had trace amounts of *R. praecox*, and only one park contained *R. laciniatus* (Table 1). In these parks and sections of linear corridors, *R. armeniacus* was present in quantities from minute amounts (less than 1.0%) to almost complete vegetative cover (nearly 98% vegetative cover in one section of the Springwater Corridor). Volunteers reported that each park or site within each park required approximately 1–5 hr to survey.

Evaluation of Herbarium Specimens

Herbarium specimens were accessed online through CPNWH, and 240 specimens of *R. armeniacus* (under the synonym of *R. bifrons*) were noted from Oregon and Washington, with 92 of those specimens showing an inflorescence or infructescence. Of these, it was determined that 10 specimens of *R. armeniacus* should be annotated to *R. praecox* (Table 2A).

Rubus praecox was distinguished from *R. armeniacus* chiefly by the presence of falcate spines on the inflorescence stalk (Figures 3 and 4), and by other characters provided by Trávníček and Zázvorka (2005) and summarized by both Bruckart et al. (2017) and Rejmanek (2017). In fresh specimens, it is easy to differentiate the congeners based on slight differences in stamen length, petal size and color, slightly different leaflet sizes and shapes, and the presence of the *Phragmidium* rust. On dried herbarium specimens, it was difficult to see many of these characters ex situ, so the falcate versus straight prickles on the inflorescence and infructescence stalks was the primary characteristic used to distinguish between these species. Of those herbarium specimens verified to *R. praecox*, the earliest collection dates in Oregon were from 1979 in Lane and Jackson counties, and in Washington from 1978 in Island County (Table 2B).

Figure 5 shows the range of *R. praecox* from documented herbarium specimens, including recent herbarium specimens (collected since 2015) of *R. praecox*, those documented as *R.*

Table 2.—Summary of herbarium specimens evaluated online through the Consortium of Pacific Northwest Herbaria from Oregon and Washington states, indicating (A) the total number of *Rubus armeniacus* (labeled as *R. bifrons*) vouchers from each state, the number of vouchers with images of an inflorescence or infructescence, and how many of those vouchers were ultimately determined to be *Rubus praecox*; and (B) the county in each state and collection year for those *R. praecox* specimens (which are labeled in CPNWH as *R. bifrons* = *R. armeniacus*).

A

	# Specimens	# Specimens with inflorescence	# Verified to be *R. praecox*
Oregon	95	39	4
Washington	145	53	6
Total	**240**	**92**	**10**

B

State	County	Year collected
Oregon	Klamath	2015
Oregon	Polk	1983
Oregon	Lane	1979
Oregon	Jackson	1979
Washington	Klickitat	2016
Washington	Whatcom	2010
Washington	Thurston	2007
Washington	Pacific	2005
Washington	Whatcom	1988
Washington	Island	1978

anglocandicans s.l., and county-level locations of those specimens labeled as *R. armeniacus* that should be annotated to *R. praecox.* Most of the voucher specimens from the Portland, Oregon, area were collected by the author or community scientists associated with this project, verified by the author, and are housed at Hoyt Arboretum Herbarium.

DISCUSSION

This study confirmed that invasive, nonnative blackberry is present in most Portland natural areas and that large brambles are almost always *R. armeniacus*, with *R. praecox* and *R. laciniatus* occurring only sporadically in small quantities. These results are additionally supported by our review of herbarium specimens accessed through the online CPNWH. From our limited evaluation of 92 online specimens from Oregon and Washington that included images with inflorescences or infructescences, we found that 9.2% of evaluated *R. armeniacus* herbarium specimens were misidentified and should be annotated to *R. praecox*. We therefore validate that *R. armeniacus* is the most widespread invader of natural habitats, especially in the northern portions of the Pacific Northwest, much like it has become an extensive invader across north and central Europe. In contrast, *R. praecox* has a wide range, but its abundance is limited. M. Rejmánek speculates that *R. praecox* may become more prevalent toward the southern portion of its

Figure 3.—Herbarium specimens of the *Rubus* congeners: (A) *Rubus armeniacus* with straight prickles on the inflorescence stalk; (B) *Rubus praecox* with falcate prickles on the inflorescence stalk. Vouchers collected by community scientists, verified by the author, and stored at Hoyt Arboretum Herbarium.

Figure 4.—Fresh flowering stalks of the *Rubus* congeners: *Rubus armeniacus* (above) with straight prickles on the inflorescence stalk and slightly larger, pink petals and stamens much longer than styles. *Rubus praecox* (below) with falcate prickles on the inflorescence stalk, smaller and narrower white petals, and stamens only marginally longer than styles. Photo provided by L. Gervais, Friends of Mt. Tabor Weed Warriors.

introduced range into California (pers. comm.), similar to its current extent in south-central Europe (Kurtto et al. 2010), but we acknowledge that it may also be under-documented in California due to taxonomic confusion.

Across western Oregon and Washington, then, we deduce that *R. praecox* is widespread in the region and has likely been here for some time, as it was documented as early as the 1970s from several different counties in both states (Table 2, Figure 5). Few

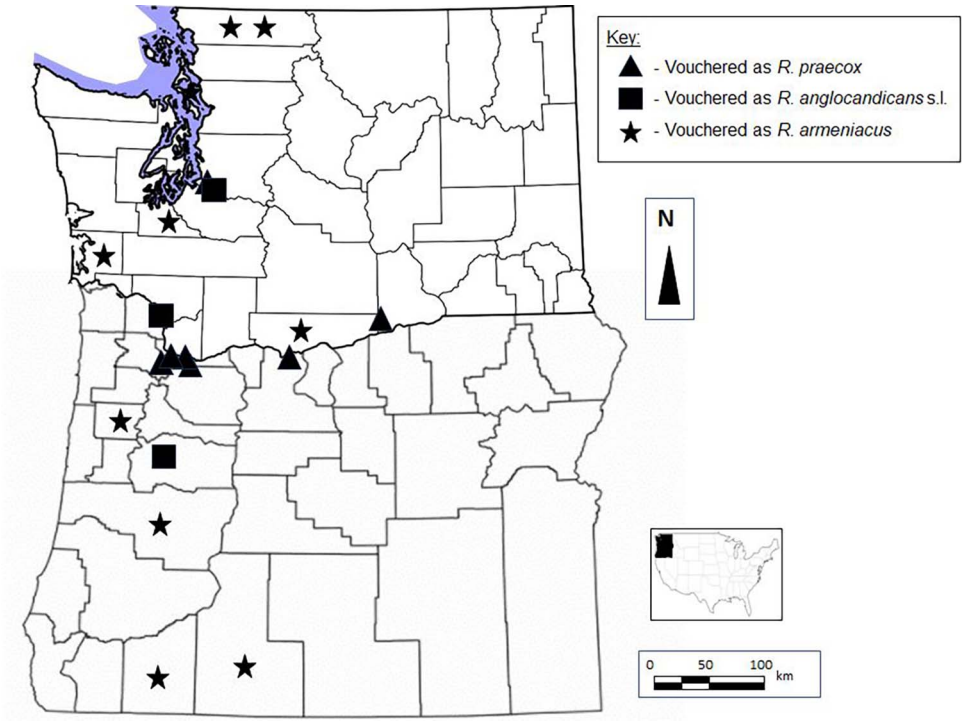

Figure 5.—Map of Oregon and Washington states with county lines, depicting the approximate locations of *Rubus praecox* herbarium vouchers. Solid triangles indicate those vouchers that are correctly labeled as *Rubus praecox*, solid squares are those vouchers labeled as *Rubus anglocandicans* s.l. (= *R. praecox*), and solid stars represent those vouchers of *Rubus armeniacus* that the author believes should be annotated to *R. praecox*. Base map obtained from Wikimedia Commons (https://commons.wikimedia.org/) with all notations produced by the author using Microsoft PowerPoint.

people recognize *R. praecox*, as it is not named in the latest edition of the *Flora of the Pacific Northwest* (Hitchcock and Cronquist 2018) and *R. anglocandicans* (listed here as a synonym for *R. praecox*) is only briefly noted in its introduction to the genus *Rubus.* Hence, since *R. praecox* is not included in the *Rubus* key to species in the regional flora, it is under the radar for those documenting and controlling nonnative *Rubus*. This supports the conclusions of Bruckart et al. (2017) that the *Phragmidium* rust only infests *R. praecox* and *R. laciniatus*, but since they only occur in small quantities there is no need to update or alter management strategies or methodologies to control *Rubus*, assuming that the same or similar control methods are effective. From our results, we concur with Bruckart et al. (2017) in this recommendation and recognize that invasive *Rubus* can be so pervasive at many sites that only localized control may be possible. We additionally advocate for developing an adaptive plan for invasive weed management before engaging in any large-scale control efforts (Tu et al. 2001; Soll 2004).

It has been tremendously worthwhile and valuable to include local community members in Arboretum-led science projects. In this study, we benefitted by not only being able to visit multiple sites and survey more areas because of the involvement of our enthusiastic volunteer community scientists, but we also trained people to specifically look for and report the presence of exotic, invasive plants at the Arboretum and elsewhere. This additionally worked to increase local support for the Arboretum and our surrounding natural areas. Many of our Arboretum volunteers wanted to learn better plant identification skills and how to prevent weed infestations, and wanted to participate in a project that may contribute to natural resources management decisions. We believe that we accomplished these outcomes, and the only drawback that we could think of for training new community scientists is the need for dedicated staff time. Excluding time spent on data analyses and writing this paper, Arboretum staff spent approximately 20–25 hr developing the project scope, preparing the workshop and handout materials, and teaching identification skills and survey methods. Staff also ensured that surveys were complete, confirmed that data collection forms were filled out correctly, and verified plant species from photos or fresh specimens. All participants had a lot of fun with this endeavor and several of our volunteers likened searching for different exotic species to a treasure hunt, with one passionate volunteer exclaiming that "Looking for *Rubus praecox* was better than playing Pokemon Go!"

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