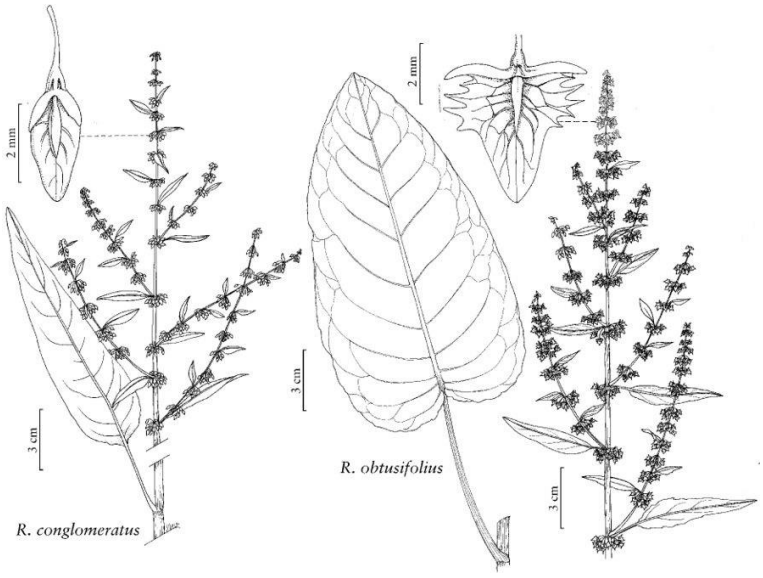

Recognizing *Rumex* - Pesky Plant Identification Project 3.0

ER 412 / ES 471: Advanced Principles and Practice in Ecological Restoration

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Summary

This report discusses the methodology and results of the third iteration of the *Pesky Plant Identification Project* for the University of Victoria's Galiano Field School at the Millard Learning Centre (MLC), part of the Galiano Conservancy Association (GCA) on Galiano Island. The research discussed in this report is part of an ongoing project that aims to identify "pesky" introduced plants and differentiate them from their native lookalikes in a simple guide that can be used in the field for restoration purposes and building community place-based ecological knowledge. This iteration of the project focused on identifying the species of the *Rumex* genus present at the MLC and differentiating those species in a visual way for field work use. Cursory research yielded minimal information about native *Rumex* species and a lack of practical keys for this genus that could be used in the field. There is also a lack of research into the implications of possible native/non-native hybridizations between *Rumex* species. A combination of literature research, field observations and tests allowed us to create a workable identification key prototype for the *Rumex* species found at the MLC. While this project has raised important questions about species hybridization that require a scope beyond the range of this project, we are confident in the creation of this visual key to identifying local populations of *Rumex* species for the purposes of supporting ongoing restoration work throughout GCA properties.

Background

We are an Environmental Studies student and a Restoration of Natural Systems student at the University of Victoria who share a passion for botany and live and study on the unceded lək̓ʷəŋən territories of the Songhees and Esquimalt First Nations. *The Pesky Plant Identification Project* was conducted at the Millard Learning Centre (MLC), owned by the Galiano

Conservancy Association (GCA), and located on the southwest shore of Galiano Island during the Galiano Field School for ER 412 / ES 471 in June 2024. The MLC is situated on the unceded lands of many Coast Salish First Nations and Hul'qumi'num-speaking groups. Historically, it was primarily inhabited by members of the Penelakut First Nation and used by Lamalcha, Hwlitsum, Chemainus, Cowichan, Halalt, Lyackson, and (ceded) Tsawwassen First Nations (Duncan and Warren, 2020). The MLC (legal descriptor: District Lot 57, Galiano Island, Parcel Identifier: 002-025-175) is 76.1 ha which contains over two kilometers of protected waterfront, two seasonal streams, and ongoing restoration projects including a food forest, a forage forest, multiple wetlands, and over 30 ha of mature coastal Douglas-fir forest. There is a network of active restoration projects across the MLC property and throughout other properties owned by the GCA (Galiano Conservancy, 2024). The MLC property has been described as a sandbox for exploring both novel and traditional restoration techniques in the quest to discover what works best for diverse types of ecosystems and restoration projects. The GCA's value as a resource for research, community engagement, and creative approaches to restoration cannot be overstated.

> *"Ecological restoration is another means of shaping, protecting, and conserving biodiversity. The practice of restoration is a process aimed at supporting the recovery of an ecosystem that has been degraded, damaged, or destroyed often by industrialized cultures. Ecological restoration intends to shift degraded environments into a recovery trajectory, supporting the redevelopment and persistence of a native species assemblage, while still enabling adaptation to local and global changes"* (Wickham et al., 2022)

Many sections of GCA property have a history of intensive human legacies, such as clear-cut logging, sheep grazing, small-scale agriculture, roads, and both residential and commercial development (Galiano Conservancy, 2024). The impacts of these historical and

ongoing disturbances in conjunction with increased travel and tourism to Galiano Island have resulted in a wide influx of introduced (non-native) species that have since become established across the island (Galiano Conservancy, 2024). While not all introduced species end up being problematic, their presence causes changes to their new environments, impacting native biodiversity (Jeschke et al., 2014). Therefore, leading theories in restoration and invasion ecology encourage monitoring introduced species populations and recording their distribution to better understand their impacts and to inform management strategies (Galiano Conservancy, 2024; Jeschke et al., 2014). Introduced species can threaten the balance of native ecosystems due to a lack of natural predators and a propensity for being able to grow and spread quickly, especially in disturbed areas. “There are a number of introduced and native species on Galiano Island that resemble each other making it difficult to distinguish between them for the purpose of monitoring and cataloging species” (Kroner, 2023). This issue of introduced species on Galiano being nearly indistinguishable from their native relatives was a leading factor for the need to develop the *Pesky Plant Identification Project*.

This project’s purpose is to create a guide for employees and volunteers at the Conservancy to be able to differentiate “pesky” or hard to identify introduced plants from their native counterparts and lookalikes. It is meant to be an assistive tool for restoration projects and site monitoring. “Consistent monitoring is an important aspect of ecological restoration because it accounts for unpredictable changes or shifts in the ecosystem, making the ability to record accurate data about plant species essential” (Kroner, 2023).

This project also has potential for a wider community and place-based value-building aspect that has yet to be explored; it could be adapted into a guide to inform locals to use when tending to their own lands as well as visitors curious about the Galiano Island’s ecology.

Although our *Rumex* ID key was created based on the specific ecology and restoration needs of the MLC, it is designed to be applicable throughout the greater GCA properties. A focus on specific place-based knowledge and community inclusion can deepen the relationship to place for people living and working on Galiano Island. Gaining deeper knowledge and understanding of a place can help guide community actions, inform values, and reaffirm human's place within the natural world rather than separate from it (Wickham et al., 2022). This plant identification key could be used as a tool to help foster this deeper connection to the land for residents and visitors of the island by assisting locals with making more informed land use decisions and increasing awareness about biodiversity on Galiano Island.

The Pesky Plant Identification Project was originally developed for the Galiano Field School in 2022, was continued in 2023, and has been carried on by us this year. The previous iterations of the project are available on the Galiano Conservancy website Knowledge Hub (Galiano Conservancy, 2024). In 2022, ID keys for several genera were developed including Forget-Me-Nots (*Myosotis*), Buttercups (*Ranunculus*), Woodrushes (*Lazula*), Bromes (*Bromus*), Annual Bluegrass (*Poa*), and Fescues (*Festuca*). The following year, Sarah Kronner developed ID keys for the Speedwell (*Veronica*) and Bentgrass (*Agrostis*) genera (Kroner, 2023). This year, with consideration for the time restraints of the course, it was determined that focusing on a single genus was more realistic for developing a usable ID key for the GCA. The genus we chose to focus on was *Rumex*, a group of plants commonly referred to as "docks."

Goals and Objectives

The goal of *Recognizing Rumex - Pesky Plant Identification Project 3.0* is in alignment with the previous two iterations of the project; to develop a clear, user-friendly field guide for

intermediate plant knowledge holders to use for differentiating notoriously difficult to identify introduced species and their native counterparts on GCA properties. Ideally, this guide will eventually include simple identification keys for all the most common introduced and invasive “pesky plants" throughout Galiano Island, and will be available to staff, volunteers, and the public as an educational resource for plant identification as well as a tool to help indicate environmental disturbance through the presence of introduced species and inform approaches to management and ecological restoration projects.

The project’s objectives are as follows:

1) Determine the distinguishing features of both native and invasive *Rumex* species present at the MLC and surrounding GCA property.

2) Compile and organize distinguishing plant features visually into a user-friendly ID key to be included in the larger *Pesky Plant Identification Project* guide.

3) Locate specimens of each *Rumex* species on the GCA property and test the accuracy and useability of the *Rumex* plant ID key in the field.

4) Time permitting, once the above three objectives have been met, we plan to review the data and results from the previous iterations of the *Pesky Plant Identification Project* and consolidate the plant keys into a more consistent, user-friendly format.

Methods

In approaching this project, we initially felt overwhelmed by the multitude of plant genera keyed out in previous iterations of this project as well as the many genera still needing further research, especially as there was a strong recommendation from both previous reports to

focus on grasses (Kroner, 2023; Stevens et al, 2022), which are notoriously difficult to identify. However, after consulting with Adam Huggins, the Restoration Coordinator at the GCA, we decided to focus on one genus, *Rumex,* and emphasize our objective of creating as clear and simple a plant ID key as possible. Our selection of the *Rumex* genus came from lists of suggested genera from the previous project reports (Kroner, 2023; Stevens et al, 2022), as well as observations in the field that nobody in our class seemed to "know [their] docks" whenever the genus came up, despite there being several plant enthusiasts present. Thus, focusing on this genus seemed like it might fill a knowledge gap that might be appreciated by a wide reach of professionals and hobbyists.

We approached keying out the *Rumex* genus like a game of "Guess Who" by looking for unique features of each species clearly visible to the naked eye and which could be used to distinguish them from the other species. We specifically tried to find ways to distinguish the native species from the introduced, as the primary goal for the ID key is use in restoration work on the conservancy.

To key out the *Rumex* genus for the GCA, we focused on the species present on the MLC property as this was where our class was based. We first examined existing literature on the varied species and existing keys for identification. We referenced sources including Flora of the Pacific Northwest (Hitchcock & Cronquist, 2018), research-grade iNaturalist results from the Biodiversity Galiano Island project, Plants of Coastal British Columbia (Pojar & McKinnon, 1994), eFloraBC (Klinkenberg [editor], 2023), and a dichotomous key from New England's Native Plant Trust (Native Plant Trust, 2024) as initial guides, as well as some other online flora compilations and literature. While it was necessary to branch out in our research to seek the information we needed, we tried to focus our research on literature tailored to the Pacific

Northwest. To help solidify our understanding of the genus on a practical level, we also examined and compared specimens found around the MLC property.

Previous iterations of the project used a flowchart generating website that required login info that was no longer valid for the formation of their keys, so we used the design website Canva in the interest of saving time as that application was more familiar to us. To finalize the key prototype, we played around with arrangements until we found a design that was simple and clear. We knew we wanted to end with individual species, so we worked backwards from there.

To aid in clarity around specific botanical terminology, illustrations were used to accompany the technical terms. We chose to feature botanical illustrations over photographs for our key because we found the illustrations to be clearer in highlighting key differences than any photos we could find or take with our limited equipment and time.

Once we completed the key prototype, we printed off a couple of copies and tested it in the field by locating and identifying *Rumex* specimens around the MLC property. For our presentation at the end of the course, we had intended to take everyone on a short plant ID walk to witness the key in action, but due to weather and time constraints we distributed samples of three different *Rumex* species leaves along with the key for the audience to test its usability.

Results

Before we created our *Rumex* plant key, we wanted to understand the *Rumex* species diversity, distribution, and habitats within the MLC where this project is based. We used iNaturalist to examine documented observations of different *Rumex* species on the MLC property

but found a lack of robust data and research grade observations. This made it challenging to locate the distinct species in their habitats on the property within our limited timeframe.

The notes from our *Rumex* species field observations are as follows.

Introduced species *R. acetosella*, *R. crispus*, and *R. obtusifolius* were the most common *Rumex* species we found throughout the GCA property. We found only one specimen of the native species R. occidentalis, on the side of the road between the GCA office and the MLC classroom. *R. conglomeratus* was most commonly found in the fenced off wetland restoration site between the GCA office and the MLC. *R. transitorius*, the other native species, was only found in the intertidal zone at Chrystal Cove.

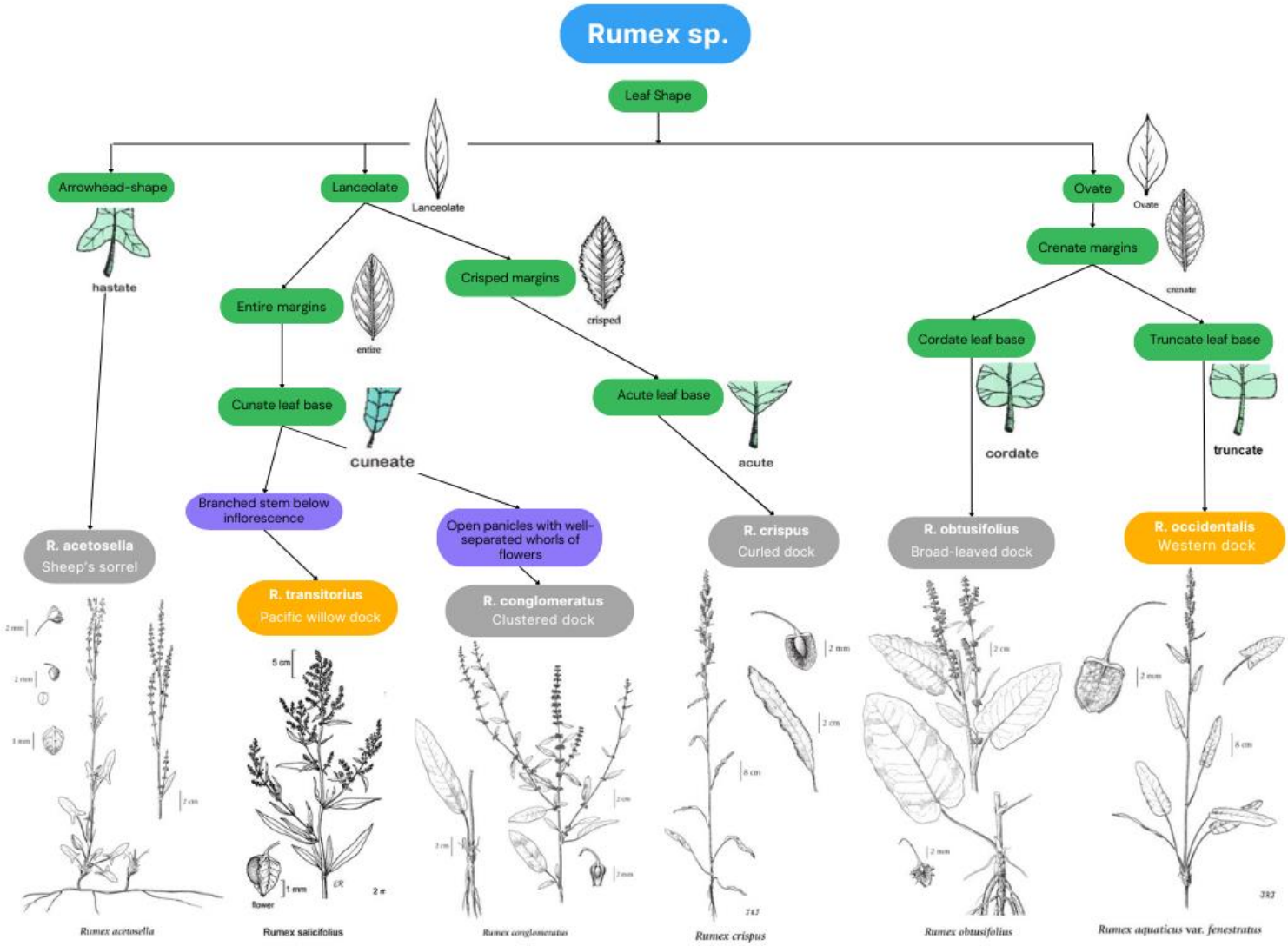
In creating our *Rumex* identification key, we found that the main defining features of *Rumex* species are leaf shape, stem branching, inflorescence, and root type (taproot, fibrous roots, stoloniferous roots etc.) (Mosyakin, n.d.). However, we determined that the method of using root structures to differentiate between *Rumex* species was too harmful for general identification because the process would require digging up the roots of individual specimens, causing damage and possibly killing the plant. Rather, we found the above-ground plant structures to be of more use for visual identification purposes.

Typically, taxonomists differentiate species within a genus by their inflorescence and flowers, as exemplified in Flora of the Pacific Northwest (Cronquist & Hitchcock, 2018), but this method was not ideal for our purposes since *Rumex* flowers and their individual parts are small and difficult to see with the naked eye. It may also be difficult for some people to distinguish between the inflorescences and the fruit (achenes) without some advanced botanical knowledge. Stem branching alone was also not sufficient to differentiate species, as this was only a notable

difference in *R. transitorius*. Rather, we found that the differences in leaf shape, specifically the basal leaves (leaves growing from the base of the plant), were the most effective as distinguishable features having unique characteristics in each species. We focused our key on basal leaf shapes as *Rumex* are herbaceous perennials whose leaves are visible nearly all year-round and are typically one of the first plant parts used for identification. We then narrowed our key by examining leaf shape details within the base of the leaves (where the leaf meets the stalk) and the leaf margins (the edges of the leaves) to determine features unique to each species.

In distinguishing *Rumex* species that have very similar leaf shapes (*R. conglomeratus* and *R. occidentalis* and possible hybrids) we found that looking at their inflorescence provided an additional layer of clarity. The strategy to focus on the leaf shapes as distinguishable features was highlighted in the design of our plant key diagram.

The key we developed is shown below. For a more extensive discussion of species characteristics, see the appendix.



Discussion

The background research we did suggests that useful and legible field ID keys for the *Rumex* genus are lacking. The scientific names are interchanged for some species depending on the guide (Flora of North America Association, 2022; Klinkenberg [Editor], 2023; Mosyakin, n.d.; Pojar & McKinnon, 2014) and none existed which include all species recorded on Galiano Island (iNaturalist, 2024). Specifically, we had difficulty in the literature determining if *R. transitorius* and *R. salicifolius* are interchangeable or distinct species. For the purposes of this

report and our key, we have used them interchangeably, following Pojar & McKinnon's classification (Pojar & McKinnon, 2014).

In using the existing resources to attempt to identify distinct species of *Rumex*, we found them to be difficult to use and impractical for field work, which is consistent with previous years: "Although a good identification tool, [Flora of the Pacific Northwest] is not practical for use in the field. It is over one thousand pages long and provides an in-depth dichotomous key to determine flowering plants in the Pacific Northwest, of which only a subset occurs on Galiano Island. Further, the keys use technical terminology and often require dissection of specific plant parts under a microscope" (Kroner, 2023). Also, while information for the introduced species was readily available from several sources, it was challenging to source a high-quality photo of one of *R. occidentalis*.

Wickham et al. propose that "...cultivating place-based values in restoration initiatives will provide reciprocal benefits by conserving biodiversity and promoting human connections to land" (2022). Once completed and compiled, this field guide could potentially serve as a mechanism for raising awareness about the ecological impacts caused by introduced species through increasing local and broader knowledge about the prevalence of introduced species and the challenges of identifying them, especially when they have hybridized with native species. This guide could also be used to verify existing *Rumex* observations on iNaturalist throughout the GCA to make them research grade as well as clarifying the initial identification of species for new observations. We encourage people to make more *Rumex* species observations across the GCA properties to increase data on species populations and distribution. When making iNaturalist observations of *Rumex* species at the GCA, we suggest including photos of the leaves,

inflorescence, and entire plant to help other iNaturalist users correctly identify *Rumex* through its most distinguishing features.

Learning to identify and key out the *Rumex* genus introduced an interesting challenge that was not addressed by the previous groups: *Rumex* species, especially *R. crispus* and *R. obtusifolius*, apparently readily hybridize with each other, as well as other *Rumex* species (Scopoli, 2005). While it is beyond the scope of this report to delve into a debate about native/non-native hybrids and what, if anything, should be done about them, it is something that should be considered for the future. For one, it adds a layer of complexity to clear identification of *Rumex* species and potentially in the development and management of restoration plans. Are hybrid species part of some of the novel ecosystems on GCA properties? There is some suggestion that hybrids are less successful than their parent species (Scopoli, 2005), which could be important in decisions to make about preserving or removing specimens.

More work could be done to flush out further characteristics of this genus, such as compiling a clear key and guide for differentiating the inflorescences. However, it was determined to be unnecessary for this project's needs. Another possible distinguishing feature we were unable to explore within this project's time constraints is to examine if there are notable differences in preferred habitat for specific species. While some species, from our observations on the MLC appear to be generalists (i.e., *R. crispus*), others such as *R. transitorius* appear to prefer a specific niche. Further understanding of preferred habitat and growing conditions is needed to inform species ID.

Remaining “pesky plants” on the list for identification according to previous reports include chickweeds, medics, rushes, sedges, clovers, vetches, and continued work on grasses

(Kroner, 2023; Stevens et al, 2022). The first group also suggested that adding a ‘threat’ or ‘severity’ rating to the introduced plants could be useful for determining priority and managing time and energy effectively. Further, all existing keys from the *Pesky Plant Identification Project* should be compiled into a single document and presented in a consistent manner (such as a booklet or comprehensive guide) suitable for field use.

Another recommendation is to include the local Indigenous names for the native plants. “Indigenous plant names are important to understand and generally describe the physical features of the plant and its use. Consultation with local First Nations and knowledge holders would be necessary for this recommendation” (Stevens et al, 2022). This recommendation would build on the cultural and community engagement potential of this project and could be expanded to include current and historical ethnobotanical uses for the plants listed, both native and introduced. This is perhaps creating too grand a scope for this specific project at this stage but is a compelling idea to consider.

For now, it is our hope that the guide we have made will be a useful aide to those engaging in restoration work on the GCA properties and throughout Galiano Island.

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Illustration References

Cover illustration from http://floranorthamerica.org/Rumex_conglomeratus

Illustrations used in Key

All illustrations except those listed below are from Flora of the Pacific Northwest (Hitchcock & Cronquist, 2018) with digital versions from eFloraBC (Klinkenberg [Editor], 2023).

Leaf margin images from https://www.pinterest.com/pin/256353403776504891/ 28 June 2024

Leaf base images from https://cmg.extension.colostate.edu/Gardennotes/134.pdf 28 June 2024

R. transitorius/R. salicifolius illustration from https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=42421 27 June 2024

Appendix

This appendix goes into more detail about the *Rumex* species present on Galiano Island for further species information beyond what the key provides. Photos of *Rumex* species were taken by Molly and Adrian at the MLC site during the Galiano field school. Unique and defining features of each species are highlighted in yellow. The images and information presented are sourced from eFloraBC unless otherwise noted (Klinkenberg [Editor], 2023).

Rumex acetosella (Sheep's Sorrel) - Introduced

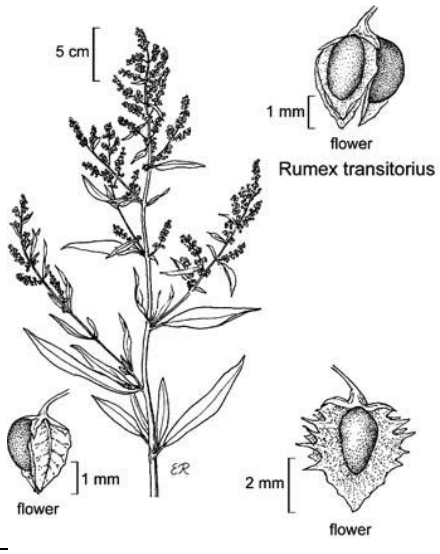
General: Annual or herbaceous perennial, dioecious with slender rhizomes. Multi-stemmed and unbranched below the inflorescence; 15-30 cm tall. Very common in dry, disturbed sites and cultivated areas. Leaves are edible with a sour flavour.

Leaves: Basal leaves hastate (arrowhead-shaped with lobes pointing outward), smooth, blades 1-5 cm long; stalks often longer than the blades; stem leaves alternate, similar but reduced upward and nearly unstalked.

Inflorescences: Unisexual flowers in an open, large but narrow panicle; flower stalks jointed near the base of the flower; perianths 1-1.5 mm long, reddish to yellowish, the inner segments tightly enclosing the achenes (fruits), lacking a grain-like swelling.

Fruits: Achenes, golden brown, smooth, approximately 1.5 mm long.

Rumex transitorius (Pacific Willow Dock)/ *Rumex salicifolius* (Willow Dock) - Native



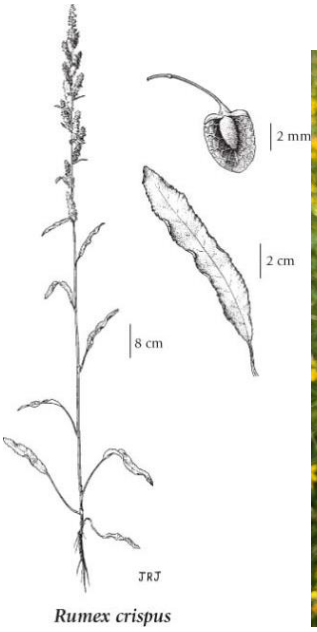
General: Herbaceous perennial, smooth stalk from a vertical rootstock; stems branching from lower nodes (below the inflorescence), growing 25-70 cm tall. Common at low elevations in coastal environments and intertidal zones at high tide line.

Leaves: Blades lanceolate, 6-17 × 2-4 cm, usually widest near middle, base cuneate, margins entire, smooth, or slightly undulate, apex acute (pointed tip).

Inflorescences: Terminal and axillary, terminal usually occupying distal 1/3 of stem, dense or occasionally interrupted near base, usually broadly paniculate (much-branched, simply).

Fruits: Achenes dark reddish brown, 1-1.5 mm.

Rumex crispus (Curled Dock) - Introduced



Rumex crispus

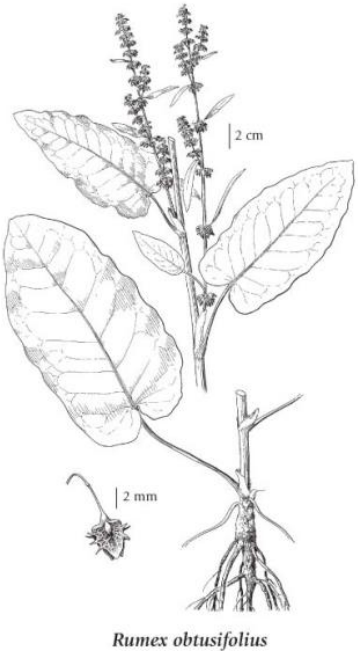
General: Herbaceous perennial from a stout taproot; stems erect, solitary, unbranched below the inflorescence, 50-100 cm tall, smooth. Grows in a wide range of habitats, preferring disturbed sites and cultivated areas. It is the most widespread and ecologically successful species of the genus, occurring almost worldwide (eFloras, n.d.).

Leaves: Basal leaves lanceolate, rounded, or acute at base, strongly crisp-margined (wavy or curled edges); blades 10-30 cm long, stalks long, pimply, and finely hairy; stem leaves alternate, becoming short-stalked.

Inflorescence: Terminal; numerous flowers whorled in dense, leafy bracted clusters, greenish to dull rusty brown, in an elongate panicle; flower stalks jointed below mid length. Flowering late spring-early fall.

Fruits: Achenes are lustrous, reddish brown, 3-angled and net-veined with grain-like swelling.

Rumex obtusifolius (Broad-leaved dock) - Introduced



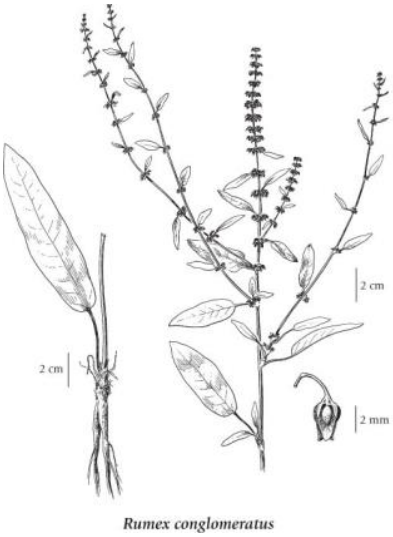
General: Herbaceous perennial growing from a large taproot; stems erect, solitary, simple (below the inflorescence), 60-120 cm tall, occasionally pimply, and finely hairy. Often found in waste places, roadsides, fields, shores, meadows, wet woods, swamps at 0-2300 m elevation.

Leaves: Basal leaves widely oblong or widely egg-shaped, heart-shaped at the base; margins often crisped, blades 10-30 cm long, stalks long; stem leaves alternate, similar to basal leaves but reduced upward.

Inflorescence: Numerous flowers in large, many-flowered panicle, 30-50 cm long; perianths greenish brown; segments with short, stout teeth on each margin; with a prominent grain-like swelling. Flowering late spring-early fall.

Fruits: Achenes, brown, smooth, shiny, about 2 mm long.

Rumex conglomeratus (Clustered dock) - Introduced



Rumex conglomeratus

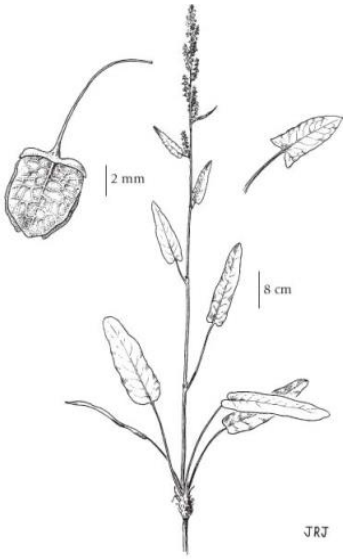
General: Herbaceous perennial growing 60-100 cm tall from a strong taproot. Stems erect, usually solitary, smooth, and unbranched below the inflorescence. Found in marshes, wet meadows, shores, alluvial woods, ditches, wet waste places from 0-1500 m elevation. *Rumex conglomeratus* often is confused with immature specimens of *R. obtusifolius*, as well as with other species (e.g., *R. sanguineus*). Its distribution in North America is insufficiently known, and some literature records may refer to *R. obtusifolius* (eFloras, n.d.).

Leaves: Blade oblong-lanceolate, (5-)10-30 × 2.5-6 cm, base broadly cuneate, rounded, or truncate, margins entire, flat to weakly undulate (Flora of North America Association, 2020).

Inflorescence: Many flowers in an open, much-branched, leafy-bracted panicle; flower stalks jointed below midlength; outer perianth segments 1-1.5 mm long, inner perianths segments 2-3 mm long, with oblong, grain-like swellings. Flowering early summer-early fall.

Fruits: Achenes, smooth, about 1.5-2 mm long.

Rumex occidentalis (Western dock) - Native



General: Herbaceous perennial growing upwards of 180 cm tall, thriving in moist environments, and typically found in marshes, bogs, wet meadows, and other shallow water habitats.

Leaves: Basal leaves ovate to lanceolate, stem leaves triangular and blade-like with a truncate base; crenate or slightly undulated margins, stems typically erect.

Inflorescences: In whorls of 12-25; flowering during the late spring and summer months; Greenish, with a few leafy bracts.

Fruits: Achenes are reddish, lustrous brown, 3-angled, net veined and without grain-like swellings.