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Incorporating Native Plant Restoration Nurseries Into Public School Programs

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Abstract

Cultivating the next generation of much-needed nursery workers requires investing in educational experiences that connect K–12 students to the native plant nursery industry. Coincidentally, public schools are showing increased interest in establishing nurseries on school grounds to support science, technology, engineering, and math (STEM) integration and to cultivate skills that will increase student employability after graduation. These nurseries can also be a source of native plants for local habitat restoration, further connecting students to the real-life applications of nursery operations. Nursery managers may find it valuable to partner with schools to offer guidance in establishing a native plant nursery and serve as mentors. This paper was presented at the 2024 Combined WFCNA & ICSGA Meeting held in Wenatchee, WA, on September 4–5, 2024.

Introduction

Schools with native plant nurseries allow students to discover the native plant world, which is a rewarding journey for both the students and those in the nursery field. Incorporating nurseries into public schools brings interconnected benefits, which can include giving students the real-world experience of growing plants for restoration, cultivating lifelong learners, and generating career interests and contacts. Standard career preparation programs may not highlight options such as soil scientist, restoration ecologist, or nursery pest specialist, but being exposed to the nursery field can lead to jobs for students and employees for businesses. Nurseries are also a rich environment to bring in speakers with expertise to help students solve problems and design their nurseries for success. These contacts can lead to future letters of reference for job and college applications, or even careers. Experiences in a school nursery can help students develop competencies and certifications that can build their resumes and be used for career placement or advancement.

Oroville School District, located in north-central Washington State just 5 miles south of the Canadian border, serves approximately 480 students, with about 81 percent qualifying for free or reduced lunches based on income. The district is very motivated to help students explore potential career opportunities. As a career and technical education teacher with a background in restoration

ecology, I saw an opportunity to introduce students to the nursery industry by developing a native plant nursery on the school grounds. The school district had a vision for involving students in habitat restoration and growing plants year-round in a state-of-the-art greenhouse. Their vision attracted me to become involved in building these programs into the career and technical education courses being offered.

Starting a School Native Plant Nursery

Connecting the Nursery to Curriculum

Many school administrators and teachers are pushed to capacity to meet State and Federal educational requirements in addition to the daily demands of teaching. The idea of starting a school nursery can feel daunting, particularly if it is seen as a new and additional program to create. However, the tasks necessary to grow plants support a wide variety of educational content standards and can fit well within existing courses, programs, and learning objectives.

Language arts standards are addressed when students write descriptions of a sprouting seed or how a plant grows over time. Math standards gain meaning when students create potting mixes using ratios of ingredients, calculate fertilizer application rates, and determine the volume of a growing container. Agricultural standards transform into practical skills when students handle seed to overcome dormancy. In addition to helping students master content standards, if a nursery can effectively support a school's dropout prevention program or career preparation program, a school district will likely be more receptive to investing resources and time in establishing a nursery.

Many different Next Generation Science Standards (NGSS) can be met in growing native plants, including many of the NGSS disciplinary core ideas related to structure and function, stability and change, and adaptation, as well as standards in:

- From Molecules to Organisms: Structures and Processes
- Ecosystems: Interactions, Energy, and Dynamics
- Heredity: Inheritance and Variation of Traits

Building the Nursery

When approval is granted to begin a school nursery, the next challenge is developing the nursery space. One should be prepared to work at a small scale, both in terms of space and budget; budgets are an increasing concern in schools, and there are a lot of programs and activities being cut back.

To build the Oroville School Native Plant Nursery, I sourced materials that were cost effective or could be donated by the community and modified nursery operations to accommodate a public school's limited budget and novice nursery workers. For example, I used pallets to organize the space and keep the containers off the ground for phytosanitary reasons (figure 1).

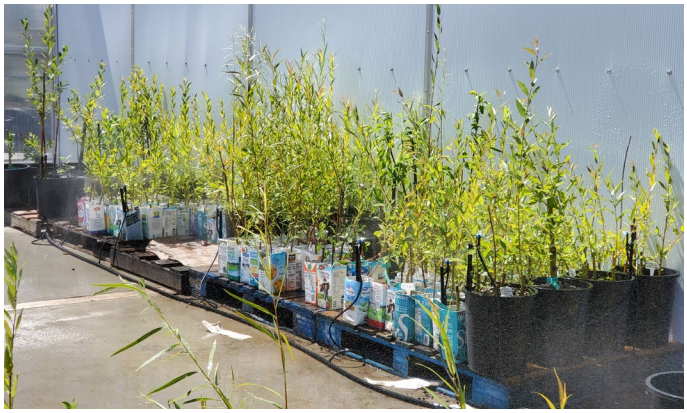

Figure 1—School nurseries are usually built on a budget, which means sourcing inexpensive materials. Stores are often willing to donate pallets. Photo by Julie Vanderwal, 2022.

To reduce the use of plastic pots, which rely on petroleum-based manufacturing, ultimately end up in landfills, and have an upfront cost of purchase, the school used donated milk and juice carton containers—an existing resource.

At the school's request, Green Okanogan, a local recycling center, asked the community not to crush the milk and juice cartons, and many people supported the school's efforts by bringing uncrushed cartons to the recycling center. After cleaning the cartons in the dishwasher, the students cut the tops off and punched holes in the bottom for drainage. The amount of labor involved in preparing beverage cartons for planting might be difficult for a commercial nursery to justify, but schools have the advantage of many hands to work on cartons during spare moments in the classroom. These cartons make great growing containers because the paper can be torn away without disturbing the root system when it is time to plant (figure 2). They also model a circular economy by reusing material prior to recycling.

Figure 2—Juice and milk cartons can serve as inexpensive pots that model reusing waste materials. Students can easily tear the paper and safely remove the seedling when it is time to plant. Photo by Julie Vanderwal, 2022.

Due to the significant time constraints of school class schedules, it is important to install automatic irrigation when the nursery is started. This is an excellent science, technology, engineering, and math (STEM) project and can be cost effective with a battery-operated timer and micro-irrigation supplies. A shade structure may be necessary depending on the climate, and schools can start off with securely anchored popup canopies, if wind conditions allow.

Others can replicate the process used to create the Oroville School Native Plant Nursery by starting small and scaling up over time as needed. A single 3- by 4-ft (0.91- by 1.2-m) pallet accommodates 100 milk cartons. Once students grow the plants successfully and everyone sees what can be learned from the process, students could add more pallets and plants, if space and class time allow. Schools may also find that staying at a micro-nursery scale is both manageable and provides meaningful work experience for students.

Nursery Management

Managing a group of students in a nursery setting requires clear roles for each student and the means to perform their tasks as independently as possible. Before the students set foot in the nursery, adult facilitators need to generate a list of every specific job that students could do and consider how an individual's strengths and areas for growth can be maximized by their specific work.

For a successful session, students should know what they are going to do before they arrive at the nursery. Just as a nursery manager may hold a morning staff meeting to assign tasks for the day, a facilitator should use time in the classroom beforehand to prepare the students.

I created a job board with sticky notes and movable clothes pins with the students' names written on them (figure 3). I would facilitate a discussion of the whole task list, which could include watering, taking soil temperatures, measuring plant growth, planting, mixing potting media, filling containers, etc. I placed the clothes pins with student names next to each task to assign jobs. Because class periods were only 46 minutes long, including taking attendance, walking to the greenhouse, cleaning up, and walking back, I found it helpful to keep students on the same jobs for the following class session as well, which would allow the group to start working more promptly the next time (figure 4).

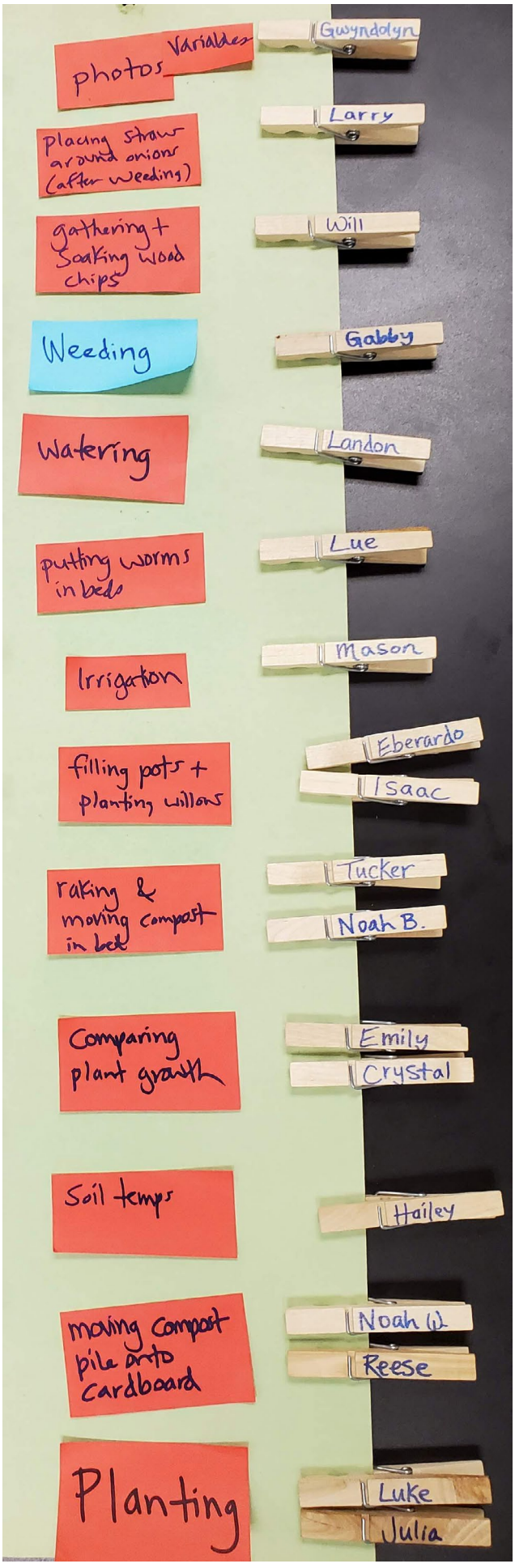

Figure 3—A school nursery has the same types of daily tasks as a professional nursery, and once trained, students can be capable of carrying out these same tasks. Photo by Julie Vanderwal, 2022.

Figure 4—Students transplant seedlings into milk and juice cartons. Photos by Julie Vanderwal, 2022.

When budgeting classroom preparation and education vs. nursery work time, efficiency is key. In a 46-minute class period, it can feel like there is only time to get started and then clean up. Tips to maximize classroom time in the nursery include:

- having an assistant prepare tools and materials beforehand,
- assigning jobs at the end of a class period (so students are ready at the start of the next class), and
- breaking larger tasks into smaller steps that can be completed in less time, but over multiple days.

Administrators can facilitate hands-on career prep experience by creating block periods so that each class period is longer. At Oroville School District, some activities like field trips are scheduled to start during the period(s) before the hosting class and can sometimes run through the advisory homeroom period after lunch to work with the students for a longer time. I had flexibility in class scheduling because the school district was very supportive of pulling students out of other classes if they kept up with their work. To provide work experience during the school day related to career areas of interest, Oroville School District developed a policy that allows for flexible class schedules for students who meet a set of high expectations for effort and achievement.

Engagement Through Tangible Connection

To spark interest and investment in growing plants, students need a tangible connection to how they benefit from plants. Few students have thought about native plants before or even know the difference between a native and an introduced species. Students are often interested in local wildlife species, particularly in rural areas. Linking native plants to wildlife survival creates tangibility that makes the native plant nursery meaningful for many students.

In Oroville, bighorn sheep (*Ovis canadensis*) cross the highway frequently. Students know and love this charismatic megafauna. Students learned that lupine species are important plants to support the bighorn sheep population, and I asked them what could be done to established lupine in an area where the bighorn sheep will graze. Students related to that need because they care about bighorn sheep, so they were invested in growing silky lupine (*Lupinus sericeus*) and velvet lupine (*L. leucophyllus*). Mule deer (*Odocoileus hemionus*) also rely on antelope bitterbrush (*Purshia tridentata*) as their primary winter forage in the area. The students wanted to plant more bitterbrush in the hills around the town for deer, which motivated them to figure out how to break bitterbrush seed dormancy. After learning about how native plants can support local wildlife species, the students became much more interested and invested in growing the plants (figure 5).

Figure 5—Bitterbrush was a native plant selected by the students to grow. This shrub is important winter forage for local mule deer populations. Photo by Julie Vanderwal, 2023.

Sterilizing Safely in a School Setting

In all nurseries, including within schools, it is important to maintain an environment that minimizes pathogen transfer between plants. However, because it is problematic for school-age students to use the nursery-standard 10 percent bleach solution, I use a solution of 3 percent hydrogen peroxide to sanitize surfaces such as pots and wood, and electric heat-treating units to sanitize tools, gloves, pots, and other materials.

Preparing pallets for growing plants— Remove all soil and organic material with a scrub brush or, ideally, a pressure washer. If scrubbed, spray the pallets with water at a high-pressure setting. Leave pallets to dry completely, preferably in the sun. When dry, saturate the pallet surface with a 3 percent hydrogen peroxide solution.

Most living organisms contain the enzyme catalase, which functions to decompose hydrogen peroxide (H_2O_2) into oxygen (O_2) and water (H_2O). Fizzing will occur as the hydrogen peroxide reacts to the catalase in microorganisms; this is a sign that the pallet is being sanitized. If fizzing persists in certain areas, spray it with more hydrogen peroxide until the fizzing stops. The absence of fizzing indicates the absence of catalase-bearing microorganisms.

A senior from Oroville Highschool was recently selected as the 2024 Washington STEM Rising Star. In her Washington STEM website video, she says:

> My STEM journey began my freshman year of high school when I joined a greenhouse management class. I started learning about complex natural systems and plant anatomy, and I fell in love with learning about the natural world. My greatest achievement in STEM was during my wildlife monitoring internship, where I implemented trail cameras to track bighorn sheep. After months of having no tangible results and just getting pictures of grass swaying and triggering the motion sensors, I finally caught pictures of a [State-managed] herd of [bighorn] sheep. It was an extremely gratifying experience, and it taught me that even though some things take time, if you stick with it, the end result will be totally worth it.

The student plans to pursue a degree in environmental science.

Integrating the Nursery Into Local Restoration

Another way to build interest and momentum for student involvement is to create field experiences that relate to growing native plants. I took students on field trips to nearby forests, rivers, creeks, and meadows to collect cuttings and seeds to bring back to the school nursery to grow. When the plants were large enough for outplanting, I identified local restoration projects where the students could install the plants (figure 6).

Figure 6—Students plant seedlings grown at the Oroville School Native Plant Nursery at a restoration site along Tonasket Creek. Photo by Julie Vanderwal, 2021.

I met with local land managers to explain our program's goals and objectives, including providing students with natural resource work experience, creating connections with local professionals, and growing native plant materials to sell to support the greenhouse program. Local Washington Department of Fish and Wildlife (WDFW) wildlife area managers and other land managers have been very supportive of this work. In one case, the Okanogan Conservation District applied for a permit on our behalf to install a streambank soil bioengineering demonstration, which included plantings. In another case, the WDFW purchased plants from our program and allowed students to install the plants. Several times, a local wildlife area manager came with us on field trips to collect cuttings.

This is the full circle of what it means to work in a nursery, and it is important to give students these opportunities.

Building a Nursery Community

When starting a nursery within a school program, a teacher or horticulturist doesn't have to build the nursery alone; there are educators and facilitators, both local and regional, who can support this work.

I started teaching during the coronavirus pandemic, which meant I taught native plant restoration remotely. Class attendance was frequently low during this time. Inviting guest speakers always increases student engagement, even in a virtual setting. Nursery specialists with the U.S. Department of Agriculture, Forest Service agreed to join my classes and speak on plant propagation, data collection, and greenhouse management. Students later had assessments to test their retention of the information. Inviting students to meet someone from the industry motivated them to join via Zoom, and class attendance was higher on these days.

Now that students and teachers have returned to the physical classroom, it is significantly easier to engage students. It's still important, however, to have a network of experts who can serve as guest speakers and resource people, whether remotely or in-person. The Washington State Department of Natural Resources, through their education and outreach program, played an important role in bringing in expertise and offering help with specific needs. At request, the program found a guest speaker who was both Spanish/English bilingual and an expert on pollinators—because one student, who spoke only Spanish, had selected to plan a pollinator garden as a supervised agricultural experience. The expert joined the class via video call to share their knowledge. Having regular help to bring in specific expertise made a huge difference in the program and created community around the work.

Finding new activities for students is important to keep them engaged in the lessons. For example, The Nature Conservancy's restoration project manager gave Oroville students a tip for processing Saskatoon serviceberry (*Amelanchier alnifolia*) seeds. She advised them to grind the seeds in a blender, with duct tape on the blades, to mimic the digestive system of a bird or bear. This became a favorite activity of the program because students loved using the blender to masticate seeds (figure 7).

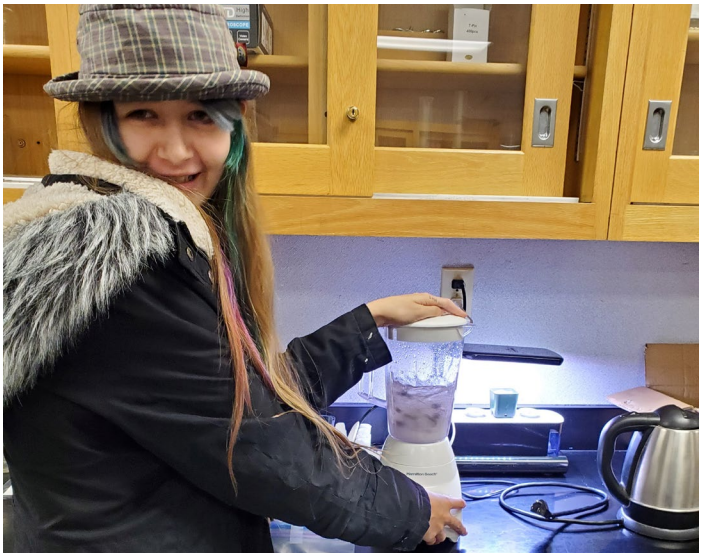

Figure 7—Finding activities that keep students engaged is an important part of running a school nursery. Masticating Saskatoon serviceberry seeds in a blender, which scarified the seeds in preparation for planting, was a popular task. Photo by Julie Vanderwal, 2022.

Building the Workforce Pipeline

Because the day-to-day operations of running a school nursery can easily take priority, it is important not to lose sight of the workforce development element, which has the potential to transform lives and helps justify funding the program. Career preparation is a cornerstone of the greenhouse in Oroville because of the goal that students graduate with skills that make them employable in agricultural and natural resource management fields.

The Washington State Nursery and Landscape Association (www.wsnla.org) has a Certified Professional Horticulturist program. With a requirement of 2,000 hours of professional experience, this program is too rigorous for most high school students to achieve. A collaboration between the association and the Oroville School District developed an entry-level certificate program that is accessible to high school students and others not yet ready or able to pursue the full Certified Professional Horticulturist program. This Level 1 Washington Certified Horticulturist program is modeled after the Certified Professional Horticulturist program.

For the Oroville school nursery, we divided the overall certificate into a series of smaller progress certificates. When a student earns at least three progress certificates, they are issued a full Level 1 Washington Certified Horticulturist certificate. Each progress certificate has a written exam and a hands-on mastery task, and the live specimen plant ID exam is shared among the progress certificates. If students decide to pursue a Certified Professional Horticulturist certificate, they will already be familiar with the exam structure.

In the nursery, students learn to master elements of the progress certificates. For example, teams of students designed irrigation systems, which is part of the irrigation progress certificate. The teams designed an irrigation system for the metal rack shelves or the pallets where the plants would grow (figure 8). Students developed written designs, constructed their systems, and then wrote about how they built the system and how it worked (figures 9 and 10). The plants were grown on the shelves and the pallets, and students compared how well the different systems functioned. Irrigation design-and-build projects touch on all aspects of STEM and provide hands-on opportunities for students to solve real-world problems.

Some of the hands-on mastery components included:

- learning to graft plants at a local apple orchard owned and operated by another teacher;
- using the Forest Service's native plant propagation protocol database (https://npn.rngr.net/propagation) to select and initiate a protocol for stratifying and germinating an assigned species of native seed; and
- accurately interpreting direction of growth in preharvested, dormant *Salix* spp. branches and accurately creating cuttings to a specific length, with angled bottom cuts and flat top cuts.

Figure 8—Teams of students designed the irrigation systems for plants to grow on metal shelves and pallets. Photo by Julie Vanderwal, 2023.

Figure 9—Students developed written plans for their irrigation systems with sketches to scale (left), constructed their systems using a variety of micro-irrigation supplies (right), and wrote a summary of how their system worked. Photos by Julie Vanderwal, 2023.

Figure 10—A student compares irrigation systems during the growing season to select which methods to replicate. Photo by Julie Vanderwal, 2023.

In the first 2 years of the certificate program, 10 students earned certificates for their resumes. Two students earned the full Level 1 WA Certified Horticulturist certificate (figure 11). One of these students was a greenhouse intern for 2 years, with the responsibility of managing the greenhouse over the summer of 2022. He completed all three progress certificates and was one of two students to graduate in 2023 with both a high school diploma and a full Level 1 Washington Certified Horticulturist certificate. He was also an intern with the nonprofit organization Conservation Northwest, working as native plant propagation coordinator for the school district. After graduating, he was hired by the Washington Department of Fish and Wildlife to work for a wildlife area manager he met on a school field trip. The resume- and contact-building opportunities from working in the school's native plant nursery proved integral for this young man's transition from school to employment.

Get Involved!

I am grateful for the people who help students and teachers because it does take a village. If you work at a nursery or are a nursery owner, your expertise is invaluable, and I encourage readers to reach out to local schools to offer support.

1. Reach out to your local school district's career and technical education program director. (Principals and superintendents are often inundated with urgent matters and may not be in a good position to fully absorb what you are offering and to respond effectively.) Ask which teachers are or may have an interest in working with plants, and ask if you can get in touch with those teachers directly.

2. Offer to come to the classroom as a guest speaker. At first, focus on planning a one-session experience with a hands-on component. This will keep things simple and allow you to make connections and get a clearer idea of who you should work with, and how receptive the school might be. Example topic: Native seed stratification. Example hands-on component: Students label zippered bags and place native seeds into a substrate like Pittmoss (a peat alternative) for refrigeration for stratification.

3. Follow up with the teachers and find out how the students liked the session. Ask if they would like to continue to work together, and whether they would be interested in growing native plants at their school.

Creating a Certificate Program in Your State

Across the United States, there are a variety of entities focused on supporting professional horticulturists. Research what organizations exist in your State and find out if they offer professional certifications. Any organization that offers professional certification is a candidate for potentially offering a high school level certification. Nursery growers can ask these organizations if they would be open to offering a certification for high school students and entry level workers, and if they have capacity to help develop one. Teachers who are already offering units on relevant topics may be able to adapt their content for a certificate program. Having support in this process from a nursery grower could be the missing piece that allows a new certificate program to be developed!

Conclusion

The K–12 experience should offer more than what is learned through worksheets—it should offer skills, contacts, and competencies that are pathways to jobs. Working in a native plant nursery at school can open doors in a student's life. Even if students decide to pursue a different career path, they will understand the role that nurseries play in restoration, reforestation, and horticulture, and can advocate for the importance of habitat restoration when collaborating with others. Schools can start a micro-nursery with very little infrastructure, and because native species are adapted to local climatic conditions, a native plant nursery can operate with or without a greenhouse.

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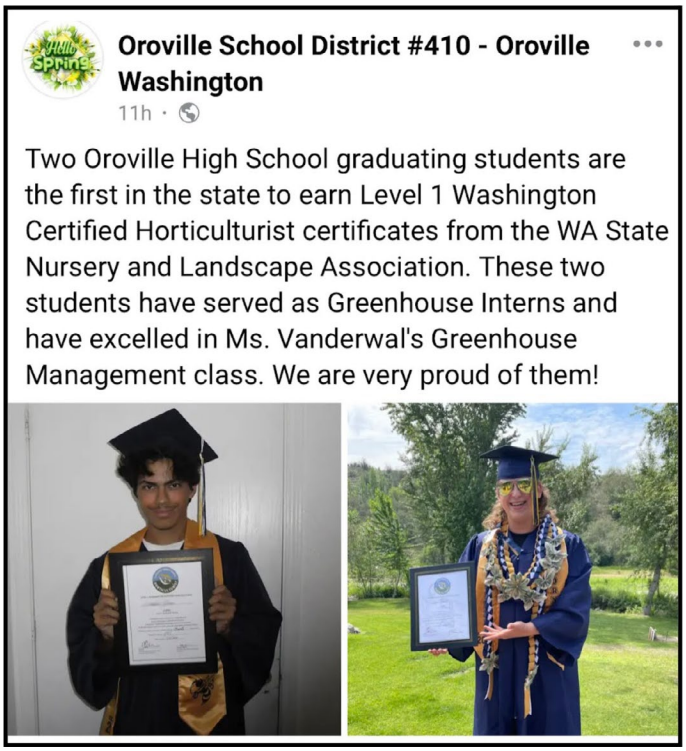

Figure 11—Following the development of the Level 1 Washington Certified Horticulturist program, two Oroville High School students successfully earned the full Level 1 Washington Certified Horticulturist certificate, while 10 other students earned progress certificates. Oroville School District Facebook post, 2023.