Educating the Next Generation©

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Every generation has its challenges in education. It's said that our current generation has lost its connection to the natural world because it is plugged into so many electronic diversions. A generation also will not protect something in their lives that they do not know or love.

We have all heard of "no child left behind" in education, but there is now a national movement to "leave no child inside." This is currently a focus of the Obama Administration's "A 21st Century Strategy for America's Great Outdoors," <http://www.doi.gov/americangreatoutdoors/>, also with Capitol Hill hearings, legislation on the state level, and grassroots organizations.

In the book "Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder" by Richard Louv (2006), he brings together the studies showing that direct exposure to nature is essential for a child's healthy physical and emotional development. They have recently linked the lack of nature in children's lives with the rise in obesity, attention disorders, and depression.

New ideas and programs are being developed to address this. One such new program is the California Native Plant Society's (CNPS) development of a curriculum that teaches kids to become observers of nature. They pointed out that if you ask a kindergarten class if they can draw they will all raise their hands. If you ask the same question to a sixth grade class very few will think they can draw and that drawing is for only a gifted few. John Muir Laws, a naturalist, educator, and artist, and Emily Breunig, a teacher for the California Institute for Biodiversity, have developed a curriculum for kids 8 years old and up. The curriculum integrates observation of nature using art, language arts, and science. The curriculum can be downloaded from the education page of the CNPS web site: <http://www.cnps.org/cnps/education/>.

Educators have expressed that the experiences with nature have to be repeated through a child's education to make a long-term impact on them. Reflect back on how you got into the field of horticulture. What childhood experiences could have led you on this path? What can we do in our profession to help pass on the knowledge and love of botany and horticulture?

Here is an example of what can be done on a local level; fast forward to Winthrop, Washington. Winthrop is a small rural town on the northeastern side of the Washington Cascades 30 miles as a crow flies from the Canadian border. It has a mix of agriculture, recreation, and forestry industries. This is a rich shrub-steppe plant community. It is important for the children to know the plants with which they coexist, what are their significant uses for wildlife, and what do they need to germinate and grow. This understanding will help preserve this environment and increase their appreciation of their surroundings.

The plan was to develop a shrub-steppe landscape garden from seed collection to installing the garden. This garden would be used as a teaching garden in the future. The recipe for the plan included a dedicated first-year teacher, Erica Bleke, who graduated from Western Washington University with a degree in

Environmental Education and an energetic sixth-grade class of children. A lesson plan aligning the project with current science standards was needed to proceed. She took a more integrated approach broadening it to cover standards in many subjects including science, communications, math, reading, social studies, writing, and art. The project would span the whole year. Included below are the targets.

Science.

- Mathematics used to ask and answer most scientific questions.
- Science and technology addressing problems in everyday life, whether at home, school, or work.
- Living organisms playing critical roles in shaping the Earth systems that we see today.
- Nonliving factors in ecosystems affecting populations of organisms found in the ecosystems.
- The major source of energy for ecosystems on Earth's surface is sunlight. Plants make their own food, animals obtain food by eating organisms and decomposers use waste, dead organisms for food and recycle nutrients.
- Human use of resources can affect the capacity of ecosystems to support various populations of organisms.
- Communications.
- Research and present a presentation to a group on their findings.

Math.

- Multiplying and dividing non-negative decimals.
- Solve single and multi-step word problems involving operations with fractions and decimals and verify solutions.
- Identify and write ratios as comparisons for part-to-part and part-to-whole relationships.
- Make and test conjectures based on data collected from explorations and experiments.

Reading.

- Apply understanding of printed and electronic text figures to locate information and comprehend text.
- Analyze sources for information appropriate to a specific topic or for a specific purpose.
- Analyze appropriateness of a variety of resources and use them to perform a specific task or investigate a topic.

Social Studies.

- Construct and analyze maps using scale, direction, symbols, legends, and projections to gather information.
- Identify the location of places and regions in the world and understand their physical and cultural characteristics.
- Understand and analyze how the environment has affected people and how people have affected the environment in past or present.
- Understand the characteristics of cultures in the world from the past or present.
- Understand the learning about the geography of the world helping us understand the global issue of sustainability.

Writing.

- Apply more than one strategy for generating and planning writing.
- Produce multiple drafts.
- Revise text.
- Publish in a format that is appropriate for a specific audience and purpose.
- Demonstrate and understand the different purposes for writing.

Art.

- Observe and draw a subject.
- Draw for a specific purpose.
- Integrate the art into a specific project.

With these goals in place the project started in the fall and began with the collection of seed. A plant list for the stratification experiments was determined by what seed was available for collection at the time. This included; blue elderberry [*Sambucus mexicana* (syn. *S. nigra* subsp. caerulea and syn. *S. cerulean*], snowberry (*Symphoricarpos albus*), chokecherry (*Prunus virginiana*), and Wood's rose (*Rosa woodsii*).

The seed was collected and weighed uncleaned then again when cleaned. The *S. mexicana* berries were plucked from the stems then pureed in a food processor, the debris was floated off then the seed was dried and weighed. The *S. albus* and *R. woodsii* seed was placed on racks and stacked onto a food dryer where they dried then were ground on the seed board and the debris was blown off. There were two collections of chokecherry. The tree collection was crushed fresh on the seed board then dried and rubbed again then the debris was blown off. The second was collected from bear scat and was easily separated from the scat.

The students did calculations to determine how many fresh seeds needed to be collected to get the number of cleaned seeds that they needed developing a ratio of unclean to clean seed. They also figured out how many seeds per gram and ounce. The seeds were checked for viability with a cut test to see if the embryos were fully developed.

Each plant had a work sheet for recording the weights and listing the treatments to be done. The experiment was done with 200 seeds for each treatment. The seed bags were labeled for each treatment and labels were made at this time too.

This was a good time to have a discussion about seed germination and seed dormancy including internal dormancy and methods of breaking dormancy ending with a discussion of what nature does and what we could do to mimic that (Tables 1, 2, and 3).

Half of the seed treatments would be stratified using natural means. The seeds were sown in five sections and covered with a screen to keep rodents out and buried outside the classroom in the snow for the winter. The other half was treated, if needed, and stratified in a refrigerator. In March these seeds were sown and the seeds from outside were dug up and brought in to germinate under lights. As the seeds germinated the data was recorded and the percent of germination was calculated.

At this time the students worked on their presentation to the first graders. The children were broken into groups and rotated through stations where they had made information poster boards on their project and a PowerPoint presentation "The Native Plants and Grasses of the Methow Valley."

Rob Crandall from Methow Natives Nursery gave a presentation on the adaptation of plants and discussed the shrub-steppe habitat with the students. They plant-

Table 1. Germination and dormancy information.

Germination	The resumption of active growth of the seeds embryo. It requires moisture, proper temperature, and oxygen. Timing varies per species.
Seed coat dormancy	A seed coat that is impermeable to water and oxygen or has an inhibiting chemical in the epidermis.
Internal dormancy	Physiological conditions delay germination. These seeds need after ripening. This is most likely found in high elevation species. Some seed need a period of dry storage or mountain species may need a period of moist cold period to simulate a cold winter. For desert seeds dry storage over 100 °F stimulates desert heats then the seeds will germinate later when it is cool. Some need treatments with chemicals like gibberellic acid.

Table 2. Methods of breaking dormancy.

Scarification	Scaring seed to let water in with sandpaper, file, pin, or knife
Hot water	180–200 °F and left to cool over 12 to 24 h
Dry heat	180–212 °F heat in an oven
Charate	Charate from a burned plant stems can neutralize germination inhibitors
Fire	For seeds with a hard thick coat. Burn in fall seed swells with rain.
Acid	Thins impermeable seed coats
Mulch	Hastens the microbial breakdown or softening of the seed coat.
Water	Removes water soluble germination inhibiting chemicals
Cold stratification	For internal dormancy simulates cold winter conditions. 1 : 3 ratio of seeds : perlite at 28–32 °F for 10–120 days
Warm stratification	Room temperatures 65 °F for after ripening of the embryos
Photochemical dormancy	Some seeds need light to germinate. Do not cover seed
Germination temperatures	Look at your surroundings where your seeds are from and mimic nature

Table 3. Mimicking nature.

What would nature do	How to mimic nature
Freeze and thaw	Moisten seed and refrigerate to mimic winter conditions
Rub between rocks, gravel	Sand seed coat lightly to make it thinner
Go through animal GI tract	Soak in sulfuric acid
Rub between rocks, gravel	Moisten seed and refrigerate
Chewed on by animal	Hot water to soften the seed coat. Sand seed coat lightly to make it thinner
Fire and charate	Burn needles over planted seeds and water in charate

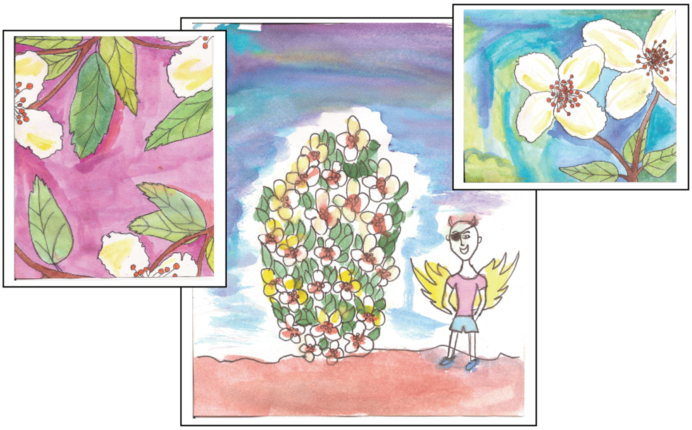
ed three native grasses into plug trays and grew them under lights to be planted in the garden. A list of shrub-steppe plants was made for which plants to be include in the garden. Each child was given a plant to do botanical drawings of and to research in the computer lab to be used to make an information plant card for the garden (Table 4 and Fig. 1).

The garden space was cleared and planted in 2 days with the two classes back to back. The design included a walkway ending with a sitting rock. The purpose of the garden was to be a teaching garden and a place to take classes and the local communities to read, draw, and observe the plants. The garden was irrigated for the first summer and weeded regularly. By the following fall there was a good foundation started for the garden.

Table 4. Plant list for shrub-steppe garden.

Common name	Botanical name
yarrow	*Achillea millefolium*
serviceberry	*Amelanchier alnifolia*
Michaux's mugwort	*Artemisia michauxiana*
big sagebrush	*Artemisia tridentata*
tall Oregon grape	*Berberis aquifolium* (syn. *Mahonia aquifolium*)
rabbitbrush	*Chrysothamnus nauseosus*
Wyeth buckwheat	*Eriogonum heracleoides*
snow buckwheat	*Eriogonum niveum*
shrubby penstemon	*Penstemon fruticosus*
Chelan penstemon	*Penstemon pruinosus*
Richardson's penstemon	*Penstemon richardsonii*
Blue Mountain penstemon	*Penstemon venustus*
mockorange	*Philadelphus lewisii*
ponderosa pine	*Pinus ponderosa*
bitter cherry	*Prunus emarginata*
chokecherry	*Prunus virginiana*
bitterbrush	*Purshia tridentata*
wax currant	*Ribes cereum*
blue elderberry	*Sambucus mexicana* (syn. *S. cerulean*)
grasses	
bluebunch wheatgrass	*Elymus spicatus* (syn. *Agropyron spicatum*)
great basin wildrye	*Elymus cinereus*
Idaho fescue	*Festuca idahoensis*

Mockorange
Philadelphus lewisii



Plant: Mockorange is a shrub. Its height can be 6 to 15 feet tall. It blooms in mid June.

Flower: The flower has 4 petals. They are a creamy white color, usually about 10 to 20 millimeters long. They cover most of the shrub.

Leaves: The leaves on the Mockorange are oval shaped. They usually have smooth edges, but sometimes there can be a few fine teeth near the tip. Their feel is slightly sandpapery.

Habitat: Mockorange is commonly found on steep slopes or rocky ledges. It is found in both riparian and shrub steppe habitats.

Range: It ranges from Canada to Washington, Oregon and Montana.

Figure 1. Example of plant information card. Illustration by Delilah Cupp, 2008.

The sustainability of the garden depends on the school incorporating it into their curriculum and the community using it as a teaching resource, to keep adding to it, and maintaining this resource. Think about what you could do to pass on your knowledge to the next generation of horticulturalists.

LITERATURE CITED

Breunig, E. 2010. Opening the world through nature journaling. California Native Plant Soc. Bulletin. 40(3) July–Sept. 2010.

Louv, R. 2006. Last child in the woods: Saving our children from nature-deficit disorder. 2nd ed. Algonquin Books of Chapel Hill, Chapel Hill, North Carolina.

QUESTIONS AND ANSWERS

Kathy Echols: Has the program gone national?

Ann Fisher-Chandler: If you go onto the website you'll see input from teachers and students trying to make this program bigger.

Rita Hummel: How do you approach the teachers? Do you have any suggestions on how to encourage teacher involvement?

Ann Fisher-Chandler: I think I got lucky with the teacher with whom I worked. She didn't know how to say no. In fact, the new teacher taking her place has yet to show as much interest. I think it just takes lots of persistence. Introducing the teachers to the book I mentioned is helpful.