Report of the Intermountain Native Plants Cooperative

Volume 6 *December 2014*

An annual report of research and extension activities for members of WERA-1013, Intermountain Regional Evaluation and Introduction of Native Plants

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Forward

The Intermountain Native Plants Cooperative, initiated in 2007, is a group of researchers who share an interest in utilizing native plants in arid urban landscapes, sharing research-based information, and exchanging superior germplasm. All are members of WERA-1013, Intermountain Regional Evaluation and Introduction of Native Plants, an officially recognized Western Education/Extension and Research Activity. The Report of the Intermountain Native Plants Cooperative is published annually and contains announcements of studies in progress by members and updates of germplasm evaluations. Some of the various research reports include work on such diverse topics as the selection criteria of native plants for urban landscapes, sexual and asexual propagation techniques of unique plants, native plant breeding techniques, native plant genetic diversity studies, evaluations on weediness of native plants in the urban landscapes and many other native plant related studies.

Cover: The photo on the cover was taken by Stephen Love and is of “Desert Indian Paintbrush” (*Castilleja chromosa*), in a garden planting Aberdeen, Idaho.

Announcements

2015 American Penstemon Society Annual Meeting will meet at the Chico, California, July 10-13, 2015. There will be tours in the region to see *Penstemon* and other native plants. For more details visit http://apsdev.org/aps/meetings.html

2015 The Eriogonum Society Annual Meeting will be out of Reno, Nevada, July 24-27, 2015. For details visit http://www.eriogonum.org/

2015 WERA Meeting will be hosted by Stephen Love in Boise, Idaho, October 2-3, 2015.

Propagation of Native Woody Plants in Utah Using Nearing Frames

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Abstract

We examined the use of a Nearing frame system for cutting propagation as a simpler, more economical alternative to a greenhouse system. The propagation of three species (*Cercocarpus ledifolius* var. *intricatus*, *Shepherdia* × *utahensis* 'Torrey', and *Berberis repens*) was evaluated in both Nearing frames and a glass greenhouse in late fall of 2013. In a second experiment, propagation of *Fraxinus anomala*, *B. repens* and *B. fremontii* was evaluated under similar conditions, but during the summer. In the fall experiment, over 90% of *Cercocarpus* and *Shepherdia* cuttings rooted in the greenhouse, while less than 11% rooted in the Nearing frame. In contrast, rooting of *B. repens* cuttings was much more variable and showed no significant difference between the two systems with 71% rooting in the greenhouse and 56% in the Nearing frame. In the summer experiment, 84% of *B. repens* cuttings rooted in the Nearing frame as compared to 28% in the greenhouse, but *F. anomala* and *B. fremontii* both had poor rooting in both the greenhouse (28%) and the Nearing frame (25% and 13% respectively). While further analysis of the data is needed, the results seem to indicate that Nearing frames may work best with shade tolerant plants such as *B. repens*.

Introduction

Current trends in landscaping are calling for the selection of water-wise, woody native plants that can be difficult to propagate efficiently and economically. Alternative propagating structures such as Nearing frames have the potential to be a simpler, more economical alternative to traditional glass greenhouses for native woody species. We compared a greenhouse propagation system (Figure 1) with a Nearing frame system (Figure 2) for the propagation of several woody shrubs (four Utah natives and one natural hybrid).

Figure 1. Greenhouse propagation environment.

Figure 2. Nearing frame propagation environment.

Materials and Methods

Experiment 1 – Late fall cutting propagation

In the fall of 2013 we examined the use of a Nearing frame system for cutting propagation of three species, (*Cercocarpus ledifolius* var. *intricatus* USU-CLI-3, *Shepherdia* × *utahensis* 'Torrey', and *B. repens,* as compared to a glass greenhouse. Greenhouse conditions were 18/15.5°C D/N, bottom heat 22°C, and natural lighting (85% of ambient PPF at solar noon). Nearing frames were 104 cm square and 46 cm deep with a plastic film cover and oriented with the open side facing north. Frames had bottom heat set at 22°C with unheated air temperatures as low as 5°C, and natural lighting (2% of ambient under the plastic) (Figure 3).

The *B. repens* cuttings were selected from a group of seedling source plants while the other two were clonal materials. During the period of Oct 30-Nov 4, 2013, 130 terminal hardwood cuttings of each species were collected, sorted for uniformity, wounded with a 1 cm basal scrape, and treated with either 0.1% IBA as Hormodin® 1

(*C. ledifolius* and *S. x utahensis*) or 2000 ppm IBA/1000 ppm NAA as Dip N'Grow® (*B. repens*). Cuttings were stuck in Turface® calcined clay in individual containers (6.5 X 6.5 X 8.9 cm) and randomly assigned to one of two greenhouse benches or Nearing frames. Nearing frame cuttings were irrigated daily until Nov 23 when irrigation was changed to every second day. Greenhouse cuttings were irrigated identically and also misted during the day using a targeted VPD accumulation value of 60 as determined by a Phytotronics® Water Plus VPD mist controller.

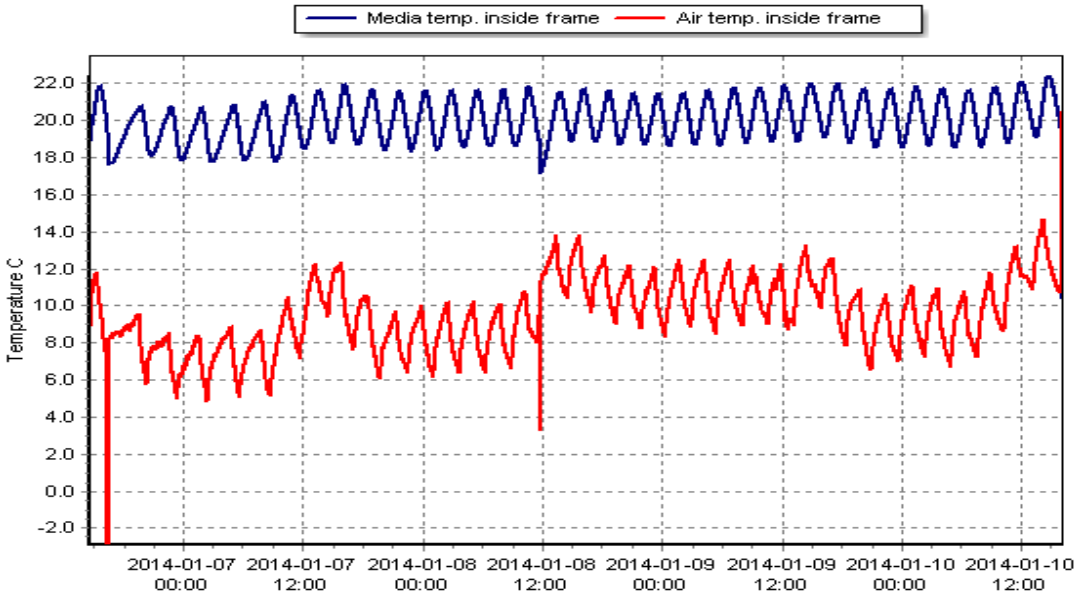

Figure 3. Air temperature inside the Nearing frame compared to media temperature on Jan 7-10, 2014. Outside air reached lows of -5°C or less.

Results

On Dec 17, 2013, cuttings were evaluated for percent rooting, roots per cutting, and length of longest root (Table 1). The cuttings of *C. ledifolius* and *S. x utahensis* had 95 and 98% rooting in the greenhouse with 5 and 11% rooting in the Nearing frame, respectively. Rooting of cuttings of B. repens was much more variable and did not show significant differences between the greenhouse (71%) and the Nearing frame (56%). All species showed significantly increased numbers of roots per rooted cutting in the greenhouse as compared to the Nearing frame (*B. repens*: 16.1 versus 3.3; *C. ledifolius*: 10.8 versus 1.7; *S. x utahensis*: 7.7 versus 2.5) (Figure 3). Average length of longest roots (mm) per rooted cutting was (*B. repens*: 81.6 versus 24.8; *C. ledifolius:* 83.8 versus 1.5; *S. x utahensis*: 100.5 versus 12.1). The overall reduction in percent rooting, roots per cutting, and root length in the Nearing frame system is probably due to the cooler air temperatures and lower light levels as compared to the greenhouse system. One explanation for these results is that *Cercocarpus* and *Shepherdia* (both of which require full-sun conditions) were not well adapted to low light levels in the Nearing frame. In contrast, it appears that *B. repens*, a more shade adapted plant, may have potential for propagation in a Nearing frame environment.

Figure 3. Rooting response of *C. ledifolius*, *B. repens*, and *S. x utahensis* (photos left to right) cuttings propagated in a greenhouse system (left within each photo) as compared to a Nearing frame system (right within each photo).

Table 1. The effect of greenhouse and Nearing frame systems on late fall rooting of little-leaf mountain mahogany (*C*. *ledifolius* var. *intricatus*), buffaloberry hybrid (*S*. × *utahensis* 'Torrey'), and creeping Oregon grape (*B. repens*).

Species	% Rooting		Roots per Cutting		Average Longest Root (mm)	
	GH	NF	GH	NF	GH	NF
C. ledifolius	95	5	10.8	1.7	83.8	1.5
S. x utahensis	98	11	7.7	2.5	100.5	12.1
B. repens	71*	56*	16.1	3.3	81.6	24.8

GH = Greenhouse system; NF = Nearing frame system
*No statistical difference between systems

Experiment 2 – Summer cutting propagation

In the summer of 2014, an additional experiment was conducted comparing the greenhouse and Nearing frame systems. Cuttings and striking dates were: single-leaf ash (*Fraxinus anomala*) on 11 June, creeping Oregon grape (*B. repens*), on 12 June, and Fremont barberry (*B. fremontii*) on 18 June. All cuttings were collected early in the morning from landscape-grown plants in Cache Valley, Utah. Cuttings were sorted for uniformity, their lower leaves stripped, stems wounded with a 1 cm side scrape, and dipped in 15 mm deep 2000 ppm IBA and 1000 ppm NAA as Dip-n-Grow in 25% ethanol for 5s with no shake. Cuttings were stuck in 4:1 perlite:peat rooting substrate in containers (6.5 X 6.5 X 8.9 cm) and were randomly assigned to one of four locations (two Nearing frames and two benches in one greenhouse) with 16 cuttings per replication. Bottom heat was supplied in both environments at 22°C. The greenhouse was misted with a Phytotronics VPD controller set at 30 VPD with 12s misting time. The Nearing frame was misted every 10 minutes for 15s. Mist systems ran from 6:00 AM to 9:00 PM. Greenhouse temperatures were at 65/60ºF DT/NT while Nearing frames were at ambient temperatures with no covering (except for the bottom heat). Cuttings were harvested on July 18 (*B. repens* and *F. anomala*) and July 28 *(B. fremontii*) and assessed for leaf color, stem length, rooting, number of roots/cutting, length of longest root, and rot on the stem.

Results

Results of this experiment indicate that percent rooting and number of roots per cuttings were approximately equal for *F. anomala* in both greenhouse and Nearing frame treatments (Table 2), in spite of the fact that the plants in the Nearing frame had generally better leaf color than in the greenhouse. With *B. fremontii*, those plants in the greenhouse did somewhat better, but we also found that almost 50% of those cuttings in the Nearing frame had necrotic stems that may have skewed the ability of the plants to root. Lastly, *B. repens* cuttings appeared to benefit from the Nearing frame with over 50% more cuttings rooted and twice the number of roots per cutting.

Table 2. The effect of greenhouse and Nearing frame systems on summer rooting of creeping Oregon grape (*B. repens*), Fremont barberry (*B. fremontii*), and single-leaf ash (*F. anomala*). Data not statistically analyzed.

Species	**% Rooting**		**Roots per Cutting**		**% Cuttings with Root Necrosis**	
	GH	**NF**	**GH**	**NF**	**GH**	**NF**
B. repens	28	84	5.1	10.0	9%	3%
M. fremontii	28	13	2.7	1.8	9%	47%
F. anomala	28	25	2.5	2.3	3%	3%

GH = Greenhouse system
NF = Nearing frame system

It would appear that, like the late fall experiment, cuttings from *B. repens* rooted better in the Nearing frame than any of the other species. This is probably due to *B. repens* being more shade tolerant than the other plants tested. Probably the closest comparison would be between *B. repens* and *B. fremontii*. The poor rooting performance of *B. fremontii* and the presence of stem necrosis suggest that this full-sun plant does not do well in a Nearing frame environment. Further, because the cuttings were treated with Alliette® (aluminum tris (O-ethyl phosphonate)) and Cleary 3336® (thiophanate methyl) fungicides, and that it was not a serious problem with the other plants, would indicate that the cause might be physiological.

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Colorado State University Ornamental Trials and Plant Select® Program

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1. Annual and Perennial Flower Evaluation Research

In 2014, approximately 1100 different varieties of annuals were grown in our research/display garden. The 2014 growing season started off cooler in May, June and July with adequate rainfall. Temperatures were warmer in August and we had a long fall with no hard freeze until late October – early November. On August 4, 2014 approximately ninety industry personnel and Advanced Master Gardeners judged these annuals in different taxa categories to determine 'Best Of's' in many different categories. *Dahlia* 'XXL Veracruz' from Red Fox was chosen as our 'Best of Show' and *Petunia* 'Supertunia® Black Cherry' from Proven Winners was chosen as our 'Best New Variety'. Our 'Best Novelty' was *Cuphea* 'Vermillionaire™' from Proven Winners. Twenty-seven other varieties were chosen to be 'Best Of' in each of the separate genera.

Approximately seventy-five new perennial taxa were planted in 2014 to our two winter, three growing season perennial trials. In November 2014 we chose five 'Top Performers' from our 2012 planting and three 'Too Good to Wait' from our 2013 planting.

Our 2014 'Top Performer Perennial' included:
Agastache x hybrida 'Blue Boa'PP24050 from Terra Nova Nurseries; *Echinacea* sp. 'Lelani'PP23526 from Terra Nova; *Echinacea purpurea* 'Profusion' from Eason Horticultural Resources; *Heuchera x hybrida* 'Georgia Plum'PP24507 from Terra Nova Nurseries and *Hibiscus x hybrida* 'Midnight Marvel'PP24079 from Walters Garden. The three 'Too Good to Wait Performers' planted in 2013 include: *Coreopsis verticillata* 'Mayo Clinic Flower of Hope'PPAF or 'Electric Avenue' from Creek Hill/Eason; *Festuca glauca* 'Casca 11'PP23307 from Skagit Gardens and *Rosa x hybrida* Sunrosa™ Red from Suntory® flowers. Complete description about both our annual and perennial winners can be found at www.flowertrials.colostate.edu.

2. Plant Select®

In 2014, seven plants were either introduced or recommended to the industry and gardening public. Also three additional plants were added to Plant Select® Petite Program. The three new introductions included:

Penstemon x mexicali 'Carolyn's Hope'PPAF; *Penstemon x mexicali* Windwalker™ Garnet Penstemon and *Zinnia grandiflora* 'Gold on Blue'. The four recommended plants in 2014 included: *Monardella macrantha* 'Marian Sampson' (Hummingbird

Trumpet Mint); *Muhlenbergia reverchonii* (Undaunted™ Ruby Muhly); *Rhus trilobata* 'Autumn Amber' (Autumn Amber Sumac); and *Scutellaria resinosa* 'Smoky Hill' (Smoky Hill Skullcap). The three Plant Select® petites for 2014 include: Dalmation Pink Cranesbill (*Geranium dalmaticum*); *Iris hookeri* (Dwarf Beach – Head Iris) and *Pinus edulis* selections (Dwarf Pinon Pine).

Plant Select® row trials are still being conducted at Colorado State University and Chatfield Denver Botanic Gardens. In 2014, 19 different taxa were planted and the 2013 plantings were evaluated by various Plant Select® personnel and data recorded throughout the growing season for flowering, overall plant performance and potential for self-seeding. Industry personnel also view and evaluate these trials yearly at both sites.

Research on irrigation effects on growth, stress, visual quality and evaportranspiration of ornamental grasses continued in 2014. Three species of ornamental grasses:

Panicum virgatum 'Rotstrahlbusch' (Rotstrahlbusch Switchgrass); *Schizachyrium scoparium* 'Blaze' (Blaze Little Bluestem) and *Calamgrostis brachytricha* (Korean Feather Reed Grass) were grown under four irrigation regimes (0%, 25%, 50% and 100% ET) and evaluated for ornamental quality and various stress parameters.

In 2014, *Panicum* was the least stressed grass then Little Bluestem and then Korean Feather Reed Grass. Visual ratings showed that the 0% treatment had significantly lower landscape impact that the other 3 treatments. Plant form however was similar across all treatments. A mini-lysimeter study was also conducted in 2014 with *Schizachyrium scoparium* 'Blaze' (Blaze Little Bluestem). Again 25%, 50% and 100% ET were used as irrigation treatments. Early in the season we saw no difference between treatments and an average Evapotranspiration (ET) was around 65%-70% of Kentucky bluegrass ET. Late in the 2014 season each treatment did appear different. During a wet year probably 25% ET would still result in satisfactory plant growth and appearance to this grass and if a real dry year approximately 50% ET would result in a satisfactory plant growth of Blaze Little Bluestem. Experiment will be repeated in the 2015 season.

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Nevada Extension Demonstration Garden Informs Public About Adaptable Native Plants for Landscapes in the Rain Shadow of the Sierra Nevada Mountains

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Introduction

Penstemons are loved by gardeners but relatively unknown by the gardening public in western Nevada (Kratsch, 2013). Gardeners tend to know about and purchase plants available at their local nurseries; they also tend to buy plants with which they are familiar. Despite the fact that 51 of the over 280 species of penstemon are native to Nevada, local nurseries in western Nevada have not carried penstemons for sale, and Nevadans are unfamiliar with the genus. In 2013, University of Nevada Cooperative Extension installed a penstemon garden on the grounds of the Washoe County Extension office (Figure 1). In 2014, visitors to the Extension office were surveyed regarding their knowledge and purchasing behaviors related to penstemons. This paper describes the results of that survey and the suitability of the penstemons planted in the demonstration garden for western Nevada gardens.

Figure 1. Washoe County Cooperative Extension penstemon garden (June 2014).

Shepherdia (buffaloberry) is a genus of non-legume nitrogen-fixing shrubs in the family Eleagnaceae. Two species are native to much of North America: *S. argentea* (silver buffaloberry) and *S. canadensis* (russet buffaloberry). One species is an endemic, *S. rotundifolia* (roundleaf buffaloberry), and found only in a relatively limited area within the Colorado Plateau in southern Utah and northern Arizona.

Figure 2. Clonal transplant of a buffaloberry hybrid in the penstemon demonstration garden (September 2014).

Silver buffaloberry is a riparian species, occurring along streambanks and moist bottomlands and hillsides (USDA NRCS, 2002). It is a thorny, thicket-forming shrub with narrow silver-green leaves and bright red berries (drupes)

in late summer. It is tolerant of wet, heavy soils, but has only limited drought and shade tolerance. Roundleaf buffaloberry is an attractive shrub with a rounded crown and heart-shaped, silvery-green leaves and is often found along dry hillsides or cascading down rocky slopes. It is intolerant of overwatering and difficulty to establish in domestic landscapes. Recently, a hybrid (*Shepherdia* x *utahensis* Sriladda, Kratsch & Kjelgren) was created between silver buffaloberry and roundleaf buffaloberry that has attractive physical characteristics similar to roundleaf buffaloberry but appears to have moisture tolerance more like that of silver buffaloberry (Sriladda et al., in review). We planted nine plants of the buffaloberry hybrids in and amongst the penstemons in our demonstration garden (Figure 2). Preliminary results of garden trials of the *Shepherdia* hybrid are also reported here.

Methods

Penstemon survey: In May 2013, Master Gardener Volunteers planned and installed a penstemon demonstration garden on the grounds of the Washoe County Extension building. Ninety plants, representing nine regionally appropriate Penstemon species were planted on the west side of the building. Species included were *Penstemon palmeri*, *P. pseudospectabilis*, *P. x mexicali* 'Red Rocks', *P. eatonii*, *P. strictus*, *P. clutei*, *P. virens*, *P. barbatus* 'Elfin Pink' and *P. pinifolius* 'Tall Orange Mix'. A public survey was developed to gather marketing information about public perception, plant preferences and plant purchasing habits related to penstemons and other flowering perennials. The short, five-question, paper-based survey was administered to 100 visitors of the Washoe County master gardener plant diagnostic clinic during May to September 2014. Clients were asked to visit the on-site garden, complete the questionnaire and return it to an enclosed collection box located in the front lobby of the Washoe County Extension office. Of the 100 surveys distributed, 29 were returned for a response rate of 29 percent. Survey results were disseminated to nursery owners, landscapers, master gardeners and the public by way of educational classes, newspaper articles, fact sheets and our Grow Your Own, Nevada website www.growyourownnevada.com.

Figure 3. Buffaloberry hybrid under partial shade to prevent afternoon wilting in July and August.

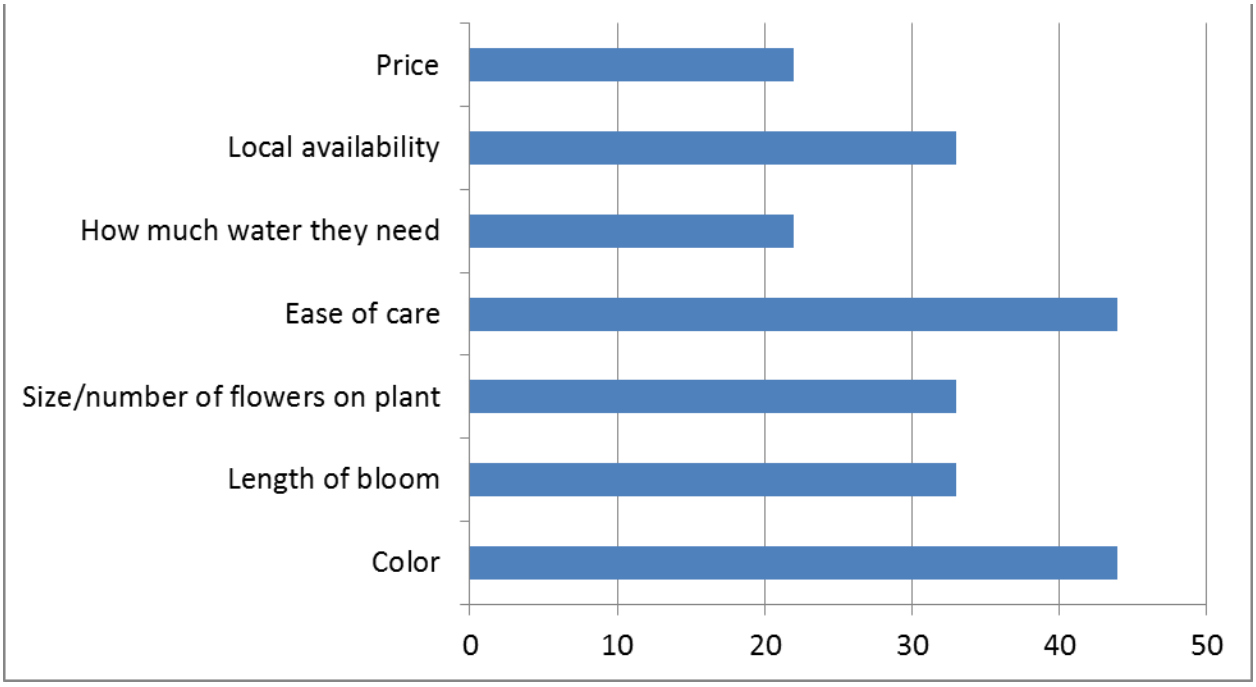
Buffaloberry hybrid garden trial:
Nine plants from cuttings of *Shepherdia* x *utahensis* were installed in the penstemon garden in July 2014. Each plant was placed within two inches of a drip emitter, and

staggered 12-inch wooden stakes were placed to the west of each plant to prevent afternoon wilting from the hot July/August sun (Figure 3). Plant height and width were measured to provide a record of plant growth and establishment. Irrigation was set to 30 minutes three times per week during the establishment period.

Results and discussion

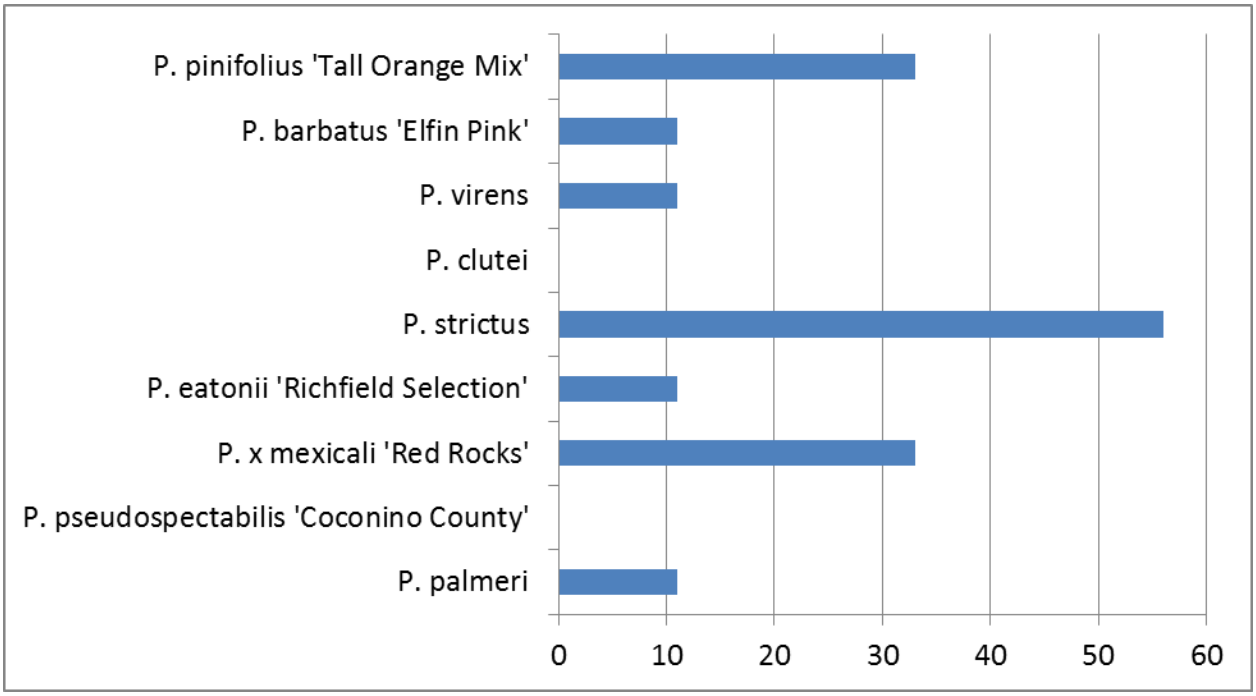
Penstemon survey: Results indicated that 42 percent of respondents were unaware that many penstemon species are native to Nevada. This is significant because previous work shows that Nevadans are interested in native plant landscaping (Curtis and Cowee, 2007a), and that a market for native plants exists in Nevada (Curtis and Cowee, 2007b). Consistent with what Curtis and Cowee (2007c) found, price, drought tolerance and local availability are important considerations when purchasing garden perennials (Figure 4). We found that ease of care and physical aesthetic qualities (size/number of flowers, length of bloom, color) were important as well.

Figure 4. Market characteristics of garden perennials. Graph bars show the percentage of survey respondents indicating whether a characteristic is important in purchase decisions.



We asked garden visitors which were their most and least favorite penstemon species in the garden, and why (Figure 5). Respondents to the survey chose species that appeared healthy and vigorous and rejected those that look “straggly.” Color was an important consideration in their decision, as was size of the plant (some preferred tall plants; others liked compact plants).

Figure 5. Preference scores for penstemons in the public demonstration garden. Graphs represent the percentage of survey respondents that prefer each penstemon entry.



Listed here are the top three penstemon species from our survey, along with one of our favorites and some additional observations from our experiences with the plants over the 2014 growing season.

Penstemon strictus (Rocky Mountain penstemon):

Figure 6. *Penstemon strictus* (Rocky Mountain penstemon) in the Washoe County penstemon demonstration garden (June 2014).

Rocky Mountain penstemon (Figure 6) was preferred almost 2 to 1 over any other penstemon species in our garden. Visitors said they loved the electric blue flowers and its tall upright form. The plants bloomed from June until August. Whereas some penstemon species could not tolerate the occasional downpours of heavy rain in the

rich soil of our garden, Rocky Mountain penstemon thrived. It was unfazed by the reflected heat from the west-facing white background wall. This penstemon was not bothered by aphids and thrips as were some large-leaved penstemon species in the garden, such as Sunset Crater beardtongue (Figure 7).

Figure 7. Aphids and thrips were attracted to the large-leaved penstemon varieties in our garden. An example is this Sunset Crater beardtongue plant (April 2014).

Penstemon pinifolius 'Tall Orange Mix' (pineleaf penstemon):

Pineleaf penstemon (Figure 8) elicited the most questions and comments of the nine penstemon species in our garden (we even found master gardeners collecting its seeds at the end of the growing season). It has bright, evergreen, finely divided leaves and long, delicate orange-red flowers that dangle from one side of the many stems. Visitors loved its fine texture, its healthy appearance and its long bloom from June to September. All transplants survived the winter in our garden and were virtually untouched by insect pests. The evergreen foliage provides winter interest to an otherwise dormant northern Nevada garden.

Figure 8. *Penstemon pinifolius* (pineleaf penstemon) has orange-red flowers and interesting finely divided leaves, unusual in the genus *Penstemon*.

Penstemon x mexicali 'Red Rocks' (Red Rocks penstemon):

Red Rocks penstemon is a no-brainer for our local nurseries since it blooms right in its container before sale, attracting would-be buyers of all kinds. This hybrid has a profusion of deep pink flowers with white centers. The blooms are plentiful and last from April through October in the climate of Reno, Nevada. Pollinators and wildlife are attracted to the large-mouthed flowers and dense foliage (Figure 9). Insect pests were rarely seen on these plants, despite their close

Figure 9. Red Rocks penstemon is a long-bloomer and a safe bet for nurseries inexperienced with native plants.

proximity to other larger leaved penstemon species. Regular irrigation does not weaken the plants, as it does with some desert species, and it appears to prolong the bloom.

Penstemon barbatus 'Elfin Pink' (Elfin pink penstemon):

Although this species is said to prefer full sun, we found the blooms were a lighter pink than their advertised color in our western exposure garden, and the blooms faded in color as the season progressed (Figure 10). For this reason, the species wasn't favored by our survey respondents. However, we noted that insects did not bother the relatively narrow foliage and bloom time was impressive, with flowers on the plant from June to October. With proper siting in the garden (an eastern exposure would be ideal), this species would be very successful in a western Nevada garden setting.

Figure 10. *Penstemon barbatus* 'Elfin Pink' is a long bloomer. This photo was taken October 8, 2014 in the Washoe County penstemon demonstration garden.

Other species in our garden were too riddled with insects or powdery mildew to warrant serious consideration for the untested native plant market inherent to western Nevada, but they do deserve attention for other more conducive environments. These include *P. palmeri* (Palmer's penstemon), *P. pseudospectabilis* (desert penstemon), *P. eatonii* (firecracker penstemon), and P. clutei (Sunset Crater penstemon). They did have their fans among our survey respondents, who were attracted to the brilliant flower colors or dramatic large, perfoliate leaves, but they did not perform well in our garden. Palmer's penstemon did not overwinter well, and surviving plants succumbed to root rot or were blemished by powdery mildew. These large-leaved penstemon species were attractive to aphids and thrips. Insect

pests are a common problem in western Nevada gardens because they often survive the relatively mild winters. It is possible that a more diversely planted garden would not have the insect problems we did, so they are worth a try under different conditions. In addition, blue mist penstemon foliage burned in the heat of summer, and many plants desiccated in a western exposure.

Buffaloberry hybrid garden trial

All nine buffaloberry hybrid plants survived, despite being planted in the heat of summer. The transplants were cuttings from parent plants grown in Logan, Utah. Because their root systems were relatively immature at the time of planting, and we noted afternoon wilting of the transplants, we installed closely spaced wooden stakes to provide filtered shade. All but one plant had at least an inch of top growth and started forming side branches by fall 2014. We did note bronzing of some of the foliage, a phenomenon that has also been reported by colleagues in Utah. It has been hypothesized that the bronzing is a nutrient deficiency (Sriladda et al., in review). However, we noted the presence of spider mite (Figure 11) in our demonstration garden, which could cause similar symptoms.

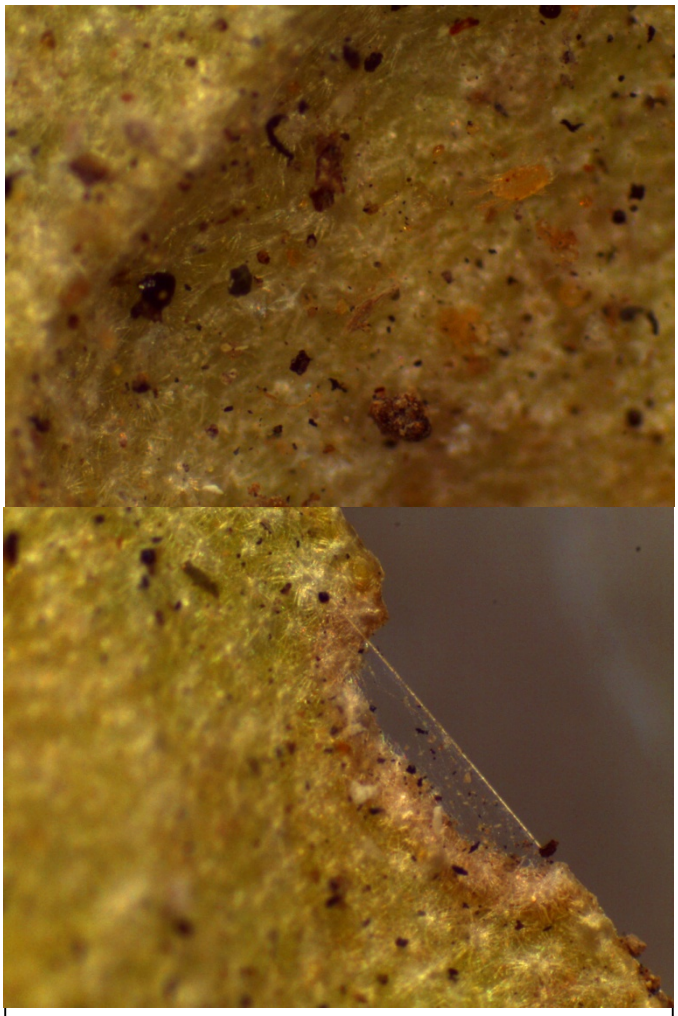


Figure 11. Buffaloberry hybrid plants with evidence of spider mite infestation. A spider mite (top) and webbing (bottom) were noted. Photo taken digitally under a stereo microscope at 35x magnification.

Conclusions

In 2013, we installed nine species of penstemon in a common garden under similar conditions of soil fertility and irrigation. This has allowed us to compare their performance in a typical garden situation in western Nevada. In 2014, we administered a survey to garden visitors. Results of the survey are consistent with previous surveys of potential native plant consumers in Nevada, and indicated at least three species that could be considered for early introduction to local nurseries – *P. strictus*, *P. pinifolius* and *P. x mexicali* 'Red Rocks'. In July 2014, we installed nine plants from cuttings from a new hybrid species, *Shepherdia x utahensis,* in the Washoe County penstemon demonstration garden. Plants survived but some have developed a spider mite

infestation, which could be related to a previously noted “bronzing” of foliage of both hybrid and parent plants under cultivation.

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Landscape-Worthy Native Shrubs from Seed

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Introduction

Woody landscape plants, by-and-large, are vegetatively propagated using stem cutting, grafting, and tissue culture techniques. Asexual propagation provides several production advantages, including stabilization of phenotype, rapid propagation, and a reduction in the time required for growout of marketable plants.

Unfortunately, most producers of native shrubs have limited capability to propagate plants vegetatively. They instead produce marketable plants from seed. In order to be accepted as landscape products, seed-grown native plants must exhibit characteristics that contribute to product quality. Seed-produced plants must be reasonably uniform, produce adequate quantities of viable seed that will germinate at a high rate, be adapted to pot culture, and grow rapidly from seedling to marketable size. Many native shrubs lack attributes that contribute to these important marketing advantages. However, there are some species that are capable of producing high quality, uniform plants in a reasonably short period of time. This report will describe some of the plants that have performed well in trials at the Aberdeen R & E Center in southeastern Idaho.

Plants of seed-propagated serviceberry (*Amelanchier alnifolia*) that show uniform size, habit, and appearance.

Essential Attributes

One characteristic essential to seed-propagated landscape species is tolerance to selection and sometimes the selfing required to increase plant uniformity. A condition of acceptable homogeneity must be obtainable within a limited number of generations. Also, the plants must be able to maintain their vigor and positive development characteristics through the selection process. Some species, such as oakleaf sumac (*Rhus trilobata*) and snowberry (*Symphoricarpos oreophilus*), to date, have been difficult

to stabilize. Sometimes the difficulty can be attributed to genetic factors, such as dioecious sexual expression or a strong outcrossing requirement. In other cases, it may be the result of limited seedling production that reduces opportunities for effective selection. In comparison, many other species have proven relatively easy to stabalize, such as serviceberry (*Amelanchier alnifolia*) and golden currant (*Ribes aureum*).

Another critical attribute required of seed-propagated shrubs is the ability to produce large numbers of seedlings, implying that large quantities of seed is available and the seed germinates easily. Shrub species such as syringa (*Philadelphus lewisii*) and desert fernbush (*Chamaebatiaria millefolium*) meet these qualifications. On the other hand, seeds of antelope bitterbrush (*Purshia tridentata*) and bearberry (*Arctostaphylos uva-ursi*) can be either difficult to obtain, hard to germinate, or both.

Finally, seed-propagated shrub species must be easy to culture in pots and rapidly grow to marketable size while experiencing minimal losses. Roundleaf buffaloberry (*Shepherdia rotundifolia*) is an example of a very desirable landscape plant that is difficult to keep alive in pots. Rockmat (*Petrophytum caespitosum*) is an example of a plant the can be grown successfully in pots but is very slow growing and requires an extended period of time to reach marketable size. Examples of species that adapt to pot culture and grow rapidly include smooth sumac (*Rhus glabra*) and ninebark (*Physocarpus malvaceus*).

Proven Seed-Grown Shrub Species

Ribes cereum
Golden Currant

In native populations, plants of golden currant exhibit considerable variability. Height can vary from less than 4 feet to more than 10 feet. Architecture can range from open to very dense, and from stiffly upright to weeping. Berry color can be the typical light orange, to red, or even black. Fall color can range from a pale yellow-orange to brilliant shades of red and red-purple.

Blooming specimen of golden currant (*Ribes aureum*) at the R & E Center in Aberdeen, Idaho

The best forms of golden currant make very nice landscape shrubs. The plants are adapted to a wide range of soil and water conditions. The lobed, light green leaves are attractive and remain healthy through the summer season. Drooping chains of bright yellow flowers come on in early spring, to be replaced by a June crop of edible berries. The shrubs finish up the season with a nice display of fall leaf color. Golden currant provides habitat and food for both pollinators and birds.

Chamaebatiaria millefolium
Desert Fernbush

The natural habitats of desert fernbush consist of hot, harsh, rocky sites where water is scarce and soils lean or largely lacking. As a result, the plants perform best in water-conserving or xeric landscapes. The species expresses itself in two distinct forms. The form common to the northern Rocky Mountains has bright green leaves and blooms in June. The southern form, found in the red rock country of the southwest, has grey leaves and blooms in late July. Both forms make good landscape specimens.

Desert fernbush is a medium sized plant, growing to a height of 5 feet, with similar spread. The leaves are finely divided, fern-like, and attractive in their own right. Flowers are white and grow in dense panicles. Post-bloom plants retain seed capsules that turn an attractive copper color and remain intact on the plant through most of the winter. In warm climates, the plants can be partially evergreen, while in cold climates the leaves typically freeze and fall off.

The late-blooming, gray-leaved southwestern form of desert fernbush (*Chamaebatiaria millefolium*).

Amelanchier alnifolia
Serviceberry

A wide range of ecosystems support serviceberry bushes, including riparian habitats, vernally moist draws, or dry hillsides. As a result, the species is adapted to varied situations in the landscape. The plants will thrive in heavily irrigated, traditional landscapes or grow quite well in water-conserving landscapes with limited, strategically applied supplemental irrigation. The species is extremely variable and plants may range in size from 3 to 15 feet. The dwarf expressions make the best landscape specimens.

Depending on the selected form, serviceberries can fill the role of a small, medium, or large shrub. Small forms are compact and dense. Large forms have much more open architecture. White flowers cover the bushes in late April to early May. In July, plants produce abundant edible berries. Plants selected for large, small-seeded berries are best for fruit production. If left on the bushes, berries provide an excellent food source for many bird species.

Edible purple berries of serviceberry (*Amelanchier alnifolia*).

Salvia dorrii, the smaller, hardier form of purple sage.

Salvia pachyphylla, the larger, less hardy form of purple sage.

Salvia dorrii
Salvia pachyphylla
Purple Sage

Purple sage is a true desert plant, thriving only in well-drained soils under xeric conditions. It is a suitable specimen only in landscapes that are, at most, provided with infrequent supplemental irrigation. Two species of *Salvia* are categorized as purple sage. *Salvia dorrii*, Dorr's purple sage, has a broad native range and is found across much of the western United States. Plants are typically about 18 inches to 2 feet tall. *Salvia pachyphylla*, big purple sage, is native to the southern Sierra Nevada region in California and Nevada, and in northern Arizona. Plants of this species can be as much as 3 feet tall.

Purple sage is an unusual, woody, evergreen species from the mint family. The leaves are strongly fragrant and exhibit a very attractive silver-green color. Bloom begins in June for Dorr's purple sage and July for big purple sage. Flowers are blue and embedded in spikes of bright purple bracts. The color combination provided by the flower parts is very striking and the bloom period is

very long. All plant parts, including the flowers stalks, of big purple sage are larger than those of Dorr's purple sage. Dorr's purple sage is hardy into the northern Rocky Mountains. Big purple sage is better adapted to low elevation southern deserts. It will survive in colder regions but may require trimming to remove damaged branches in the spring.

Ericameria nauseosa
Rubber Rabbitbrush

Found in every western state, rubber rabbitbrush is one of the most widespread of the desert native plants. It grows throughout and beyond the sagebrush steppe ecosystems that are common east of the coastal ranges. The species is typified by tremendous variability, including forms that are landscape worthy and others that are too lanky and weedy to be suitable in a cultivated site. The plants are adapted only to xeric conditions or to landscapes with minimal supplemental irrigation.

Dwarf silver form of rubber rabbitbrush (*Ericameria nauseosa*) suitable for landscape

The dwarf forms of rubber rabbitbrush with either bluish or silver foliage make good small landscape shrubs. Bloom occurs very late in the season, past the time when most other plants have gone to seed. This not only makes the bright yellow flowers important for late season color in the landscape, but makes them extremely valuable as a food source for native pollinator species.

Philadelphus lewisii
Philadelphus microphyllus
Syringa or Mockorange

Although considered to be drought tolerant plants, the habitats of native mockorange species include a minimal level of moisture. As a result, mockorange requires some supplemental irrigation in the landscape. The two species of mockorange discussed here are very distinct from each other. Lewis mockorange (called syringa in Idaho where it is the state flower) is a northwest species that grows up to 15 feet tall. Littleleaf mockorange is native to the southwest and is smaller, usually less than 5 feet tall. Both species make very nice landscape specimens.

Large, fragrant flowers of Lewis mockorange (*Philadelphus lewisii*).

Lewis mockorange eventually becomes a large shrub, if provided adequate water and fertility. New growth is strongly vertical and sucker-like. Older branches grow many secondary branches and become brushy. The light green, toothed leaves are relatively large and broad. In June, plants produce copious amounts of 2-inch, 4-petaled, extremely fragrant flowers.

Littleleaf mockorange is a medium-sized shrub. It has a more arching or weeping form than its larger cousin. The grayish leaves are small and oval. The flowers are smaller than those of Lewis mockorange, but just as attractive and fragrant. Littleleaf mockorange appears to be somewhat more drought tolerant than Lewis mockorange.

Smaller flowers and leaves of littleleaf mockorange (*Philadelphus microphyllus*).

Physocarpus malvaceus
Ninebark

In situ, ninebark is most commonly found in moist, shady woodlands or seasonally damp canyons. However, it occasionally shows in sunny ravines and dry hillsides, suggesting wide adaptability, a trait that shows up in test plots. It can withstand a wide range of conditions in the landscape, from heavily- to lightly-irrigated. This is a variable species; some forms make good landscape plants and others do not. A negative attribute of some ninebark plants is aggressive, rhizomatous growth habit, making them moderately invasive. Other plants maintain a clump habit. Some plants develop leaf spots and leaf burn that reduces attractiveness as the summer progresses. Others do not. Some plants produce intensely beautiful fall leaf colors, while others remain less colorful. Selection of a superior form is important to get the most out of this species in the landscape.

Ninebark (*Physocarpus malvaceus*) in a native setting above Hell's Canyon, Idaho.

Ninebark provides three seasons of interest in the landscape. In early spring, shrubs are covered with tight clusters of attractive white flowers. In summer, the glossy, dark green leaves are set off by red overtones in the new growth. In fall, leaves develop handsome shades of orange and red. Ninebark is a medium-sized shrub, typically 4 to 6 feet tall.

Amorpha nana
Dwarf False Indigo

Primarily a plant of the northern plains, dwarf false indigo makes its way into the Intermountain West in the foothills of Colorado's Front Range and east-central New Mexico. Common natural habitats include dry plains and rocky hillsides. It is considered to be a drought tolerant plant. In the landscape it requires some supplemental water during dry periods, but does not do well where conditions are constantly moist. This is a truly dwarf shrub, usually less than 18 inches tall.

Dark reddish-brown flower spikes and pinnate leaves of dwarf false indigo (*Amorpha nana*).

The small size of false indigo bush makes it very versatile in the landscape. It can be used as a short border plant, planted around structures and foundations, placed as a specimen in a small bed, or grouped to accentuate the fine texture of leaves and soft color of the flowers. The leaves are finely pinnate, much like vetch. The flowers are light to dark red-purple and maintained through a long bloom period. Post-bloom, the spikes of pods add interesting texture to the plants, which remain attractive all summer.

Dasiphora fruticosa
Shrubby Cinquefoil

In its natural habitat, shrubby cinquefoil can be found growing streamside, on vernally damp flats, on dry hillsides, or even on bare rocky cliffs. It shows wide adaptation that gives it that ability to grow under a broad range of conditions in the landscape. Shrubby cinquefoil does well in heavily irrigated sites but will also grow with minimal supplemental water. Growth habit of shrubby cinquefoil varies from upright shrubs to 6 feet tall to prostrate forms that hug the ground.

A prostrate form of shrubby cinquefoil (*Dasiphora fruticosa*) from Steen's Mountain.

Leaves of shrubby cinquefoil are small, dark green, hairy, and pinnate. They remain attractive into late fall. Primary flower color is dark yellow, although white, orange, pink, or light red flowers are occasionally seen (cultivars with red or pink flowers are derived from plants of European provenance). Many cultivars of shrubby cinquefoil are available in cultivation. The best forms of shrubby cinquefoil have dense, dwarf growth habit and long bloom periods.

Conclusions

A moderate palette of native shrubs can be grown and sold for landscape applications without the necessity of vegetative propagation. As more research is completed the list of shrubs suitable for seed propagation will become larger. These facts should make it easier for native landscape nurseries to supply homeowners and landscape designers with adequate volumes of water-conserving, sustainable woody landscape materials.

Native Plants in the All-American Selections Display Garden at University of Wyoming

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One of the projects at the University of Wyoming is the All-America Display Garden which includes several named cultivars of native plants. This year the UW AAS Garden highlighted 6 different perennials with native plants in their gene pools. The six were:

- *Gaillardia aristata* 'Arizona Apricot'
- *Gaillardia* 'Mesa Yellow'
- *Echinacea purpurea* 'Powwow Wild Berry'
- *Echinacea hybrida* 'Cheyenne Spirit'
- *Gaura lindheimeri* 'Sparkle White'
- *Penstemon hartwegii* 'Arabesque'

Laramie rated USDA Hardiness Zone 4 and is a harsh site for AAS evaluations. AAS makes the plant selections for the trial each year, meaning some plants are not locally adapted. The 2014 growing season was a difficult one, marked by cool and moist conditions early on. Many of the plants in the AAS garden did not respond well, growing slowly or not at all until late July and early August. This had a dramatic effect on cultivar performance. Included here are general descriptions and performance comments for the 6 native cultivars.

Gaillardia aristata 'Arizona Apricot' (Figure 1): This was the third growing season for many of the plants. This particular cultivar was a 2011 AAS winner. It blooms profusely and is very cold hardy.

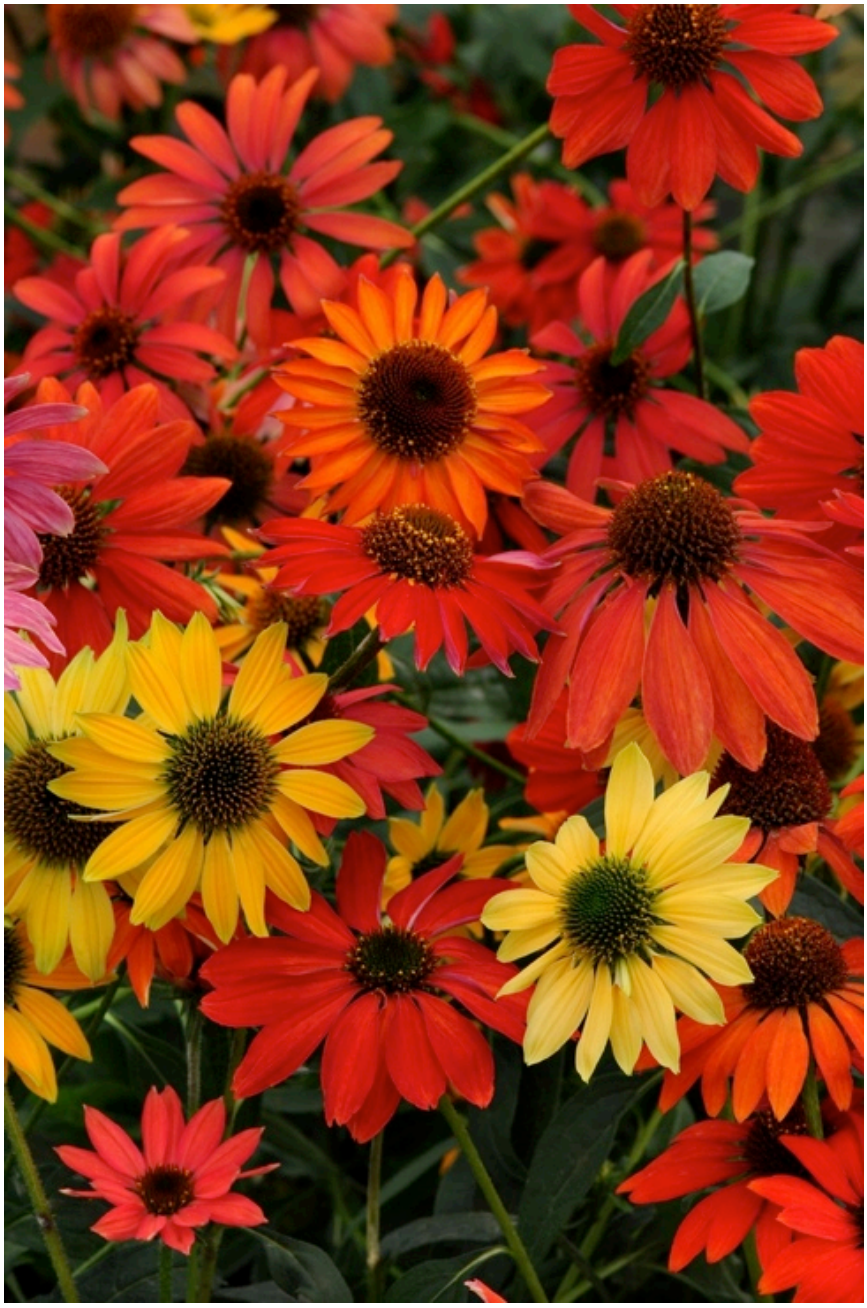
Figure 1. *Gaillardia aristata* 'Arizona Apricot'. Photo August 2, 2014, Karen Panter.

Gaillardia ‘Mesa Yellow’, has performed very well It is hardy and has also been through two winters in Laramie (Figure 2). ‘Mesa Yellow’ was a 2010 AAS winner.

Figure 2. *Gaillardia* ‘Mesa Yellow’. Photo August 2, 2014, Karen Panter.

A 2010 AAS winner, *Echinacea purpurea* ‘Powwow Wild (Figure 3) flowered during its first growing season after spring planting. Winter hardiness has not been a problem with this cultivar of *Echinacea*.

Figure 3. *Echinacea purpurea* ‘Powwow WildBerry’. Photo July 30, 2013, Karen Panter.



A 2013 AAS winner, *Echinacea hybrida* 'Cheyenne Spirit' did not perform well in the garden. About half of the initial plants did not make it through the winter of 2013-2014. It has been very slow to establish in the garden and has yet to bloom. For the second report in a row, conditions necessitated the use of an AAS photo instead of my own because plants have yet to bloom (Figure 4).

Figure 4. *Echinacea purpurea* 'Cheyenne Spirit' in bloom. Photo courtesy All-America Selections (www.all-americaselections.org

A new entry to the garden, *Gaura lindheimeri* 'Sparkle White' (Figure 5) is not rated for Laramie's USDA Hardiness Zone 4 (it is rated Zone 6) so is not expected to survive the coming winter. However, it established easily and flowered profusely this first summer. 'Sparkle' is a 2014 AAS winner.

Figure 5. *Gaura lindheimeri* 'Sparkle White' flowers. Photo August 2, 2014, Karen Panter.

Lastly, the 2014 AAS winning 'Arabesque' cultivar of *Penstemon hartwegii* (Figure 6) is another group that may be regarded as an expensive annual in Laramie's climate. It is rated for Zone 6. 'Arabesque' established easily and red flowers appeared early on in the season this year.

Figure 6. *Penstemon hartwegii* 'Arabesque' blooms. Photo August 2, 2014, Karen Panter.

Breeding Native Flowers for Drought Tolerant Urban Landscapes; 2014 Progress Report

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This report focuses on five areas of program work during 2014. First, we collected and transplanted plants of five *Penstemon* species of interest. Second, we initiated an in-depth set of *Penstemon* interspecific crosses. Third, we collected, from our field plots, seed from the first generation of EMS treated *P. strictus* plants. Fourth, we made outstanding progress on our 2013 initiated *P. scariosus* diversity study. Finally, the importance of being observant while collecting plants from their native habitat.

1. *Penstemon* Collections and Transplanting

We were able to make seven collection trips specifically focused on collecting plants and seed for possible breeding parents in the 2015 breeding season. The longest trip was to southern California then across southern Arizona, in late April and early May, specifically to collect *P. eatonii* and *P. palmeri* within their southwestern-most range. The majority of that collection trip was to locations we had never visited before; thus, requiring flowering plants to unambiguously identify the species. Because of the time of year we were unable to collect seed and a lower number of these plants survived transplanting. Although, we do have some specimens from most of the accessions still growing in the greenhouse. We made one additional collection trip to the Arizona strip, again focusing on *P. eatonii* and *P. palmeri*; however, we also collected accessions of *P. laevis* and *P. thompsoniae* the last of September and first of October. The other four parent stock plants collection trips were focused on collecting diverse accessions of *P. scariosus*, *P. fremontii* and members of the *Penstemon* subsection *Caespitosi* or the mat *Penstemon*.

Our reasoning for collecting *P. eatonii* and *P. palmeri* is that they offer primarily color (*eatonii*), blossom size and fragrance (*palmeri*) to our interspecific breeding program. *Penstemon fremontii* and *P. laevis* both show promise as potential parents in our breeding program and we have indications that they may act as “bridge species” in wide crosses. The *Caespitosi* subsection is a recent directional choice in our program inasmuch as we have learned there is a potential market for mat *Penstemon* that bloom throughout the season. We have found accessions, within the mat *Penstemon* complex, which indeed produce a second set of blooms with late summer rains. Finally our reasoning for collecting *P. scariosus* is that we have found that it is a species that has tremendous variability and is one that we should consider for second bloom flushes, large bloom size, and outstanding blue color.

2. *Penstemon* Hybridization

We made over 600 wide crosses, both inter- and intraspecific (Figure 1) during spring 2014. Specifically we attempted interspecific crosses between 12 species combinations (Table 1); as well as, a number of wide intraspecific crosses between *P. palmeri* x *P. palmeri* and *P. eatonii* x *P. eatonii*. All of these intraspecific crosses were between accessions which were from rather geographically separated areas. For

instance *P. palmeri* and *P. eatonii* collected from Spanish Fork and American Fork Canyons, Utah were crossed with the same species collected from southern Utah and central and southern Arizona. Some of these crosses readily produced seed while others were less fecund.

Table 1. Interspecific crosses within *Penstemon* and observations as to whether a seed pod developed. The determination of seed viability within pods will be completed in winter 2014.

Cross	***Capsules development?***
barbatus x eatonii	yes
eatonii x barbatus	yes
eatonii x laevis	yes
eatonii x fremontii	yes
eatonii x palmeri	yes
eatonii x pseudospectabilis	yes
eatonii x scariosus	no
palmeri x eatonii	yes
palmeri x laevis	yes
pseudospectabilis x eatonii	yes
pseudospectabilis x palmeri	yes
sepalulus x rostriflorus	yes

Figure 1. Method of identifying emasculated pistil (purple strand of yarn) and hand pollinated pistils (small labeled tags attached to each pollinated pistil).

3. *Penstemon strictus* Mutagenesis Project

Late fall of 2012 we planted several hundred *P. strictus* plants, which as seed, had been treated with the chemical mutagen known as EMS (ethyl methanesulfonate). During early bloom (late May 2014) we bagged one blossom spike on each plant, before the buds had opened; thus, precluding natural cross pollination. However, none of these "bagged" blossom spikes produced seed. There are two probable hypothesis for this complete lack of seed with every bagged flower spike. One is that bagging caused too much heat to accumulate in the bag resulting in flower sterility. The second, and more probable scenario, is that *P. strictus* requires cross pollination for successful seed set. We favor the second scenario because we know that a number of the *Penstemon* are totally or nearly completely self-incompatible. We are unsure of *P. strictus*; but, it is probable that it is generally self-incompatible. Furthermore, for years, blossom spike bagging has been successfully used to produce selfed seed in the Nebraska *Penstemon* breeding program conducted under the direction of Dale Lindgren (personal communication).

As a result of our inability to harvest self-pollinated *P. strictus* seed we have changed our breeding approach, on this project, to a technique referred to as "mass selection." It is a much slower approach and requires more plants each year as well as being very prone to "miss" many mutations; however, alternatives are limited and labor intensive.

4. *Penstemon scariosus* Diversity Study

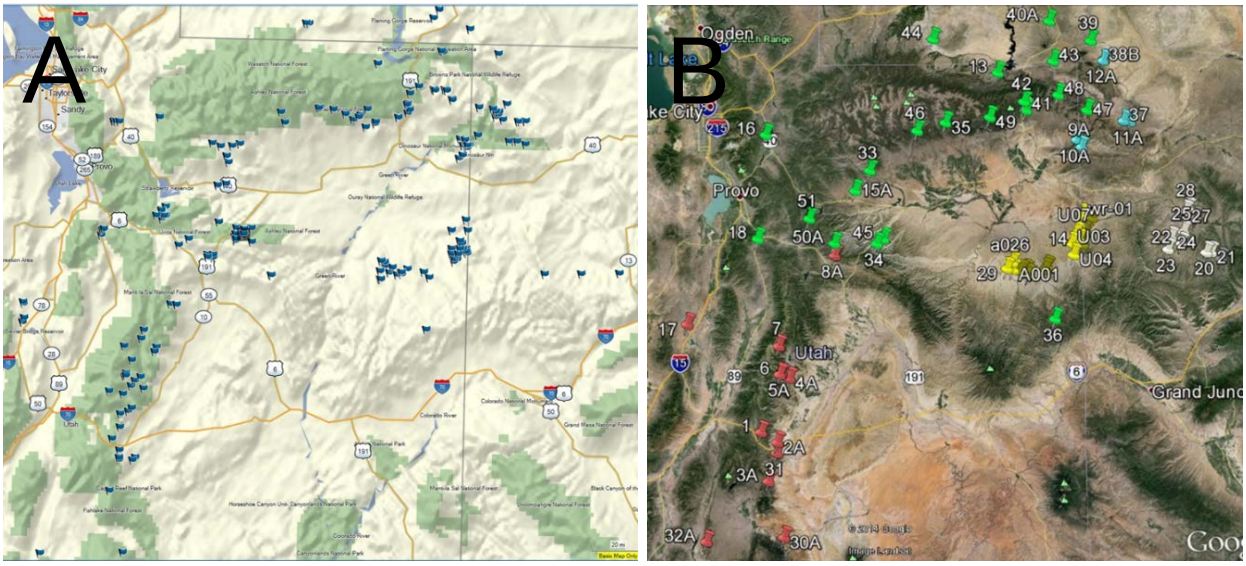
Penstemon scariosus is recognized as having a broad complex range of phenotypic variability (Holmgren, 1984; Neese and Atwood, 2008). There are four named varieties of this species *albifluvis*, *cyanomontanus*, *garrettii*, and *scariosus* (Neese and Atwood, 2008). However, of the four varieties reported by Neese and Atwood (2008), *P. scariosus* var. *albifluvis* is the most distinct, as determined by phenotypic taxonomic characteristics. Variety *albifluvis* is found almost exclusively on the oil shale ledges of the Green River Formation (England, 1982). In the last few years, there has been an ever increasing interest in recovering the oil found in these formations. Because of its unique limited habitat combined with increasing efforts to recover the hydrocarbons found in these formations, the taxon is being considered for listing as endangered under the Endangered Species Act of 1973 (Ashe, 2013). In the field, populations of this species have been observed producing flowers eight weeks or more after the initial blossom spikes formation, under conditions devoid of rain.

During 2013, we began studies to identify the phenotypic and genotypic diversity of *P. scariosus* during the summer of 2013. In early 2014, we learned of possible funding from the Vernal, UT office of the Bureau of Land Management (BLM) to fully explore and report back on the diversity of this species using the molecular marker tools known as simple sequence repeats (SSRs, also known as microsatellites). Microsatellites are useful markers for DNA fingerprinting. Our objective is to develop an understanding of the genetic relationships of the varieties within *P. scariosus,* test the hypothesis that *P. scariosus* var. *albifluvis* is somewhat distinct within *P. scariosus*.

Summarizing our 2013-14 field seasons on this project, we collected over 600 different *scariosus* samples from 65 populations, with a minimum of eight samples per population. These samples represent all four varieties of *P. scariosus*, across all verified locations of this species (see Figure 2). Additionally, we identified putative

SSRs from *P. scariosus* sequence data from a 2013 class project and tested those as well previously published *Penstemon* SSRs from our lab and elsewhere (Dockter et al., 2013; Kramer and Fant, 2007). The laboratory aspect of this study is underway at this time. When complete, this study will be the most comprehensive study of its kind in *Penstemon*.

Figure 2. The blue flags in panel "A" are locations where *P. scariosus* has been reported in herbarium records. The pins in panel "B" are where tissue samples and new herbarium samples were collected for this study. The yellow "pins" are where *P. scariosus* var. *albifluvis* were collected, the blue, *cyanomontanus*, the green, *garrettii*, and the red is where we collected samples of the variety *scariosus*. The white pins represent an area where probable identified *P. scariosus* or a very near relative are found and collected.



5. Being Observant While Collecting

One of the most important aspects of being lucky is, being smart enough to know when that luck has led you to something potentially useful. While doing field work we were fortunate to come across the most interesting naturally mutated *Penstemon* we have seen (Figure 3). It is unknown as to what is the specific cause of the mutation in this *P. subglaber*. We believe there are at least two mutations involved. The first mutation involves a shift to pink from the normal colors found in this species which include shades of blues and blue-lavenders. We did find several plants in the population that were pink like this one. However, no other plant we saw had the variegation found in this plant. At present, we believe there are two possible hypothesis that may explain this variegation. First, the plant maybe infected with a virus which could cause a look similar to this which have been identified in some species. Although, we believe a more viable explanation lies in the possibility that this phenotype is caused by a genetic transposable element, the documented cause of striping in some commercially available "Indian corn" (*Zea mays*). We have initiated vegetative propagation for this plant and hope to begin to address questions relative to this very unusual find.

Figure 3. Extremely unusual flower phenotype found in a *P. subglaber* plant during our 2014 field season.

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Nurturing Native Plants: A Guide to Vegetative Propagation of Native Woody Plants in Utah

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In order for native woody plants to take a greater role in water conserving landscapes throughout Utah, it is imperative that superior specimens of these plants be selected, propagated, and grown to marketable size. In a study by Hooper, Endter-Wada, and Johnson, landscape architects in Utah indicated that the biggest limitations to their use of native plants were unavailability (79.5%), desired size not available (68.1%), and customer perception that native plants are not as beautiful as traditional garden plants (70.1%). Improved vegetative propagation will help solve all three of these limitations because it permits the selection and clonal propagation of natives that do have more desirable characteristics, and because it enables the nursery industry to grow such plants in the sizes and quantities needed for the market.

Historically, most of native woody plants have been grown from seed to preserve their genetic diversity for use in reclamation projects. While diversity is valuable in a wildland situation, managed horticultural landscapes are better served by more genetically defined materials. For example, landscape architects are reluctant to specify the use of a tree or shrub that has an unknown fall color, form, or mature size. Propagating these genetically diverse plants as clones enables the production of a consistently true-to-type product that can be named and described.

We have developed the on-line publication *Nurturing Native Plants: A Guide to Vegetative Propagation of Native Woody Plants in Utah* (Figure 1) to facilitate vegetative propagation of native plants to encourage their production by Utah nurseries and enthusiasts. This was done by compiling protocols in an easy-to-follow 'recipe' format. The information was derived from research done at Utah State University, online sources such as the Native Plant Network, peer-reviewed publications, and anecdotal experience from students and nurserymen. While it is designed to be expandable, the guide currently includes information on over 50 protocols (Figure 2). The design of the guidebook is similar to that of a cookbook and includes a description of the propagule, materials needed, and the appropriate environment (Figures 3 & 4). This publication can be accessed through the Center for Water Efficient Landscaping at: www.cwel.usu.edu or at https://extension.usu.edu/files/publications/publication/NurturingNativePlants2014.pdf.

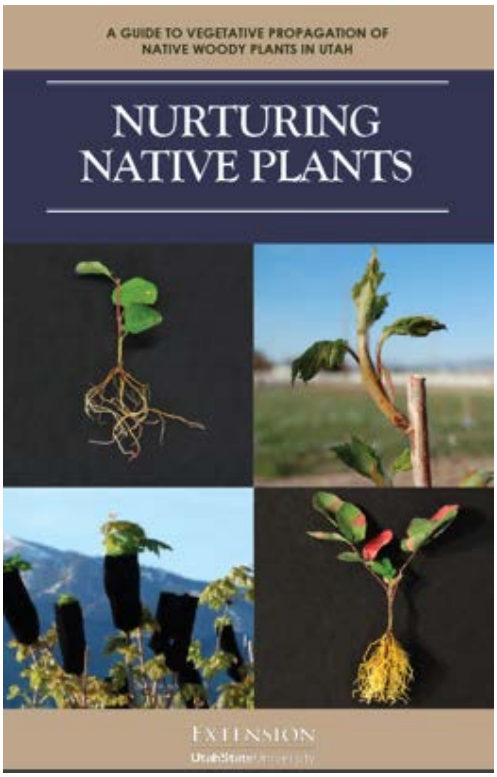

Figure 1. Cover of the on-line publication *Nurturing Native Plants: A Guide to Vegetative Propagation of Native Woody Plants in Utah.*

Figure 2. A list of the woody plant material propagation protocols covered in the guidebook.

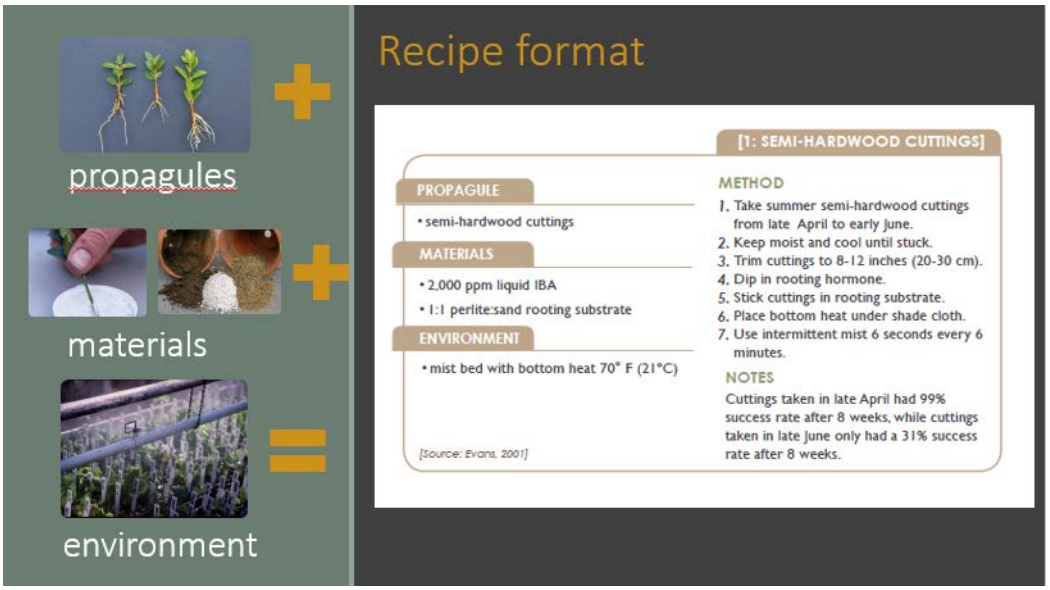

Figure 3. Each 'recipe' includes information on propagules, materials, and environmental conditions required.

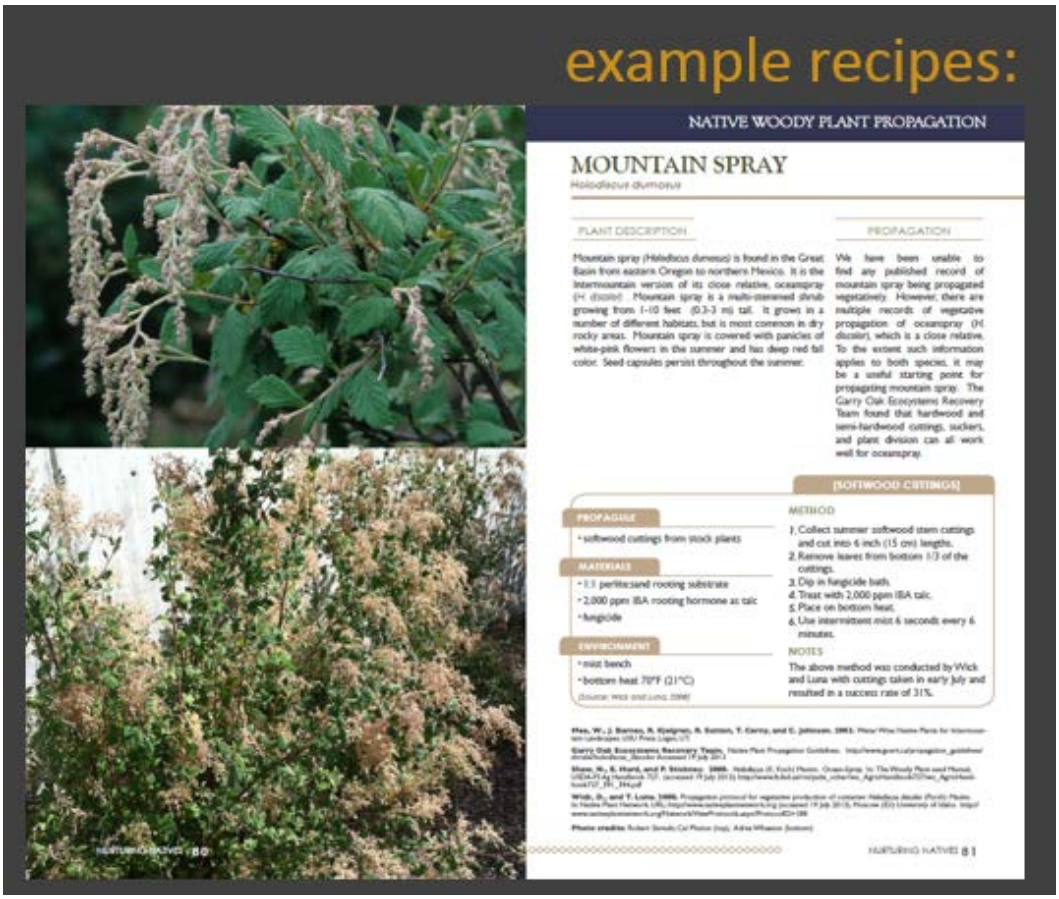

Figure 4. An example of a recipe as formatted for the guidebook. Each recipe also contains a brief description of the plant, references to original sources, and directions on specific steps required for propagation.

References:

Hooper, V.H, J. Endter-Wada, C.W. Johnson. 2008. Theory and Practice Related to Native Plants: A Case Study of Utah Landscape Professionals. Landscape Journal 27(1):127-141. DOI:10.3368/lj.27.1.127

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