

SAES-422 Annual Report

Participants:

Esther McGinnis (esther.mcginis@ndsu.edu) – North Dakota State University; Fargo, ND
Heidi Kratsch (kratschh@unce.unr.edu) – University of Nevada; Reno, NV
James E. Klett (jim.klett@colostate.edu) – Colorado State University; Fort Collins, CO
Ji-Jhong Chen (jjjhong1227@aggiemail.usu.edu) – Utah State University; Logan, UT
Karen Panter (kpanter@uwyo.edu) – University of Wyoming; Laramie, WY
Orville Baldos (obaldos@hawaii.edu) – University of Hawaii; Manoa, HI
Stephen Love (slope@uidaho.edu) – University of Idaho; Aberdeen, ID
Katie Pierce – University of Idaho; Aberdeen, ID
Ben Pierce – University of Idaho; Aberdeen, ID
Amy Jo Detweiler (amyjo.detweiler@oregonstate.edu) – Oregon State University Extension Service; Redmond, OR
Asmita Paudel (asmita.paudel@aggiemail.usu.edu) – Utah State University; Logan, UT
William Graves (graves@iastate.edu) – Iowa State University; Ames, IA
Genhua Niu (genhua.niu@ag.tamu.edu) – Texas A&M University; Dallas, TX
Larry A. Rupp (larry.rupp@usu.edu) – Utah State University; Logan, UT
Mengmeng Gu (mgu@exchange.tamu.edu) – Texas A&M University; College Station, TX
Tracy Dougher (tracyaod@montana.edu) – Montana State University; Bozeman, MT
Ursula Schuch (ukschuch@ag.arizona.edu) – University of Arizona; Tucson, AZ
Youping Sun (youping.sun@usu.edu) – Utah State University; Logan, UT
Donald Merhaut – University of California; Riverside, CA
Randy Nelson – North Dakota State University; Fargo, ND
Vance Owens – National Institute of Food and Agriculture; Kansas City, MO
Brandon Miller – University of Minnesota; St. Paul, MN
Gerald Burgner – Texas A&M University; College Station; TX
Roger Kjelgren – University of Florida; Apopka, FL
John Erickson – National Institute of Food and Agriculture; Kansas City, MO
Hang Duong – University of Florida; Gainesville, FL
Amita Kaundal – Utah State University; Logan, UT

Brief Summary of Business Minutes:

October 29, 2021 @11 a.m. - 3:30 MST – Zoom

--- All participants introduced themselves.

--- Tracy Dougher (Administrative Advisor) shared that the midterm review of our project was highly positive. Highlight collaborations in reports, and keep impact statements non-technical and concise. Focus on how we meet objectives:

“Objectives: 1) Establish a regional system for the development, evaluation, and introduction of new native plant materials; 2) Coordinate regional efforts to provide education to both public and industry professionals on native plant use, propagation, and production.”

--- Minutes of the 2020 annual business minutes were approved unanimously.

---Steven Love explained how to become a state's official member/representative.

---Membership: Issues associated with sustaining e-mail address database were discussed. Personal contacts with those who might be interested in joining was described as an effective strategy for expanding participation. The potential for collaborations with a group based in the Southeast were discussed.

--- Updates on collaborative research, education and grant activities (see additional detail under Collaborative Accomplishments):

- Multi-state grant proposal in preparation
- Potential to pursue collaborative research on mitigation of heat islands
- Collaborative groups collecting plant germplasm
- Shared educational programs in North Dakota and Minnesota

--- WERA-1013 Website (<https://wyoextension.org/westernnativeplants>):

- Utah State University is hosting the website.
- New native plant species profiles can be added to the website via contacting Steven Love.

--- Annual meeting in 2022:

- The importance of a tour associated with meeting with ASHS in 2022 was discussed. A tour at Chicago Botanic Garden is possible.

---Vance Owens and John Erickson (NIFA representatives) overviewed the opportunities for funding through NIFA.

--- Nomination and election of incoming Chair-elect and Secretary:

- Chair: Orville Baldos, University of Hawaii.
- Chair-elect and Secretary: Amita Kaundal selected if she is designated as a member of the group; Brandon Miller would accept role if Amita Kaundal cannot serve.

--- Participants delivered research reports from their states.

--- Meeting adjourned @ 3:30 pm MST.

Collaborative Accomplishments, Impacts, and Outcomes

WERA-1013's tradition of collaborations among participants has continued this year, despite restrictions resulting from the global pandemic. Collaborations are closely linked to the groups two objectives.

Objective 1: Establish a regional system for the development, evaluation, and introduction of new native plant materials

Members of the group traveled to the Mount Charleston area in southern Nevada, where germplasm from plants adapted to harsh environments was collected. Identification of such germplasm is important as members of the group work together to assess newly collected taxa for their potential as marketable introductions to horticultural commerce. Planning is underway

among members for such work to expand regionally. Several members of WERA-1013 collaborated this year on a proposal to acquire funding overcome barriers to increased use of native plants in managed landscapes. The proposed outcomes of the project are to enhance the competitiveness of the commercial native plant market through research to improve native plant propagation and production success and through increased access and awareness of the value of native plants to landscape sustainability. This collaboration will include WERA-1013 members from Nevada, Colorado, Idaho, Utah, and Texas. The team will take annual field trips to collect propagules from candidate plants, propagation and production research to determine effective protocols, field trials within each state to clarify the range and define the parameters to determine an appropriate market, and outreach to increase awareness of native plant landscape benefits. Ultimately, a regional system for ongoing development of novel native climate-adapted plant products will result, supporting water conservation across arid West. Separately, members of the group are in early stages of discussions on collaborations focused on mitigation of local and regional urban heat islands.

Objective 2: Coordinate regional efforts to provide education to both public and industry professionals on native plant use, propagation, and production

Members of WERA-1013 from North Dakota and Minnesota have partnered to share educational programming on native plants, leading to greater impacts on clients in industry and the general public than would be the case if each state catered only to those within its borders. The WERA-1013 website, which includes content from numerous members of WERA-1013, continues to provide factual information on plants native to the western United States. Utah State University delivered 7 presentations and published 8 conference abstracts and 6 peer-reviewed papers on Native Plants Journal, HortScience, or HortTechnology, jointly with the University of Idaho or the University of Nevada. North Dakota State University Extension, in a collaboration with the University of Minnesota, has an active pollinator education program that educates the public, Master Gardeners, and the nursery industry on the use of native perennial plants to nourish pollinators. These pollinator gardens/meadows totaled 131,542 square feet in both North Dakota and Minnesota. In the past year, 33 individuals or institutions across the two states qualified for a free pollinator garden sign, indicating that an area was transitioned to a pollinator garden.

State-level Accomplishments

Nevada

-----Built a web page where we can update our native plant demonstration garden species and educational activities at <https://extension.unr.edu/master-gardeners/program.aspx?ID=105>

-----Finished two new Native Plant Demonstration Gardens: one at Truckee Meadows Nature Study Area in Washoe County, NV and the other at the Elko County Extension office.

-----Beginning a collaboration with a local landscape architect to teach “Sustainable Landscape Design” and “Water Efficient Landscaping” to homeowners. This will be part of our new Water Efficient Landscaping for Homeowners workshop, which will be debuted in spring 2022. This workshop will include a class on how to incorporate native plants into the landscape.

Arizona

Installed experiment to determine irrigation needs of shrubs, including native shrubs, to determine the water needs of these plants and to promote low water use taxa in the arid Southwest. Plants are irrigated for establishment with three irrigation treatments to commence in spring of 2022.

Idaho

Acquisition of New Plant Material: Native plant collection activities are integral to the University of Idaho native plant domestication project. In spite of continuing University of Idaho COVID-19 travel restrictions, combined with historical western US drought conditions, a successful collection foray was planned and concluded to the Mount Charleston area in southern Nevada. Twenty-two accessions, primarily of woody species, were collected in the form of both seed and vegetative cuttings. Cuttings were transported to the Aberdeen R & E Center where they were stuck in pots for rooting and subsequent grow-out.

Evaluation and Selection of Native Plant Accessions: Evaluation of horticultural performance was continued on accessions established over the past 16 years at the Aberdeen R & E Center. Plots were exposed to environmental factors designed to enhance selection of adapted, drought-tolerant species. Drought stress was imposed by limiting applied irrigation water to approximately 30% of optimal requirement for a bluegrass lawn in SE Idaho. Plot-by-plot and sometimes plant-by-plant observations were recorded describing hardiness, soil and climate adaptation, mature appearance, flower color, bloom period, plant longevity, pest issues, and general horticultural value. Inferior species/accessions were systematically eliminated from evaluation plots.

Native Plant Seed Increases: Seed was harvested from superior accessions and used to establish parental plants within a seed increase block. Subsequently, seeds harvested from increase blocks are distributed via legal transfer to the University of Idaho's Native Roots, LLC industry partner. During the spring of 2021, we completed the process of transplanting accessions from our original increase blocks into a new site in order to improve block symmetry and renew vigor in the parental plants.

New Product Transfers: In the spring of 2021, 16 native plant accessions expressing superior market potential were legally transferred to Native Roots, LLC for establishment within their commercial-scale seed increase field. Transferred domesticated species products included:

Penstemon neotericus – Plumas County beardtongue

Heuchera parvifolia – Littleleaf alumroot

Hymenoxys lapidicola – Stone rubberweed

Scutellaria nana – Whitepine skullcap

Anaphalis margaritacea – Pearly everlasting

Arenaria fendleri – Fendler's sandwort

Artemisia ludoviciana – White sagebrush

Verbena macdougalii – MacDougal's verbena

Carex geyeri – Geyer's sedge

Carex hoodii – Hood's sedge

Carex pachystachya – Chamisso sedge
Holodiscus discolor – Ocean spray

Public Releases of Domesticated Native Plants: Due to COVID-19 induced negative elements in the market place, our Native Roots, LLC delayed public releases of new native plant products until the spring of 2022.

Wyoming

The WERA1013 Intermountain Native Plants web site moved to Utah State University in the spring of 2021. The new site address is <https://cwel.usu.edu/westernnativeplants/>. The email listserve is still hosted by the University of Wyoming. The University of Wyoming, however, continues to host the email listserve for the group.

Utah

--- Completed transferring the WERA-1013 Intermountain Native Plants web site from the University of Wyoming to Utah State University.

--- Acquisition of New Plant Material: Utah State University, in collaboration with the University of Idaho, made a plant collection trip to Desert National Wildlife Refuge, Las Vegas, NV. Twenty-four accessions of 13 native plant species were collected as cuttings and propagated using an intermittent mist system in a Utah Agricultural Experiment Station (UAES) research greenhouse on 14 June 2021. There were 17% to 88% of cuttings rooted, depending on plant species.

--- Evaluation, Selection, and Propagation of Native Plant Accessions:

- 1) Five native plant selections [*Asclepias tuberosa* (Butterfly weed), *Cercocarpus montanus* ‘Coy’ (true or alder-leaf mountain mahogany), *Hymenoxys acaulis* var. *arizonica* ‘Sol Dancer’ (‘Sol Dancer’ daisy), *Paxistima myrsinites* (mountain lover)] were transplanted at UAES Greenville Research Farm. In 2021, plants were irrigated when the cumulative evapotranspiration (ET₀), recorded using a Utah AgWeather Station (Utah Climate Center, Logan, UT), reached 0.90 inches. In 2022 and 2023, plants will be irrigated at 20%, 50%, or 80% ET₀ for 20 weeks from May to September. Plant visual quality, morphological and physiological parameters will be recorded monthly in 2022 and 2023.
- 2) Six native plants [*Amelanchier pumila* (dwarf serviceberry), *Arctostaphylos uva-ursi* (kinninnick), *Ceanothus velutinus* (snowbrush ceanothus), *Cercocarpus montanus* (alder-leaf mountain mahogany), *Cercocarpus montanus* ‘Coy’ (alder-leaf mountain mahogany) and *Shepherdia utahensis* ‘Torrey’ (hybrid buffaloberry)] are currently evaluated for salinity tolerance in a UAES research greenhouse.
- 3) Cutting propagation were conducted for six species native to the western United States, including *Acer grandidentatum* (bigtooth maple), *Ceanothus prostrata* (pinemat), *Cercocarpus montanus* ‘Coy’ (alder-leaf mountain mahogany), *Cercocarpus ledifolius* var. *intricatus* ‘Double Dawn’ (little leaf mountain mahogany), *Cercocarpus ledifolius* var. *intricatus* ‘Hoodoo’ (little leaf mountain mahogany), and *Paxistima myrsinites* (mountain lover).

- 4) 650 grafts were made to propagate *Pinus monophylla* (single-needle pinyon pine) with *Pinus edulis* (double-needle pinyon pine) as the rootstock. These plants will be transplanted in UAES Blue Creek Research Farm and a private farm land in Washington County, UT.

--- Utah State University delivered 7 presentations and published 8 conference abstracts and 6 peer-reviewed papers on Native Plants Journal, HortScience, or HortTechnology, jointly with the University of Idaho or the University of Nevada.

--- New Product Transfers: four new releases produced at Utah State University have been licensed for Cache Valley Nursery (Hyrum, UT) to propagate, grow, sell, and distribute them in the United States and Canada. They are *Cercocarpus montanus* ‘Coy’ (alder-leaf mountain mahogany), *Cercocarpus ledifolius* var. *intricatus* ‘Double Dawn’ (little leaf mountain mahogany), *Cercocarpus ledifolius* var. *intricatus* ‘Hoodoo’ (little leaf mountain mahogany), and *Shepherdia utahensis* ‘Torrey’ (hybrid buffaloberry).

North Dakota

NDSU Extension has an active pollinator education program where we educate the public, Master Gardeners and the nursery industry on the use of native perennial plants to nourish pollinators. As part of the program, gardeners, farmers, and institutions can apply for a free “Certified Pollinator Garden” sign through the Extension Master Gardener Program if they plant new pollinator gardens/meadows or if they retrofit existing gardens to be pollinator-friendly. The use of native plants are strongly encouraged. In the past year, 33 individuals or institutions qualified for a free pollinator garden sign. These pollinator gardens/meadows totaled 131,542 square feet in both North Dakota and Minnesota

Hawaii

Public releases of native Hawaiian plant selections: Germplasm release manuscripts of *Jacquemontia sandwicensis* ‘Puhala Bay’ and *Peperomia sandwicensis* ‘Palikea’ were published in HortScience. ‘Puhala Bay’ is a *Jacquemontia sandwicensis* selection suitable for hanging baskets and as a ground cover. ‘Palikea’ is a *Peperomia sandwicensis* selection for use as a desk plant for indoor spaces. Cuttings of these selections are available for interested nurseries in Hawaii.

Native indoor plant selection: A selection of *Peperomia mauiensis* was grown for six months under three light levels to evaluate its potential use as an indoor plant. Survival of the species under high, office and low light conditions was high.

Micropropagation of *Peperomia sandwicensis*: A selection of *Peperomia sandwicensis* possessing larger and variegated leaves compared with ‘Palikea’ has been put in sterile culture in 2018. It has been subcultured several times to produce microcuttings. Studies on acclimatization and rooting of microcuttings are on-going. Indoor light tolerance studies will be conducted later this year.

Colorado

In 2021, Plant Select® introduced three plants and promoted an additional two plants. Penstemon strictus 'PWWGO6S' Blanca Peak® Rocky Mountain Penstemon was one introduction that provided a 3 to 4 week eye catching display of white tubular flowers in late spring. It is long lived and native to higher elevations of AZ, CO, NM, UT and WY. Antirrhinum sempervirens 'PO2OS' (Drew's Folly™ Hardy Snapdragon). This hardy perennial, flowers quite heavily when in full bloom that the foliage is completely masked. Pink blooms in late May into June and will thrive in a wide range of soil types and dryer conditions and requires little maintenance. Helichrysum trilineatum 'PO21S' (SteppeSuns® Hokubetsi). This plant is native in the Malati mountain range of South Africa. SteppeSuns® Hokubetsi is a selection that forms a rounded, dense, silver shrub with clusters of bright yellow strawflowers. This clone is adaptable and tolerates extremes in temperatures, water, and soil types.

Two woody plants were promoted in 2021 that were introduced in previous years. They include Viburnum burejaeticum 'PO17S' (Mini Man™ dwarf Manchurian viburnum) which is a compact form of Manchurian viburnum that has clusters of white flowers in Spring followed by persistent red to black fruit. The other woody plant repromoted was Acer tataricum 'GarAnn' 'PP15023' (Hot Wings® Tatarion Maple). The scarlet red samaras against the dark green foliage is a major feature on this plant in mid to late summer. Plant is adaptable to alkaline soil and will grow in full sun or part shade.

Due to COVID, no new plant explorations happened in 2021 but Plant Select® is working on a plant exchange with Argentina and some seed has arrived from this exchange and is being germinated and grown at Denver Botanic Gardens and hopefully in 2022 will be evaluated at several sites in Colorado in the future.

In 2021, greenhouse experiments continued with Lavendula angustifolia 'Wee One' and with Sideritis syriaca. Two different media and two fertilizers at two rates were evaluated on these two taxa. With Lavendula more cuttings were produced when grown in Berger BMG and fertilized with 14-14-14 or 20-10-20 at either 100 or 200 ppm.

With Sideritis syriaca more cuttings were produced from stock, plants grown in Berger BMG with little differences observed from different fertilizers and rates. Rooting was often 100 % successful after 4 weeks under mist.

Some initial propagation research was started looking at a Verbascum 'Letitia' propagation by leaf cuttings. We found best rooting and subsequent plantlet development occurred when petiole bases were dipped in 1:19 Dip 'N Grow Solution for 30 seconds and stuck in Pinstrup Blond Gold 5-20+ TRIANUM

Also in 2021, studies continued to determine photoperiod response for Sideritis syriaca and Scutellaria scordifolia. No reproductive tissue was observed with Sideritis after six weeks of the different light treatments. With Scutellaria reproductive tissue was observed in 14 hour dark and 10 hours light treatment along with control but not in the 16 hour dark 8 hours light treatment.

Also in 2021, six woody plants were planted at three of our research sites throughout Colorado. Species planted included: Various Quercus hybrids and Foresteria neomexicana 'Silver Satin'.

We continue to evaluate woody plants at three sites for a five-year period. *Shepherdia* 'Totem' is an upright form that has done well in all of the trials and Plant Select® hopes to introduce this clone to the public in 2023.

California

We continue to evaluate native plant groundcovers at The University of California Agricultural Operations Experiment Station, located in Riverside, CA. This research has been conducted as a team, with Extension Specialists, Donald Merhaut of the Department of Botany and Plant Sciences and Amir Haghverdi of the Department of Environmental Sciences. Two Ph.D. graduate students are also actively involved in this project. The groundcovers are being studied for drought tolerance, heat tolerance, aesthetics and reflected heat load. Currently, the three native plants in this trial include:

Baccharis 'Starn Thompson', which is a hybrid of two species, *sarothroides* and *pilularis*. *Baccharis sarothroides* is native to the deserts of southwestern North America and *B. pilularis* is native to the coastal regions of western North America from Mexico to Oregon. This hybrid produces no seeds and has a more prostrate growth habit.

Oenothera stubbei is native to southwestern North America.

Eriogonum fasciculatum 'Warriner Lytle', a native of southwestern North America in northern Mexico and into California. This cultivar was introduced by the Theodore Payne Foundation.

Activities

Nevada

-----Taught "Native Plants of Nevada" for our Beginning Master Gardener training (177 participants), August 29.

-----Webinar for GreenACT Nevada on "Native Pollinator Plants and Why They're Important," (36 participants), May 20.

-----Held a workshop and native plant giveaway event "Using Native Plants to Attract Pollinators and Other Beneficial Insects," (36 participants), April 17.

-----Completed two educational YouTube videos; currently working to make them bilingual:

Pollinator Protection: Things you can do to protect local native pollinators.

Pollinator Health: Planting native plants to attract and provide for native pollinators.

Arizona

Determined suitable shrub species to be tested at the University of Arizona Campus Agriculture Center with input from five university collaborators in the Western United States and nursery industry collaborators.

Idaho

Research activities include achievement of native plant domestication using methods developed specifically for this purpose: collection from wild populations, field establishment, evaluation, cyclical mass selection, and industry transfer.

Extension activities include demonstration of native plant efficacy in public gardens and educational events for professionals and the general public on topics related to native plant landscaping and water-conserving landscape design.

Utah

--- Collected twenty-four accessions of 13 native plant species in the middle of June 2021 and propagated them in a UAES research greenhouse.

--- Transplanted five native plant selections [*Asclepias tuberosa* (Butterfly weed), *Cercocarpus montanus* 'Coy' (true or alder-leaf mountain mahogany), *Hymenoxys acaulis* var. *arizonica* 'Sol Dancer' ('Sol Dancer' daisy), *Paxistima myrsinites* (mountain lover)] for deficit irrigation trials at UAES Greenville Research Farm.

--- Currently evaluating six native plants [*Amelanchier pumila* (dwarf serviceberry), *Arctostaphylos uva-ursi* (kinninnick), *Ceanothus velutinus* (snowbrush ceanothus), *Cercocarpus montanus* (alder-leaf mountain mahogany), *Cercocarpus montanus* 'Coy' (alder-leaf mountain mahogany) and *Shepherdia utahensis* 'Torrey' (hybrid buffaloberry)] for salinity tolerance in a UAES research greenhouse.

--- Evaluated the timing for cutting collection, different rooting hormones, types of cuttings (terminal and stem cuttings) for cutting propagation of *Cercocarpus montanus* (alder-leaf mountain mahogany).

--- Grafted 650 *Pinus monophylla* (single-needle pinyon pine) onto *Pinus edulis* (double-needle pinyon pine).

--- Disseminated research results at local, regional, and national conferences.

Colorado

In 2021, Plant Select® celebrated its 24th anniversary and held our annual meeting in person in June 2021 at Denver Botanic Gardens. Over 150 persons attended and heard speakers and took tours showcasing Plant Select plants. Virtual presentations were given at the 2021 ProGreen Conference along with virtual talks about Plant Select at state and national conferences. A Bring on the Heat Program was conducted at many garden centers throughout the region. Memorial Day weekend promoting the 2021 and 2022 Plant Select® introductions and recommendations.

North Dakota

The Extension Horticulturist delivered eight presentations either in person or via Zoom on planting native perennial pollinator plants and grasses. These presentations reached 682 gardeners and green industry personnel.

Hawaii

Peperomia mauiensis plant giveaway and consumer survey: In December 2020, a *Peperomia mauiensis* plant giveaway and consumer survey was conducted at the Maui Nui Botanical Garden in Kahului. Forty-three Maui residents participated in the plant giveaway and survey. Results of the initial survey indicated the following: 1) 41 respondents recommend buying the plant/are willing to buy it; 2) when asked about pricing, majority of respondents said they are willing to pay \$5 for a plant in a 3 inch ceramic pot and \$3-5 for a plant in a 3 inch plastic pot; 3) almost all are interested in buying more potted native plants and 4) almost all respondents are willing to buy more native plants if there is a greater variety available. Survey results six months after receiving the plant are currently being summarized.

California

Research and extension activities continue regarding the evaluation of groundcovers, looking at drought and heat tolerance and heat loads emitted from plant material. Heat loads have been evaluated to explore the possibility of selecting native plants to mitigate the heat-island effect in urban environments.

Short-term Outcomes

Nevada

Education on the value of native plants for pollinator protection and landscape water efficiency was provide to master gardeners, nursery workers, landscapers, and landscape architects.

Arizona

Establish irrigation needs of shrubs by exposing different taxa to three irrigation regimes (20, 50, and 80% of local reference evapotranspiration). Evaluation of growth, aesthetic performance, and resistance to abiotic and biotic stressors will determine which shrubs species are low input and low water use. Green industry professionals and anyone planting shrubs will gain specific knowledge about water use of the plants tested and their performance in arid landscapes of the Southwest.

Idaho

The foremost outcome for the Idaho native plant domestication research/education project is development of new and improved native plant products for potential use by the western U.S. landscape nursery industry. Including the twelve species transferred to Native Roots, LLC in 2021, a total of 213 products have been released. Fifty-six of these species are being actively marketed. Native Roots, LLC continues to create partnerships with production, wholesale, and retail nurseries in several Rocky Mountain states to expand the market for these products.

An important secondary outcome is improved consumer understanding of the value of native plant in increasing landscape sustainability, inclusive of water-conservation, urban habitat creation, and native pollinator support. In 2021, educational information was delivered through web sites, workshops, and field days. Due to COVID-19 restrictions, a greater percentage of

educational events were delivered digitally. Greater awareness of the value of drought tolerant native plants is demonstrated by increasing demand for native plants in the retail marketplace.

Wyoming

Since the web site was moved to Utah State University, we do not have data on activity on the site. We do know that, according to Google Analytics, activity on the native plants web site was 4,301 pageviews, in FY20; unique pageviews for FY20 were 3,157. The page with the most views was the plantlist (784 or 18.2%), with the plant page *Zinnia grandiflora* receiving the most views (141 or 3.3%).

Utah

--- The development of new and improved native plant products for landscape use by the green industry in Utah and the Intermountain West.

--- Four selected/domesticated accessions were licensed to Cache Valley Nursery, Hyrum, UT, in May, 2021, bringing the total number of product transfers to 8 (Sego Supreme™ Plant Introduction Program). Pineae Greenhouses and Takao Nursery continues to create partnerships with production, wholesale, and retail nurseries in several western states to expand the market for these products. As of June 30, 2021, a total of 21,339 SeGo Supreme™ plants (*Tetrandeum acaulis* var. *arizonica*, *Epilobium canum* subsp. *Garrettii*, *Penstemon platyphyllus*, and *Salvia dorrii* var. *clokeyi*) were sold.

--- Research results and publications increased knowledge about whole plant responses to water stresses, the reliability and adaptability of native plants in water-efficient landscapes, and propagation techniques of native plants. Research results are delivered through peer-reviewed publications, and local, regional, and national conferences. As a result, citizens of Utah and the greater western U.S. have a greater awareness of the value of native plants, indicated by ever-increasing demands, requests, and inquiries for native plants.

Colorado

In 2021, more than 2,663,000 million Plant Select® plants were sold and grown from grower members of Plant Select® with most growers in the Rocky Mountain and Intermountain Region. This shows a continual growth over a nine-year period from 1.7 million in 2012. These plants were purchased by many garden centers and landscape contractors throughout Colorado and used by many landscape contractors throughout Colorado and landscape management personnel throughout the WERA 1013 region. Many homeowners have planted these plants throughout the region and are now more satisfied gardeners.

Demonstration gardens throughout Colorado, Idaho, Montana, Utah and Wyoming have reported back to Plant Select® on plant performance in these different states. Public education continued throughout 2020 with many virtual talks but in 2021 many were again face to face.

Texas

-----Education on the potential damage of crapemyrtle bark scale on plants including native American beautyberry was provided to Master Gardeners, Nursery Workers, Landscapers, and Landscape Architects.

-----Protocols on how to propagate two native *Vaccinium* species were published.

North Dakota

Education on the value of native plants for pollinator habitat was provided to the gardening public and to the green industry.

Hawaii

- Increased knowledge in propagation and ornamental uses of *Jacquemontia sandwicensis* and *Peperomia sandwicensis*.
- Increased knowledge on indoor light tolerance of *Peperomia mauiensis*.
- Increased knowledge on consumer preferences on native Hawaiian plants

California

The major outcome of this project includes educating the landscape industry and the Master Gardeners on the adaptive nature of native plants and the aesthetic characteristics of some native plant species. This research is one of the few projects in California that is evaluating native plants alongside non-native plants. Preliminary results of this research have also been presented at the Annual Conference of the American Society for Horticultural Sciences (ASHS).

Outputs

Idaho

Delivered drought tolerant-plant materials to the nursery industry, distributed via a partnership agreement with the Native Roots, LLC. Other outputs involve extension programming, including a web presence and contributions to workshops, field days, and conferences aimed at education on topics related to water-conserving landscape practices.

Nevada

Native plant demonstration gardens are being used as an onsite adjunct to education regarding native plant benefits.

Arizona

Planted 15 species of shrubs at the Campus Agricultural Center in Tucson, AZ through the spring of 2021 and irrigated plants to promote establishment.

Wyoming

Work continues on adding new plant descriptions to the web site.

Utah

--- Four new releases are under preparation for Cache Valley Nursery (Hyrum, UT) to propagate, grow, sell, and distribute them in the United States and Canada.

--- Peer-reviewed papers, conference abstracts (presentations), extension publications, and trade news have been published on HortScience, HortTechnology, Native Plants Journal, and Bulletin of the American Penstemon Society.

North Dakota

A new Master Gardener Pollinator Demonstration Garden was installed in Bismarck, ND.

Texas

----Recordings of our crapemyrtle bark scale presentations are available at [Chat with Green Aggies - YouTube](#).

----Protocols on how to propagate two native *Vaccinium* species could help producers effectively propagate these two species.

Hawaii

- Two new selections of native Hawaiian plants have been released.
- Information about the two new selections was made available to stakeholders (e.g. fellow researchers, nursery and landscape industry, landscape architects and the public) via two open access journal articles and an article in the Hawaii Landscape magazine
- One selection of *Peperomia mauiensis* have been evaluated under three indoor light levels
- Respondents (43) were surveyed about native plants and given *Peperomia mauiensis* plants.

Colorado

A promotional brochure was developed in 2021 introducing three new plants and promoting two other past introductions from Plant Select®. Other outputs include our monthly newsletter with over 5,279 readership and with adding more YouTube videos connected with our monthly newsletter. Our marketing program explains how Plant Select® helps one plant smarter and is a collaborative model.

California

Due to the pandemic, all outputs have been accomplished through zoom meetings, both for the UC Master Gardener Program and the conference at ASHS.

Milestones

Arizona

Installation and establishment of species are on track with irrigation treatments scheduled to start in spring 2022.

Idaho

The prominent milestone for the Idaho native plant domestication project is delivery of valuable and publicly acceptable plant products. In spite of restrictions imposed by COVID-19, development and transfer of new products progressed at a near-typical pace. The exception being a delay in public release of new native plant products.

A secondary milestone is effective delivery of educational materials on native plant topics, delivered through annual field days, demonstration gardens, instructional publications, workshops and conferences, and social media. This milestone was achieved in 2021, although, educational delivery systems were modified due to essential COVID-19 social distancing protocols.

Wyoming

The web site move to Utah State University has already occurred.

Utah

Delivery of four potentially valuable and publicly acceptable plant products to Cache Valley Nursery, Hyrum, UT. A secondary milestone is effective delivery of native plant utilization information through presentations at local, regional, and national conferences and peer-reviewed publications.

A Utah Department of Agriculture and Food (UDAF) Specialty Crop Block Grant has been awarded to develop *Ceanothus velutinus* for specialty crop production. A USDA grant has been awarded to determine the potential of *Acer grandidentatum* (bigtooth maple), *Acer platanoides* (Norway maple), and *Acer negundo* (boxelder) for maple syrup production.

Texas

----- Increasing our knowledge and understanding of crapemyrtle bark scale infestation and potential damage on native American beautyberry and native ecosystems.

----- Increasing our knowledge on how to propagate two native *Vaccinium* species.

Colorado

In 2021 we were able to hold a hybrid annual meeting in June 2021 with over 150 in attendance face to face and many more virtually. We were able to hold a 'Bring on the Heat' event in garden

centers throughout the region the last weekend in May introducing to the public the 2021 + 2022 Plant Select® introductions and recommendations.

California

The major milestones of this research are determining the drought tolerance and adaption of native plants to urban landscapes. Secondly, understanding the effects of plant material on heat-island effects in urban landscapes is being elucidated.

Impact Statements

Nevada

Increasing stakeholders' knowledge of which native plant species can thrive, and attract and/or support a diversity of pollinators and other beneficial insects will contribute to conservation of pollinator habitat, facilitate landscape water conservation, and add to the tools available for effective management of plant pests, while minimizing overuse of chemical pesticides.

Idaho

The ultimate impacts of the Idaho native plant domestication project will be the water conservation, urban habitat creation, and native pollinator support that results from public acceptance and utilization of attractive, adapted, drought-tolerant native plants.

Wyoming

The web site will be a source of useful information for native plant enthusiasts in the Rocky Mountain west.

Utah

--- Growers will increase their production of these cultivars and the general public will increase their purchase and use of these materials in their own landscapes.

--- Increasing the knowledge about whole plant responses to water stress and improving vegetative propagation of native plants will allow us to promote the use of stress-tolerant plants for water conservation and native plants for water-efficient landscaping.

--- The Utah native plant selection and introduction projects will ultimately help water conservation and improved environmental stewardship through public acceptance of adapted, drought-resilient and/or salt-tolerant plants and water-efficient landscaping practices.

North Dakota

Since 2016, the NDSU Extension Master Gardener Program has certified 172 pollinator gardens/meadows totaling 4.6 million square feet.

Texas

----- Increasing stakeholders' knowledge on how to manage crapemyrtle bark scale infestation and minimize potential damage on native American beautyberry and native ecosystems.
----- Potentially providing suitable blueberry rootstock for high pH soils and a landscape plant with great fall color.

Hawaii

Increasing availability and knowledge on native Hawaiian plants can help increase usage in urban landscaping. This in turn, can help educate the public and increase awareness on the importance of conserving native plants.

Colorado

In 2021 despite the pandemic we were still able to have several face to face meetings and met more individually with city planners to utilize more Plant Select® plants in median plantings and homeowner associations. This is showing the public how this style of gardening can save water and still create beautiful and functional gardens. However, the greatest impact is the water conservation by planting these native and Plant Select® plants.

California

The primary impacts of this research have been the determination of native plant material that can mitigate water use in landscapes. More importantly, this research is elucidating the impact of plant material on the mitigation of the heat-island effects in urban landscapes.

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