DWARF YELLOW FLEABANE

Erigeron chrysopsidis A. Gray
Asteraceae – Aster family

Corey L. Gucker & Nancy L. Shaw | 2019

ORGANIZATION

NOMENCLATURE

Erigeron chrysopsidis A. Gray is commonly referred to as dwarf yellow fleabane. This species belongs to the Disparipili section, Conyzinae subtribe, Astereae tribe within the Asteraceae family (Nesom 2008). Nomenclature for subtaxa and synonyms follows Nesom (1992a; 2006).

NRCS Plant Code. ERCH4 (USDA NRCS 2017).

Subtaxa. *Erigeron chrysopsidis* A. Gray var. *austinieae* (Greene) G.L. Nesom, *E. c.* var. *brevifolius* Piper, and *E. c.* var. *chrysopsidis*.

Synonyms. *Chrysopsis hirtella* DC, *E. austiniae* Greene, *E. chrysopsidis* subsp. *austiniae* (Greene) Cronquist.

Common Names. Dwarf yellow fleabane and golden daisy (Nesom 2006; Rhodes et al. 2010).

Chromosome Number. Chromosome number is 2n = 18 (Solbrig et al. 1969; Cronquist et al. 1994; Nesom 2006).

Hybridization. Intermediates between varieties *austiniae* and *chrysopsidis* are found in northern Malheur County, Oregon, and northwestern Owyhee County, Idaho, where their ranges overlap (Nesom 1992a, 2006). Intergrading also occurs between varieties *brevifolius* and *chrysopsidis*, but rarely, as their populations only overlap near 6,000 feet (1,800 m) elevation in the Wallowa Mountains of the same county in Oregon (Nesom 1992a).

DISTRIBUTION

Dwarf yellow fleabane frequently occurs in Washington, Oregon, California, Idaho, and Nevada (Fig. 1; Nesom 1992a, 2006). Variety *austiniae* is the most widely distributed, occurring in southeastern Oregon, northeastern California, southwestern Idaho, and in Elko, Eureka, Humbolt, and Washoe counties in Nevada (Nesom 1992b). Variety *chrysopsidis* occurs at mid- to low-elevation sites from southeastern Washington to

southeastern Oregon (Nesom 1992a; Hitchcock and Cronquist 2018). Variety *brevifolius* is restricted to upper elevation sites in the Wallowa Mountains in the northeastern corner of Oregon (Nesom 1992a, 2006). Because of its limited distribution, variety *brevifolius* is considered a conservation concern (Nesom 2006).

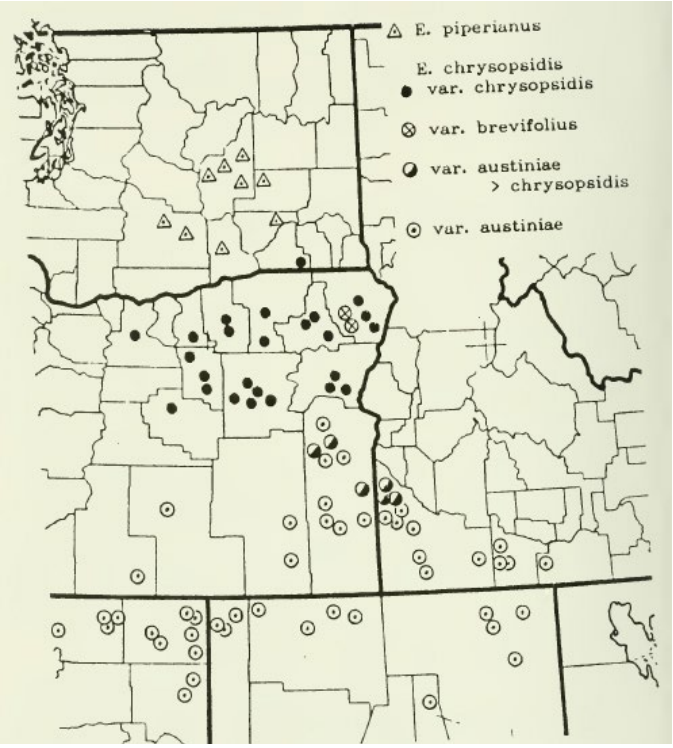

Figure 2. Distribution of dwarf yellow fleabane varieties and a relative, Piper's fleabane (*Erigeron piperianus*). Figure from (Nesom 1992a).

Habitat and Plant Associations. Dwarf yellow fleabane occupies dry, gravelly and rocky, open sites often with bunchgrasses (Idaho fescue [*Festuca idahoensis*], bluebunch wheatgrass [*Pseudoroegneria spicata*]) and sagebrush (*Artemisia* spp.), but it is also associated with juniper (*Juniperus* spp.), ponderosa pine (*Pinus ponderosa*), and alpine communities (Leckenby and Toweill 1983; Cronquist et al. 1994; Nesom 2006). Varieties *austiniae* and *chrysopsidis* are typically associated with dry, lower elevation communities of sagebrush and juniper, whereas variety *breviolius* is associated with rocky slopes and cliffs of alpine slopes and summits (Nesom 2006).

Dwarf yellow fleabane occurs on shallow, rocky basalt soils in the Zumwalt Prairie in Wallowa County, Oregon, which occupies elevations of 3,490 to 5,510 feet (1,060-1,680 m). Winters there are cold and moist; summers are very warm and dry; and annual precipitation averages about 19 inches (490 mm) (Bartuszevige et al. 2012). In south-central Oregon, dwarf yellow fleabane is common in western juniper/mountain big sagebrush (*J. occidentalis*/*A. tridentata* subsp. *vaseyana*) communities (Leckenby and Toweill 1983). In the Blue and Ochoco mountains of eastern Oregon, fleabanes (*Erigeron* spp.) are frequent in the understory of curl-leaf mountain mahogany (*Cercocarpus ledifolius*), antelope bitterbrush (*Purshia tridentata*)-big sagebrush (*A. tridentata*), mountain big sagebrush, and little sagebrush (*A. arbuscula*) shrublands and ponderosa pine/antelope bitterbrush woodlands (Johnson and Swanson 2005). In northeastern Nevada, dwarf yellow fleabane was reported as occurring in the seedbanks of 2 of 17 big sagebrush sites and in the aboveground vegetation of 3 of 17 sites (Barga and Leger 2018).

Elevation. The species ranges from elevations of 2,600 to 8,500 feet (800-2,600 m) (Cronquist et al. 1994; Nesom 2006). Variety *austiniae* occurs at elevations of 3,900 to 6,600 feet (1,200-2,000 m). The elevation range of variety *brevifolius* is 5,900 to 10,500 feet (1,800-2,300 m) and variety *chrysopsidis* from 2,600 to 8,500 feet (800-2,600 m) (Nesom 1992a, 2006).

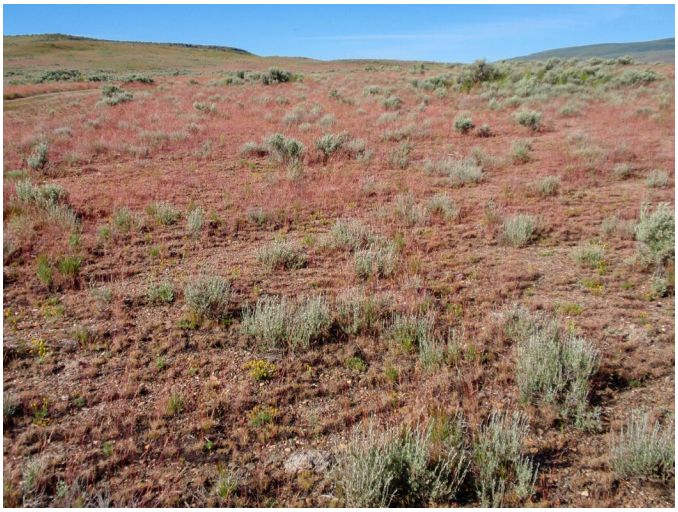

Figure 2. Dwarf yellow fleabane growing in sagebrush habitat in Oregon. Photo: USDI BLM OR030 Seeds of Success (SOS).

DESCRIPTION

Dwarf yellow fleabane is a perennial forb with a slender taproot and short, branched caudex. Stems are often erect, 1 to 6 inches (3-15 cm) tall with long spreading hairs or short hairs (Cronquist 1947; Cronquist et al. 1994; Nesom 2006; Hitchcock and Cronquist 2018). All or most leaves

are in basal tufts, or there may be a few reduced stem leaves (Cronquist 1947; Cronquist et al. 1994; Nesom 2006). Leaves are entire, narrow and linear, and up to 3.5 inches (9 cm) long and 3 mm wide (Cronquist 1947; Nesom 2006). Leaves are often very hairy with spreading hairs of mixed of uniform lengths (Cronquist et al. 1994). The bases of lower leaves are often enlarged and whitish (Cronquist 1947; Nesom 2006). Plants produce just one flower head per stem. Flower heads are comprised of both yellow ray and disk florets, but ray flowers may or may not have ligules (Cronquist 1947; Nesom 2006). Involucres typically measure 4 to 7.5 mm high and 0.9 to 1.7 mm wide (Cronquist 1947; Nesom 2006). Disk florets are bisexual and fertile. Flower heads contain 20 to 60 ray florets, which are pistillate and fertile (Nesom 2006). Disk florets measure 4 to 4.5 mm long, and ray florets when they have ligules can be up to 11 mm in length (Cronquist et al. 1994; Nesom 2006). Dwarf yellow fleabane produces a cypsela or dry, single-seeded fruit, which is 2-nerved, hairy, and has an outer pappus of few, slender, inconspicuous bristles and an inner pappus of 15 to 25 bristles (Cronquist 1947; Cronquist et al. 1994; Nesom 2006).

Distinguishing Varieties. Dwarf yellow fleabane varieties are morphologically distinguished by their pubescence and flowers. Varieties can also often be distinguished by their distributions, which have little overlap in area and elevation. See earlier Distribution and Elevation sections.

Figure 3. *Erigeron chrysopsidis* var. *austiniae*. Photo: Steve Matson, 2006, hosted by CalPhotos.

Variety *austiniae* produces stems with spreading hairs of essentially equal lengths (Nesom 1992a, 2006). Involucres are 4.5 to 6 mm high. Ligules of ray florets are either absent or scarcely or failing to exceed the involucre or disk florets. Disk corollas measure 3.5 to 4.5 mm long (Nesom 2006; Hitchcock and Cronquist 2018). Numerous collections of variety *austiniae* in northwestern Owyhee County, Idaho, and northern Malheur County, Oregon, produced short ligules (1-3 mm or rarely 4 mm long), but elsewhere in the range of variety *austiniae* production of even tiny ligules is rare (Nesom 1992a). Variety *austiniae* can also be confused with rayless shaggy fleabane (*E. aphanactis*) where their distributions overlap (R. Johnson, Brigham Young University, personal communication, June 2019).

Variety *brevifolius* grows to 1.6 to 2.4 inches (4-6 cm) tall (Piper 1900). Stems have appressed to spreading hairs of even or uneven lengths and are leafless for about 75 to 90% of their total length (Piper 1900; Nesom 2006; Hitchcock and Cronquist 2018). Involucres measure 3.5 to 5.5 mm high with 20 to 50 ray florets with ligules measuring up to 7 mm long and surpassing the involucre. Disk corollas measure 2.5 to 4.5 mm long (Nesom 2006; Hitchcock and Cronquist 2018). Variety *brevifolius* is in every way smaller than the other varieties (Piper 1900).

Variety *chrysopsidis* produces stems with spreading hairs of mostly uniform lengths (Nesom 1992a; Hitchcock and Cronquist 2018). Flower heads are relatively large with involucres of 5 to 7.5 mm long. Ray florets have well-developed, conspicuous ligules measuring up to 11 mm long and surpassing the involucre. Disk corollas are 3 to 4.5 mm long (Nesom 1992a, 2006; Hitchcock and Cronquist 2018).

Reproduction. Dwarf yellow fleabane reproduces from seed. Throughout the species range, flowers are most common from May through July, although they may be present as late as August (Nesom 1992b, 2006). Self-compatibility or self-incompatibility of flowers was not reported, but fleabanes attract pollinators (James and Nunnallee 2011) and are recommended in plantings to encourage pollinators (Ogle et al. 2011).

ECOLOGY

Dwarf yellow fleabane occupies dry, gravelly or rocky, open sites in shrubland and woodland communities (Leckenby and Toweill 1983; Cronquist et al. 1994; Nesom 2006), which suggests an ability to colonize sites opened by disturbances, but few ecological studies were available.

Post-fire recovery of dwarf yellow fleabane may depend on fire season or fire severity. After an August fire in Wyoming big sagebrush (*A. tridentata* subsp. *wyomingensis*) in southeastern Oregon, dwarf yellow fleabane was considered a "severely impacted" species. Cover of dwarf yellow fleabane on burned plots was 80% or lower than that of pre-fire and unburned reference areas for up to 4 years after fire. The August fire removed all Wyoming big sagebrush, and density of yellow rabbitbrush (*Chrysothamnus viscidiflorus*) resprouts was low in the first post-fire year (Bates et al. 2007). Dwarf yellow fleabane was just "slightly reduced" by a fall prescribed fire in Wyoming big sagebrush on the Northern Great Basin Experimental Range near Burns, Oregon. Cover of dwarf yellow fleabane was 50 to 90% of that of pre-fire values within 3 years of burning. The prescribed fire killed 92% of Wyoming big sagebrush plants (Bates et al. 2011). Frequency of dwarf yellow fleabane was slightly greater on burned than control plots in the first post-fire year following a fall prescribed fire in Wyoming big sagebrush in south-central Oregon. The prescribed fire consumed about 80% of the understory. Frequency of dwarf yellow fleabane was 0% on both control and pre-burn plots. In 1998, frequency of dwarf yellow fleabane was 12% on control and 4% on 1-year old burned plots (Wrobleski 1999).

Wildlife and Livestock Use. Dwarf yellow fleabane is consumed by a variety of wildlife species. At the Starkey Experimental Forest in the Blue Mountains of northeastern Oregon, dwarf yellow fleabane was considered unpalatable but made up nearly 4% of the summer diet composition of elk (*Cervus elaphus*) (Stewart et al. 2011). In central Washington, least chipmunks (*Tamius minimus* subsp. *scrutator*) fed heavily on dwarf yellow fleabane in the spring and summer. From specimens in big sagebrush/mixed bunchgrass communities in Kittitas County, the mean relative frequency of dwarf yellow fleabane was 16% in stomachs collected in June and 4% in stomachs collected in July. Dwarf yellow fleabane along with Pacific lupine (*Lupinus lepidus*) were the most highly preferred forbs in June (Hall 1969). Dwarf yellow fleabane is also utilized by greater sage-grouse (*Centrocercus urophasianus*) (Rhodes et al. 2010).

REVEGETATION USE

Use of dwarf yellow fleabane in revegetation was not reported in the literature, but its use by wildlife (Hall 1969; Rhodes et al. 2010; Stewart et al. 2011) suggests it may be a useful component of native seed restoration mixes.

DEVELOPING A SEED SUPPLY

For restoration to be successful, the right seed needs to be planted in the right place at the right time. Coordinated planning and cooperation is required among partners to first select appropriate species and seed sources and then properly collect, grow, certify, clean, store, and distribute seed for restoration (PCA 2015).

Developing a seed supply begins with collecting seed from native stands. Collection sites are determined by current or projected revegetation requirements and goals. Production of nursery stock requires less seed than large-scale seeding operations, which may require establishment of agricultural seed production fields. Regardless of the size and complexity of any revegetation effort, seed certification is essential for tracking seed origin from collection through use.

Seed Sourcing. Because empirical seed zones are not currently available for dwarf yellow fleabane, generalized provisional seed zones developed by Bower et al. (2014), may be used to select and deploy seed sources. These provisional seed zones identify areas of climatic similarity with comparable winter minimum temperature and aridity (annual heat:moisture index). In Figure 4, Omernik Level III Ecoregions (Omernik 1987) overlay the provisional seeds zones to identify climatically similar but ecologically different areas. For site-specific disturbance regimes and restoration objectives, seed collection locations within a seed zone and ecoregion may be further limited by elevation, soil type, or other factors.

The Western Wildland Environmental Threat Assessment Center's (USFS WWETAC 2017) Threat and Resource Mapping (TRM) Seed Zone application provides links to interactive mapping features useful for seed collection and deployment planning. The Seedlot Selection Tool (Howe et al. 2017) can also guide restoration planning, seed collection, and seed deployment, particularly when addressing climate change considerations.

Releases. As of 2019, there were no dwarf yellow fleabane germplasm releases.

Wildland Seed Collection. Details about wildland seed collection were limited in the literature, though some harvesting clues are provided in plant photographs taken by the USDI BLM Seeds of Success (SOS) field collection crews. Seeds of individual plants mature over a period of about a week. Seeds are adapted for wind dispersal (Fig. 5) suggesting that population monitoring and revisiting sites is necessary to maximize harvests.

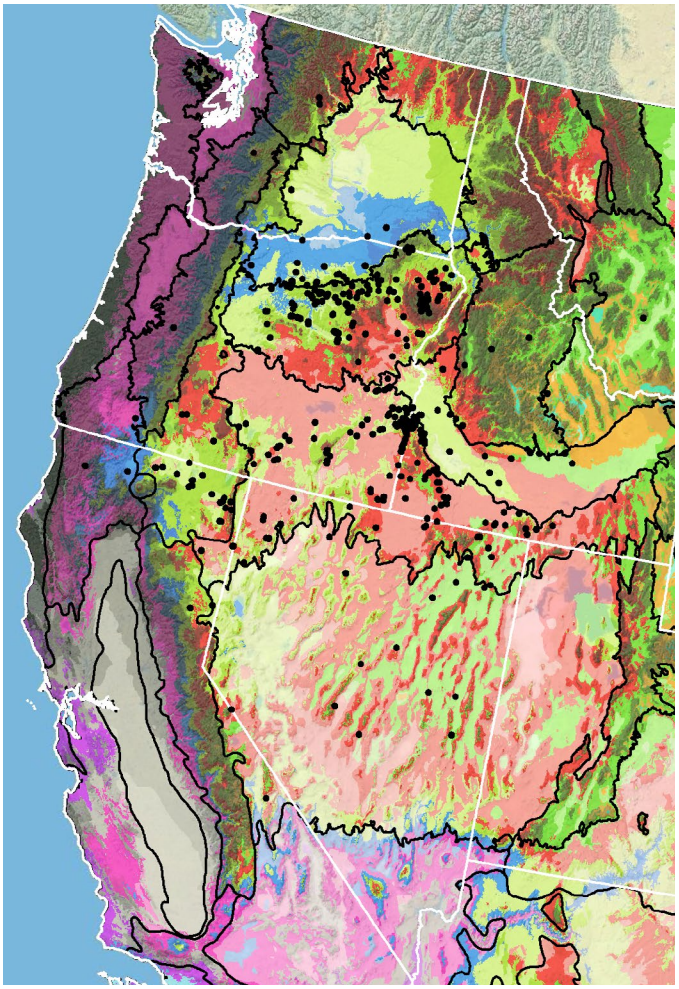

Figure 4. Distribution of dwarf yellow fleabane (black circles) based on geo-referenced herbarium specimens and observational data from 1881-2016 (CPNWH 2017; SEINet 2017; USDI USGS 2017). Generalized provisional seed zones (colored regions) (Bower et al. 2014) are overlain by Omernik Level III Ecoregions (black outlines) (Omernik 1987; USDI EPA 2018). Interactive maps, legends, and a mobile app are available (USFS WWETAC 2017; www.fs.fed.us/wwetac/threat-map/TRMSeedZoneMapper2.php?). Map prepared by M. Fisk, USDI USGS.

Seed Cleaning. Seed cleaning procedures used by the Bend Seed Extractory for lots less than 5 lb (2,270 g) were as follows (K. Harriman, U.S. Forest Service, personal communication, April 2019). Desert yellow fleabane seed (Fig. 7) would first be sieved to remove non-seed plant material. For very small seed lots, the pappus can be removed by hand-rubbing, while larger seed lots would be put through a Missoula de-winger to remove the pappus. The seed lot is then sieved again to remove any material smaller than the seeds and then processed through a continuous seed blower. If inert material remains that differs in shape or size of the seed, the lot would then be processed through a clipper seed cleaner and sieved again, if necessary (K. Harriman, U.S. Forest Service, personal communication, April 2019).

Figure 5. Dwarf yellow fleabane plant just beginning to produce seed. Photo: USDI BLM ORO30 SOS.

Figure 6. *Erigeron chrysopsidis* var. *austiniae* seed head. Photo: Steve Matson, 2006, hosted by CalPhotos.

Wildland seed certification. Wildland seed collected for direct sale or for establishment of agricultural seed production fields should be Source Identified through the Association of Official Seed Certifying Agencies (AOSCA) Pre-Variety Germplasm Program that verifies and tracks seed origin (Young et al. 2003; UCIA

2015). For seed that will be sold directly for use in revegetation, collectors must apply for certification prior to making collections. Applications and site inspections are handled by the state where collections will be made. Details of the collection site and procedures are required for seed that will be used for planting agricultural seed fields or nursery propagation. Seed collected by most public and private agencies following established protocols may enter the certification process directly without certification agency site inspections when protocols include collection of all data required for Source Identified certification (see Agricultural Seed Field Certification section). Wildland seed collectors should become acquainted with state certification agency procedures, regulations, and deadlines in the states where they collect. Permits or permission from public or private land owners are required for all collections.

Collection timing. Wildland seed collection sites will need to be scouted starting in May, which is when dwarf yellow fleabane begins to flower. Flowering can continue into August, although this is rare (Nesom 2006). The single reported dwarf yellow fleabane seed collection by the BLM Seeds of Success field crews was harvested on June 21, 2011 from a 4,240-foot (1,290 m) site in Malheur County, Oregon (USDI BLM SOS 2017).

Collection methods. Wildland dwarf yellow fleabane seed could be harvested by hand stripping or plucking the seed heads (Fig. 6).

Several collection guidelines and methods should be followed to maximize the genetic diversity of wildland collections: collect seed from a minimum of 50 randomly selected plants; collect from widely separated individuals throughout a population without favoring the most robust or avoiding small stature plants; and collect from all microsites including habitat edges (Basey et al. 2015). General collecting recommendations and guidelines are provided in online manuals (e.g. ENSCONET 2015; USDI BLM SOS 2016). As is the case with wildland collection of many forbs, care must be taken to avoid inadvertent collection of weedy species, particularly those that produce seeds similar in shape and size to those of dwarf yellow fleabane.

Post-collection management. Although not specifically discussed in the literature, post-collection management of dwarf yellow fleabane seed likely requires attention similar to that of most wildland seed. Seed should be dried thoroughly before storing and if insects are suspected, insect strips can be used or seed can be stored at low temperatures to prevent substantial loss to insect damage.

Figure 7. Dwarf yellow fleabane seed collected from native stands in Oregon. Photo: USDI BLM ORO30 SOS.

Seed Storage. Dwarf yellow fleabane is orthodox. After 47 days of storage at 15% relative humidity and -4 °F (-20 °C), seeds retained 100% viability (RGB Kew 2017).

Seed Testing. Seed viability is tested using the general procedures described for other Asteraceae genera as no specific AOSA procedure exists for dwarf yellow fleabane (AOSA 2010). There is no AOSA rule for testing germination or purity of dwarf yellow fleabane, but there is one for germination of aspen fleabane (*Erigeron speciosus*) seed, which may provide a good starting point. Purity standards are also listed for aspen fleabane (AOSA 2016).

Germination. There were no germination studies on dwarf yellow fleabane seed, but Young and Young (1986) suggest that seed from fleabane species requires light to germinate. Germination of the related Piper's daisy (*E. piperianus*) was examined by Link et al. (2015) who collected seed in June, stored it at room temperature, and germinated it by burying the seed just below the surface in a greenhouse. Germination success was 50 ± 8%.

Wildland Seed Yield and Quality. Post-cleaning seed yield and quality was reported for a single dwarf yellow fleabane seed lot collected in Oregon (USFS BSE 2017). The USFS Bend Seed Extractory received 0.05 lb of wildland collected seed. Clean weight was 0.008 lb, for a cleanout ratio of 0.16. There were 1,440,000 seeds/lb (3,174,603/kg). Purity was 95%, fill was 99%, viability was 96%, and pure live seed (PLS) was 1,354,320 lbs (2,985,714/kg). These results suggest that dwarf yellow fleabane seed is tiny and can be cleaned to high level of purity and fill. Viability of fresh seed can be high as well (USFS BSE 2017).

Marketing Standards. Acceptable seed purity, viability, and germination specifications vary with revegetation plans. Purity needs are highest for precision seeding equipment used in nurseries, while some rangeland seeding equipment handles less clean seed quite well.

AGRICULTURAL SEED PRODUCTION

There was no research on growing dwarf yellow fleabane for seed increase in the available literature. See other species reviews or chapters here: aspen fleabane (*E. speciosus*) and desert yellow fleabane (*E. linearis*) for more on Agricultural Seed Production and Wildland Seeding and Planting.

Agricultural Seed Certification. It is essential to maintain and track the genetic identity and purity of native seed produced in seed fields. Tracking is done through seed certification processes and procedures. State seed certification offices administer the Pre-Variety Germplasm (PVG) Program for native field certification for native plants, which tracks geographic source, genetic purity, and isolation from field production through seed cleaning, testing, and labeling for commercial sales (Young et al. 2003; UCIA 2015). Growers should plant certified seed (see Wildland Seed Certification section) and apply for certification of their production fields prior to planting. The systematic and sequential tracking through the certification process requires pre-planning, understanding state regulations and deadlines, and is most smoothly navigated by working closely with state certification agency personnel.

NURSERY PRACTICE

Growth of dwarf yellow fleabane in the greenhouse or outdoor nursery setting was not described in the literature but is likely similar to Piper's daisy. Growth of Piper's daisy in a greenhouse by Link et al. (2015) involved sowing seed in 164-ml cone-tainers filled with 46% potting soil containing a slow-release fertilizer, 46% sand, 4% perlite, and 4% vermiculite. Growth temperatures were controlled at about 80 °F (27 °C) day and 61 °F (16 °C) night. Irrigation was automated to optimize germination and growth with more irrigation during seed germination and less during growth. Plants were fertilized using 20N:20P_2O_5:20K_2O (10-ml solid dissolved in 7.6 l of water).

WILDLAND SEEDING AND PLANTING

Use of dwarf yellow fleabane in revegetation or restoration was not reported in the literature but may respond similar to Piper's daisy. Link et al. (2015) reported on establishing Piper's daisy. After planting in the winter and by the spring of the second growing season, survivorship had dropped to 21%, but summer seed production occurred on 99% of remaining plants, resulting in 121 new plants in the summer of the third growing season.

Dwarf yellow fleabane naturally occurs on dry, gravelly or rocky, open sites and tolerates shallow basalt soils in sagebrush, juniper, ponderosa pine, and alpine communities (Leckenby and Toweill 1983; Cronquist et al. 1994; Nesom 2006; Bartuszevige et al. 2012). For more information on the habitats where dwarf yellow fleabane and specific varieties could be used in revegetation efforts, see earlier Distribution, Plant and Habitat Associations, and Elevation sections.

ACKNOWLEDGEMENTS

Funding for *Western Forbs: Biology, Ecology, and Use in Restoration* was provided by the USDI BLM Great Basin Native Plant Materials Ecoregional Program through the Great Basin Fire Science Exchange. Great thanks to the chapter reviewers: Steven Link, Native Plant Landscaping and Restoration and Robert Johnson, Brigham Young University.

LITERATURE CITED

Association of Official Seed Analysts [AOSA]. 2010. AOSA/SCST Tetrazolium testing handbook. Contribution No. 29. Lincoln, NE: Association of Official Seed Analysts.

Association of Official Seed Analysts [AOSA]. 2016. AOSA rules for testing seeds. Vol. 1. Principles and procedures. Washington, DC: Association of Official Seed Analysts.

Barga, S.; Leger, E.A. 2018. Shrub cover and fire history predict seed bank composition in Great Basin shrublands. Journal of Arid Environments. 154: 40-50.

Bartuszevige, A.M.; Kennedy, P.L.; Taylor, R.V. 2012. Sixty-seven years of landscape change in the last, large remnant of the Pacific Northwest bunchgrass prairie. Natural Areas Journal. 32(2): 166-170.

Basey, A.C.; Fant, J.B.; Kramer, A.T. 2015. Producing native plant materials for restoration: 10 rules to collect and maintain genetic diversity. Native Plants Journal. 16(1): 37-53.

Bates, J.D.; Davies, K.W.; Sharp, R.N. 2007. Response of Wyoming big sagebrush communities to wildfire. In: Davies, K.W.; Nafus, A.M., eds. Sagebrush steppe - Research progress report 2007. Burns, OR: U.S. Department of Agriculture, Agricultural Research Service: 10-21.

Bates, J.D.; Rhodes, E.C.; Davies, K. 2011. Impacts of fire on sage-grouse habitat and diet resources. Natural Resources and Environmental Issues. 17(5): 1-17.

Bower, A.D.; St. Clair, J.B.; Erickson, V. 2014. Generalized provisional seed zones for native plants. Ecological Applications. 24(5): 913-919.

Consortium of Pacific Northwest Herbaria [CPNWH]. 2017. Seattle, WA: University of Washington Herbarium, Burke Museum of Natural History and Culture. http://www.pnwherbaria.org/index.php2017 [Accessed 2017 June 29].

Cronquist, A. 1947. Systematic treatment of the species: [*Erigeron latus-Erigeron basalticus*]. Brittonia. 6(2): 192-242.

Cronquist, A.; Holmgren, A.H.; Holmgren, N.H.; Reveal, J.L.; Holmgren, P.K. 1994. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Volume 5: Asterales. Bronx, NY: The New York Botanic Garden. 496 p.

European Native Seed Conservation Network [ENSCONET]. 2009. ENSCONET seed collecting manual for wild species. Edition 1: 32 p.

Hall, G.L. 1969. Habitat and food habits of *Eutamias minimus scrutator* in the semi-desert regions of central Washington. Ellensburg, WA: Central Washington State College. Thesis. 60 p.

Hitchcock, C.L.; Cronquist, A. 2018. Flora of the Pacific Northwest: An illustrated manual. Second Edition. Seattle, WA: University of Washington Press. 882 p.

Howe, G.; St. Clair, B.; Bachelet, D. 2017. Seedlot Selection Tool. Corvallis, OR: Conservation Biology Institute. https://seedlotselectiontool.org/sst/ [2017 Accessed June 29].

James, D.G.; Nunnallee, D. 2011. Life histories of Cascadia butterflies. Corvallis, OR: Oregon State University Press. 447 p.

Johnson, C.G.; Swanson, D.K. 2005. Bunchgrass plant communities of the Blue and Ochoco mountains: A guide for managers. Gen. Tech. Rep. PNW-GTR-641. Portland, OR: U.S. Department of Agriculture, U.S. Forest Service, Pacific Northwest Research Station. 119 p.

Leckenby, D.A.; Toweill, D.E. 1983. Response of forage species seeded for mule deer in western juniper types of south-central Oregon. Journal of Range Management. 36(1): 98-103.

Link, S.O.; Cruz, R.O. 2015. Establishment of Piper's daisy (*Erigeron piperianus*) in the shrub-steppe of south-central Washington. Native Plants Journal. 16(2): 107-116.

Nesom, G.L. 1992a. Taxonomic notes on *Erigeron* (Asteraceae: Astereae) of California, Nevada, and Arizona. Phytologia. 73(3): 186-202.

Nesom, G.L. 1992b. *Erigeron* and *Trimorpha* (Asteraceae: Astereae) of Nevada. Phytologia. 7(3): 203-219.

Nesom, G.L. 2006. 186. *Erigeron*. In: Flora of North America Editorial Committee, ed. Flora of North America North of Mexico. Volume 20 Magnoliophyta: Asteridae, part 7: Asteraceae, part 2 Asterales, part 2 (Aster order). New York, NY: Oxford University Press: 256-348.

Nesom, G.L. 2008. Classification of subtribe Conyzinae (Asteraceae: Astereae). Lundellia. 11(8): 8-38.

Ogle, D.; Pavek, P.; Fleenor, R.; Stannard, M.; Dring, T.; Cane, J.; Fullen, K.; St. John, L.; Tilley, D. 2011. Plants for pollinators in the Inland Northwest. Boise, ID: U.S. Department of Agriculture, Natural Resources Conservation Service. 65 p.

Omernik, J.M. 1987. Ecoregions of the conterminous United States. Map (scale 1:7,500,000). Annals of the Association of American Geographers. 77(1): 118-125.

Piper, C.V. 1900. New and noteworthy northwestern plants - IV. Bulletin of the Torrey Botanical Club. 27(7): 392-401.

Plant Conservation Alliance [PCA]. 2015. National seed strategy for rehabilitation and restoration 2015-2020. Washington, DC: U.S. Department of Interior, Bureau of Land Management. 52 p.

Rhodes, E.C.; Bates, J.D.; Sharp, R.N.; Davies, K.W. 2010. Fire effects on cover and dietary resources of sage-grouse habitat. The Journal of Wildlife Management. 74(4): 755-764.

Royal Botanic Gardens, Kew [RBG Kew]. 2017. Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ [Accessed 2019 February 1].

SEINet–Regional Networks of North American Herbaria Steering Committee [SEINet]. 2017. SEINet Regional Networks of North American Herbaria. https://Symbiota.org/docs/seinet [Accessed 2017 June 16].

Solbrig, O.T.; Anderson, L.C.; Kyhos, D.W.; Raven, P.H. 1969. Chromosome numbers in Compositae VII: Astereae III. American Journal of Botany. 56(3): 348-353.

Stewart, K.M.; Bowyer, R.T.; Dick, B.L.; Kie, J.G. 2011. Effects of density dependence on diet composition of North American elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*): An experimental manipulation. Wildlife Biology. 17(4): 417-430.

USDA Forest Service, Bend Seed Extractory [USFS BSE]. 2017. Nursery Management Information System Version 4.1.11. Local Source Report 34-Source Received. Bend, OR: U.S. Department of Agriculture, Forest Service, Bend Seed Extractory.

USDA Forest Service, Western Wildland Environmental Threat Assessment Center [USFS WWETAC]. 2017. TRM Seed Zone Applications. Prineville, OR: U.S. Department of Agriculture, Forest Service, Western Wildland Environmental Threat Assessment Center. https://www.fs.fed.us/wwetac/threat-map/TRMSeedZoneMapper.php [Accessed 2017 June 29].

USDA Natural Resources Conservation Service [USDA NRCS]. 2017. The PLANTS Database. Greensboro, NC: U.S. Department of Agriculture, Natural Resources Conservation Service, National Plant Data Team. https://plants.usda.gov/java [Accessed 2019 February 1].

USDI Bureau of Land Management, Seeds of Success [USDI BLM SOS]. 2016. Bureau of Land Management technical protocol for the collection, study, and conservation of seeds from native plant species for Seeds of Success. Washington, DC: USDI Bureau of Land Management. 37 p.

USDI Bureau of Land Management, Seeds of Success [USDI BLM SOS]. 2017. Seeds of Success collection data. Washington, DC: U.S. Department of the Interior, Bureau of Land Management, Plant Conservation Program.

USDI Environmental Protection Agency [USDI EPA]. 2018. Ecoregions. Washington, DC: U.S. Environmental Protection Agency. https://www.epa.gov/eco-research/ecoregions [Accessed 2018 January 23].

USDI Geological Survey [USGS]. 2017. Biodiversity Information Serving Our Nation (BISON). U.S. Geological Survey. https://bison.usgs.gov/#home [Accessed 2017 June 29].

Utah Crop Improvement Association [UCIA]. 2015. How to be a seed connoisseur. Logan, UT: UCIA, Utah Department of Agriculture and Food, Utah State University and Utah State Seed Laboratory. 16 p.

Wrobleski, D. 1999. Effects of prescribed fire on Wyoming big sagebrush communities: Implications for ecological restoration of sage grouse habitat. Corvallis, OR: Oregon State University. Thesis. 76 p.

Young, J.A.; Young, C.G. 1986. Collecting, processing and germinating seeds of wildland plants. Portland, OR: Timber Press. 236 p.

Young, S.A.; Schrumpf, B.; Amberson, E. 2003. The Association of Official Seed Certifying Agencies (AOSCA) native plant connection. Moline, IL: AOSCA. 9 p.

RESOURCES

AOSCA NATIVE PLANT CONNECTION
https://www.aosca.org/wp-content/uploads/Documents///AOSCANativePlantConnectionBrochure_AddressUpdated_27Mar2017.pdf

BLM SEED COLLECTION MANUAL
https://www.blm.gov/sites/blm.gov/files/programs_natural-resources_native-plant-communities_native-seed-development_collection_Technical%20Protocol.pdf

ENSCONET SEED COLLECTING MANUAL
https://www.publicgardens.org/resources/ensconet-seed-collecting-manual-wild-species

HOW TO BE A SEED CONNOISSEUR
http://www.utahcrop.org/wp-content/uploads/2015/08/How-to-be-a-seed-connoisseur20May2015.pdf

OMERNIK LEVEL III ECOREGIONS
https://www.epa.gov/eco-research/ecoregions

CLIMATE SMART RESTORATION TOOL
https://climaterestorationtool.org/csrt/

SEED ZONE MAPPER
https://www.fs.fed.us/wwetac/threat-map/TRMSeedZoneMapper.php

AUTHORS

Corey L. Gucker, Great Basin Fire Science Exchange Support
University of Nevada, Reno
Boise, ID | cgucker@unr.edu

Nancy L. Shaw, Research Botanist (Emeritus)
USDA Forest Service, Rocky Mountain Research Station
Boise, ID | nancylshaw@usda.gov

Gucker, Corey L.; Shaw Nancy L. 2019. Dwarf yellow fleabane (*Erigeron chrysopsidis*). In: Gucker, C.L.; Shaw, N.L., eds. Western forbs: Biology, ecology, and use in restoration. Reno, NV: Great Basin Fire Science Exchange. 9 p. Online: http://greatbasinfirescience.org/western-forbs-restoration

COLLABORATORS