Current and Potential Use of Broadleaf Herbs for Reestablishing Native Communities

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Abstract—Use of forbs for revegetation in the Intermountain West has been problematic due to the large number of species and lack of research data. Some forbs are found in numerous plant communities and distributed over wide geographic ranges while others are more narrowly adapted. Seed sources for revegetation use may be selected from species and ecotypes indigenous to the planting area. Management of local stands to improve seed production may be required to insure the availability of adequate quantities of seed. Alternatively, seed of an increasing number of commonly used species is being grown in agricultural settings with more reliable seed supplies resulting. Advances in wildland seeding methodology and forb seed production, harvesting, and conditioning technology have resulted from recent research and plant materials development programs.

Introduction

Shrublands of the Great Basin have undergone drastic changes since early settlement. Domestic livestock grazing and other human impacts, the spread of weedy annuals, and concurrent changes in fire frequency and intensity have reduced the diversity of sagebrush (*Artemisia* spp.) communities. Considerable effort has been directed toward revegetating disturbed rangelands. Seedings have generally been designed to increase forage production for livestock and, more recently, to re-establish native plant communities and wildlife habitat. Seed mixes have included various introduced and native grasses, forbs, and shrubs (Stevens 1983). Over the past 30 to 40 years most seed mixes were dominated by introduced grass species. These grasses were seeded because of their ease of establishment, forage production potential, ability to compete with invasive exotics, and their soil stabilization characteristics. In addition, the required quantities of seed were usually available. Plant materials development efforts over this period have gradually increased the number of native grass and forb species seeded and the amount of seed marketed. Research has also improved our understanding of secondary successional processes occurring when combinations of species are planted together (Walker and others 1995).

The use of native forbs in restoration has been limited due to a number of factors. These include the large number of forb species present in the Great Basin, our limited knowledge of seed production and seeding requirements for most species, the difficulty of harvesting forb seed from wildland stands, the highly unpredictable quality and quantity of wildland seed collections, and the frequently high cost of available seed. Overcoming these obstacles requires selection of accessions adapted to proposed planting areas, development of seed and seeding technology for each species, and establishment of seed production fields. In some situations, managing selected wildland stands to improve seed production may be a viable alternative when specific ecotypes are required for use over extensive areas. Both options require considerable time and effort for the development of reliable seed supplies.

Importance of Native Forbs

Native forbs are common and important components of most native plant communities of the Great Basin. Numerous species occur within this region, but most are not as widespread as the more common native grasses. Salt desert shrub and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) communities support fewer native forbs than more mesic shrubland communities. Forbs occasionally grow in pure stands, but more frequently they are found as associated species growing with grasses and other forbs in grasslands, or as understory species in shrub or tree communities. Individual species may be distributed over wide geographic ranges and occur in a variety of plant communities, or they may be narrowly distributed edaphic endemics. Some species exhibit considerable variability within and among populations (Shaw and Monsen 1983).

The addition of native forbs to revegetation projects contributes to the establishment of a more complex community and enriches the food supply for sagebrush-associated wildlife, such as mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), elk (*Cervus elaphus*), sage-grouse (*Centrocercus urophasianus*), sharp-tailed grouse (*Tympanuchus*

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phasianellus), blue grouse (*Dendragapus obscurus*), and small mammals. Native forbs play a number of roles in wildland seedings:

1. They increase community diversity, health, and resilience.
2. Pioneer forbs provide ground cover and soil stabilization on disturbed and unstable sites.
3. Leguminous forbs improve nitrogen availability.
4. Forbs reduce the ability of exotic species to enter the community.
5. Vegetative plant parts as well as fruits and seeds of individual forb species are often valuable seasonal food sources for specific organisms.
6. The fire resistance of seedings may be improved by the addition of forbs that remain green well into the summer.
7. Forbs improve the aesthetics of seeded disturbances and low maintenance landscaping projects.

Sage-Grouse Use of Forbs

Forb-rich sagebrush communities are vital to the survival of sage-grouse and other species that rely on the complex of vegetation and associated faunal components of the community. The importance of forbs in the survival of upland bird species is becoming better understood and is proving to be more important than previously thought. In spring, sage-grouse diets change from sagebrush-dominated to forb-dominated. Breeding habitats used by prelaying hens should provide a diversity of forbs high in calcium, phosphorus, and protein; the condition of these areas may greatly affect nest initiation rate, clutch size, and subsequent reproductive success (Barnett and Crawford 1994; Connelly and others 2000). Juvenile sage-grouse are dependent upon insects and succulent forbs as critical food sources after hatching and until brood dispersal in fall. Chicks follow the habitat use of the hens with broods and broodless hens (Barnett and Crawford 1994; Beck and Mitchell 1997; Braun and others 1977; Wallstead 1971).

Reestablishment of Native Forbs

Selection of Seed Sources

For seedings on rangeland sites, local seed sources of native forbs should be added to seed mixes of compatible grasses and shrubs. Where reestablishment of native communities is the goal, land managers may need to contract collection and increase of local seed to produce adequate supplies for the project site. Released forb varieties or prevariety releases are available for a few species (table 1). Seed supplies of released materials are generally produced in agricultural seed fields and sufficient quantities for major seedings may be available or can be produced under contract. The area of adaptation for these has been determined to varying degrees, and is described in the release documentation. Species and seed sources known to be competitive with invasive species must be used if weeds are expected to be a problem. The availability and cost of native forb seed remains the greatest obstacle to inclusion of these species in seeding mixes.

Seeding Mixes

Although forb species may make up only a small portion of the plant composition and cover in sagebrush habitats, they are extremely important in the diets of sage-grouse broods and many other vertebrate and invertebrate species. Consequently, it is important to provide forb diversity in seedings, even when species must be seeded at low densities or spot seeded in favorable areas. Established seedings should be managed to allow forb growth to continue through spring and summer, particularly in sage-grouse breeding habitat (Paige and Ritter 1999).

Seeding Techniques

Even the commonly seeded forbs represent a number of plant families and genera and, consequently, an array of fruit and seed types and sizes is represented. Successful seeding requires that seedings be conducted at the appropriate season, usually late fall in the Great Basin, in order that moist prechilling requirements be met. This permits seeds to germinate in early spring when soil moisture conditions are most likely to be favorable. Seed must be planted at the appropriate depth. Another consideration is the condition of the fruit or seed structure planted. Although some will flow well and are easily seeded, others tend to mat together and must be seeded in drill boxes with agitators. Broadcasting can generally be successfully accomplished if seeds are diluted with seeds of grasses and covered as necessary following seeding.

Relative competitive abilities and affecting factors are largely unknown for native forbs. Nevertheless, substantial anecdotal information on common species strongly suggests that forbs should be sown separately or with other species that are sown in low densities to minimize competition. Likewise, the ability of seeded forbs to compete with invasive species that may be present on the site must be considered. If site preparation practices are not adequate to control weeds, the use of scarce and valuable seed, or the seeding itself, should be reconsidered.

Like all seedings, those including native forbs should be protected from grazing until plants are fully established and managed carefully thereafter to prevent degradation of the seeding or decline or loss of individual species. Monitoring data can be used to evaluate seeding techniques and may suggest improvements for future seedings.

The Future of Native Forb Development

Native forb seed grown in agricultural fields or collected from wildland stands is currently available for some species (table 1). Supplies, however, remain limited and erratic. In the last several years, threats to Great Basin ecosystems have fostered efforts to develop plant materials and seed and seeding technology for native forbs considered priority species by land management agencies. Personnel at State and Federal laboratories are developing selections of individual

Table 1—Forb characteristics and releases[a].

Species	Ecological status[b]	Origin[c]	Longevity[d]	Adaptation: Soil	Adaptation: Annual precipitation	Seeds per pound	Planting requirements[e]	Expected seed quality at time of purchase: Viability	Expected seed quality at time of purchase: Purity	Releases	Market availability of seed[f]
					inches	*number*[g]		*percent*	*percent*		
Achillea millefolium Western yarrow	E/M	N	P	Loam to clay loam	8–26	2,124,000–4,124,000	B/D	85–90	20–90+	None	5
Agoseris glauca Pale agoseris	M/L	N	P	Moist, well drained	>10	560,000	B/D	20–50; variable	20–60	None	2
Antennaria rosea Rose pussytoes	M	N	P	Coarse textured, well drained	>12	6,000,000	B	20–50	20–60	None	1
Artemisia ludoviciana Louisiana sage	E/M/L	N	P	Sandy loam to clay loam	>10	2,495,000–2,500,000, 3,800,000	B/D	75–85	20–90	'Summit'	2
Aster chilensis Pacific aster	M/L	N	P	Coarse to clay loam	>10	2,600,000	B/D	80–90	20–90	None	2
Aster glaucodes Blueleaf aster	M	N	P	Loam to clay loam	12–16	540,000	B/D	80–90	20–90	None	2
Astragalus cicer Cicer milkvetch	M	I	P	Sandy loam to clay loam	>15	114,000–122,000, 130,000		95	95	'Lutana', 'Monarch' 'Windsor'	5
Balsamorhiza sagittata Arrowleaf balsamroot	L	N	P	Deep, well drained, coarse to medium textured	8–25	55,000	D	80–90	95–99	None	3
Coronilla varia Crownvetch	M	I	P	Coarse to medium textured, well drained, low fertility, low pH	>26	109,760, 138,160	D	75	95	'Emerald'	5
Crepis acuminata Tapertip hawksbeard	M/L	N	P	Sandy to coarse, gravelly soil	8–20	800,000		80–90	90	None	1
Eriogonum ovalifolium Oval-leaved eriogonum	M/L	N	P	Gravelly to sandy clay, well drained	10	120,000	D/B	90	95–98	None	1
Eriogonum umbellatum Sulfur eriogonum	M/L	N	P	Well drained, medium textured, slightly basic to neutral pH	8–18	120,000, 209,000, 300,000	D	90	95–98	'Sierra'	2
Hedysarum boreale Northern or Utah sweetvetch	M/L	N	P	Dry, often rocky soil; well drained sandy loam to basic, silty clay loam	12–18	33,585, 70,000, 86,000–96,700, 125,000	D	95	90	'Timp'	3
Helianthella uniflora Oneflower helianthella	M	N	P	Coarse, shallow, well drained	10–35	52,560–53,560, 267,000	B/D	60	75	None	1

(con.)

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					inches	*number*[g]		*percent*	*percent*		
Linum lewisii Lewis flax	M/L	N	P	Fine to coarse textured, well drained	10–24	278,000–422,325	B/D	90	95–99	'Appar'	5
Linum perenne Perennial flax	M	I	P	Fine to coarse textured, well drained	10–24	278,280	B/D	90	95–99	None	2
Lomatium dissectum Fern-leaved lomatium	M/L	N	P	Dry, rocky	>14	42,225, 134,000	D	60–85	85	None	1
Lomatium nudicaule Barestem lomatium	M	N	P	Sandy			B/D	60–85	85	None	1
Lomatium nuttallii Nuttall lomatium	M	N	P	Light to heavy textured, well drained, basic	13–16	42,200–42,225	D	60–80	90	None	1
Lomatium triternatum Nineleaf lomatium	M/L	N	P	Well drained or dry, rocky, acidic to basic	8–20	42,000, 100,000	D	70	75	None	2
Lupinus argenteus Silvery lupine	E/M	N	P	Fine to medium, coarse	>10	18,300, 126,000	D	95	90	None	2
Onobrychis viciifolia Sainfoin	M	I	P	Sandy loam to clay-loam	12–16	22,000–26,000	D	90–95	95–98	'Eski', 'Remont'	5
Penstemon acuminatus Sharpleaf penstemon	E/M	N	P	Dry, open, sandy areas, often in sand dunes	12–30	400,000, 592,379	B/D	84	95	None	1
Penstemon deustus Scabland penstemon	E/M	N	P	Basalt scabland, volcanic soils	10–18	400,000	B/D	90	95	None	1
Penstemon eatonii Eaton Penstemon	M	N	P	Well drained, rocky to sandy loam	8–16	350,000–400,000	B/D	90–95	95	Richfield Selected	4
Penstemon pachyphyllus Thickleaf beardtongue	E	N	P	Sandy or gravelly	12–16	336,000	B/D	70	95	None	1
Penstemon palmeri Palmer penstemon	E	N	P	Well drained gravelly to sandy loam	10–16	609,675–610,000, 294,000	B/D	85–90	95	'Cedar'	4
Penstemon speciosus Sagebrush penstemon	E/M	N	P	Coarse-textured soils	8–24	400,000, 481,544	B/D	66–97	95	None	1
Penstemon strictus Rocky Mountain penstemon	M	N	P	Silty clay loam to sandy loam	14–26	262,000, 400,000	B/D	85–90	95	'Bandera'	3
Phlox hoodii Spiny phlox	M/L	N	P	Heavy clay, silty, loamy, or coarse deep soils			B		60–80	None	1

(con.)

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					inches	*number*[g]		- - - - - *percent* - - - -			
Sanguisorba minor Small burnet	E/M	I	P	Well drained sandy loam to silty clay, basic loams	12-25	34,000–55,115	B/D	90	80–95+	'Delar'	5
Sphaeralcea coccinea Scarlet globemallow	M	N	P	Sandy loam to clay	6–35	500,000–500,660, 800,000	D	90	80–90 (with gravity table)	ARS-2936	3
Sphaeralcea grossulariaefolia Gooseberryleaf globemallow	E	N	P	Sandy loam to clay	8–14	500,000–500,660, 850,000	D	90	80–90 (with gravity table)	ARS-2892	3
Trifolium repens White clover	M	I	P	Moist, deep soils	>20	672,000–880,000	B/D	80	95	None	5
Vicia americana American vetch	L	N	P	Sandy, clayey, medium textured soils	>9	24,500–41,314	D	85–95	90–98	None	1
Viguiera multiflora Showy goldeneye	M	N	P	Sandy loam to clay loam	15–20	800,000, 1,054,885–1,055,000	B/D	40–60	90–95	None	2

[a] References: Dayton (1960); Davis and others (2002); Goodrich and Neese (1986); Hermann (1966); Hitchcock and Cronquist (1973); Johnson (1993); Jorgensen and Stevens (2004); Link (1993); Monsen (2000); Nold (1999); Plants for a Future (2004); Plummer and others (1968); Redente and others (1982); Rumbaugh (1983); Rumbaugh and others (1993); Shaw and Monsen (1983); Stevens and others (1996); Stevens and Monsen (1988); Stevens and others (1985); U.S. Department of Agriculture, Forest Service (1937, 2004); U.S. Department of Agriculture, Natural Resources Conservation Service (2004).
[b] Ecological status: E = Early seral, M = Mid seral, L = Late seral, I = Introduced, no status.
[c] Origin: N = Native, I = Introduced.
[d] Longevity: P = perennial, B = biennial.
[e] Planting: B = broadcast or aerially seed, D = drill seed.
[f] Market availability: 5 = Excellent, large quanties, 4 = Good, generally sufficient, 3 = Fair, some seed available, 2 = Limited, small quantities may be available, 1 = Very limited, seed not usually available except by contract harvesting.
[g] Literature values vary widely, possibly resulting from differences in seed cleaning practices and the structure considered the seed.

species. Additional research conducted by scientists at these agencies and at universities provides seed and seeding technology and seeding guidelines for selected species. Plant materials developed through these efforts are made available to private growers for increase and for commercial seed production. In some cases, USDA Forest Service, USDI Bureau of Land Management, and other State and Federal agencies have provided wildland seed collections directly to growers for contract production of local seed sources for specific projects. Private growers have also made source-identified seed collections from wildland sites and planted them in seed fields. The challenge now for public and private agencies is to set priorities for the seed needs by species and population to direct research efforts and provide some stability for seed producers attempting to contend with the wide annual fluctuations in postfire seedings as well as the funding available for revegetation projects.

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