

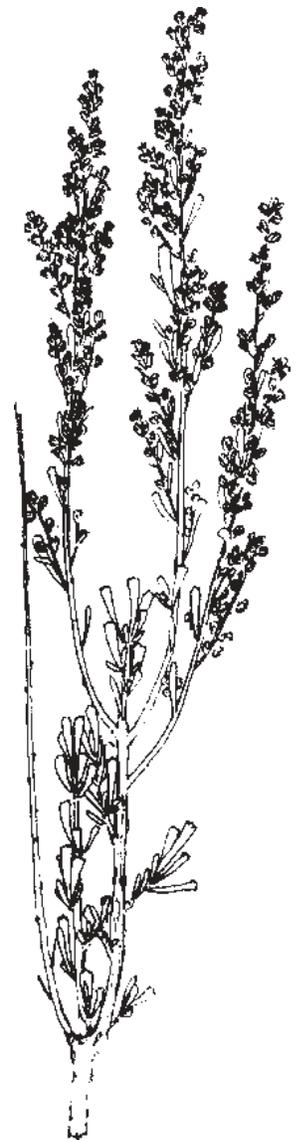
Chapter 28

Establishing Plants by Transplanting and Interseeding

Transplanting _____

Many shrubs, trees, forbs, and grasses can be successfully established to provide rapid, effective soil stabilization, forage, and cover through transplanting bareroot or container-grown stock, wildings, and stem cuttings (McArthur and others 1984a; Monsen 1974; Shaw 1981; Stevens 1980a, 1994; Tiedemann and others 1976).

Successful transplanting requires that strict procedures be followed. When transplanting by hand or when using a mechanical transplanter, general rules that need to be followed with wildings, bareroot or container-grown stock, and stem cuttings are: (1) never allow roots or stem ends to dry, (2) keep plants cool—do not allow them to overheat prior to planting, (3) plant during cool periods with adequate soil moisture, (4) compact soil around the roots at planting time, and (5) eliminate plant competition around the transplant (Ferguson and Monsen 1974; Penrose and Hansen 1981; Ryker 1976; Stevens 1981).



Transplanting during the most desirable period is essential. Within the Intermountain West, transplanting should generally be done in the spring when chances of frost heaving have passed, soil moisture is high, temperatures are low, and chance of rainfall is high.

Proper handling of plant materials can determine success or failure. Roots of bareroot stock can dry out with as little as 30 seconds exposure to air, particularly with wind or high ambient temperatures. Roots must be kept damp, and, if possible, cool at all times. Roots of container stock, once out of the container, will dry out but will tolerate longer periods of exposure than bareroot stock. Temperatures in plastic bags and cardboard boxes can be damaging or lethal, especially when containers are placed in direct sunlight for short periods of time.

Plants must be properly placed in the soil. Care should be taken to ensure that roots are placed vertical, with no "J" or "S" root configuration. Following proper plant placement, soil should be firmly compacted around the roots. All air pockets must be eliminated. Air pockets and loose soil can result in poor anchoring, dry roots, little or no uptake of water and nutrients, and death of the plant. Transplanting is most successful when soil moisture is high, ambient temperatures are low, and one or more storms (snow or rain) are expected within 5 weeks following transplanting. In central Utah, at 4,500 ft (1,370 m) elevation, transplanting projects completed before March 15 will most likely occur in moist soil and receive three to four storms within 4 to 5 weeks. At 6,000 ft (1,830 m) elevation, transplanting should be completed by April 1.

An important factor contributing to success is the selection of plants adapted to the planting site (Penrose and Hansen 1981; Rehfeldt and Hoff 1977; Stevens 1981). Selected species must be able to establish and maintain themselves. This does not mean that the wilding transplants, or seed source for nursery stock need to come from or near the proposed treatment area, but it does mean that they need to be adapted to the site.

Size of transplants can affect establishment success. Plant tops and roots can be too short or too long. In working with shrub transplants of various sizes, the most successful results were obtained with bareroot stock having roots from 6 to 12 inches (15 to 30 cm) long and tops at least 13 inches (33 cm) long (McKenzie and others 1980; Stevens 1979; Stevens and others 1981b) (fig. 1). Container-grown stock should have roots as long as the container.

Transplanting results can vary between species (Everett 1980; Ferguson and Monsen 1974; Stevens 1980a,b; Tiedemann and others 1976) (table 1). Most sagebrush (fig. 2) and rabbitbrush species, as well as

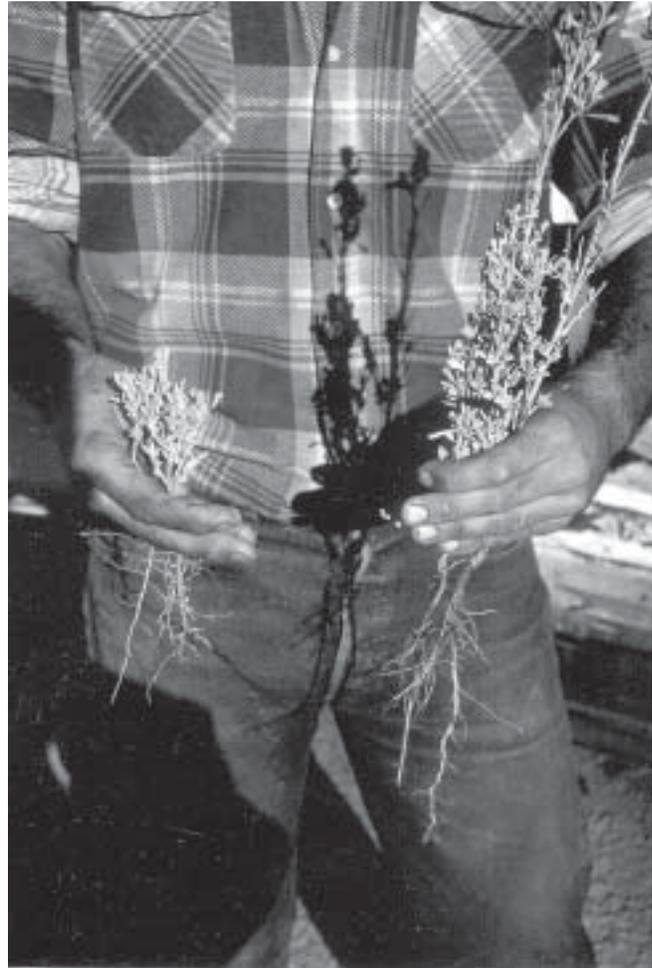


Figure 1—Wilding bareroot stock of basin big sagebrush (right) and Wyoming big sagebrush (left).

rhizomatous forbs and grasses transplant with good success (Stevens and others 1981b).

The success of shrubs and forbs transplanted into grass stands can be increased when planting is done on spots or in strips that have been sprayed with an effective herbicide, or on scalps that are wide and deep enough to remove competition during establishment, and that are effective water harvesters (fig. 3). However, scalping too deep can result in removal of the most fertile soil and reduced plant growth (Stevens 1985a).

A specially designed implement hitch has been developed (USDA Forest Service, Equipment Development Center, San Dimas, California Drawings No. RM 35-1 through 09) (McKenzie and others 1980) that will keep a transplanter at a constant depth, with balanced pressure on the compact wheels even on rough terrain. This hitch meets special requirements for transplanting (Moden and others 1978a).

Very successful shrub, forb, and grass transplanting can be rapidly accomplished using a heavily

Table 1—Expected success of establishment, using bareroot, container-grown, and stem-cutting planting stock^a.

Species	Bareroot and wilding stock	Container-grown stock	Stem cuttings
Shrubs			
Bitterbrush, antelope	6	4	
Bladdersenna	5	4	
Cliffrose	5	4	
Currant, golden	8	8	
Elderberry, blue	5	4	
Ephedra, green	4	1	
Greasewood, black	3	1	
Indian apple	5	4	
Kochia, forage	8	8	
Mountain mahogany, curleaf	5	2	
Mountain mahogany, true	5	2	
Oak, Gambel	5	2	
Rabbitbrush, low mountain	7	7	
Rabbitbrush, greenstem rubber	8	7	
Rabbitbrush, threadleaf rubber	8	7	
Rabbitbrush, whitestem rubber	8	7	
Rabbitbrush, spreading	10	10	
Rose, Woods	8	8	4
Sagebrush, basin big	10	10	
Sagebrush, mountain big	10	10	
Sagebrush, Wyoming big	8	8	
Sagebrush, black	10	10	
Sagebrush, silver	10	10	
Saltbush, fourwing	3	1	4
Serviceberry, Saskatoon	6	4	
Snowberry, mountain	9	9	3
Sumac, Rocky Mountain smooth	5		
Sumac, skunkbush	5		
Winterfat	6	2	
Wormwood, oldman		10	10
Forbs			
Alfalfa	6	8	
Aster, spp.	10	10	
Balsamroot, arrowleaf	1		
Balsamroot, cutleaf	1		
Bluebell	9		
Burnet, small	6	7	
Crownvetch	10	10	
Flax, Lewis	8	8	
Geranium spp.	3		
Globemallow, gooseberryleaf	8	8	
Globemallow, scarlet	8	8	
Goldeneye, showy	6	9	
Iris, German	10		
Lupine spp.	2	6	
Milkvetch, cicer	8	9	
Sagebrush, Louisiana	10	10	
Sainfoin	6	8	
Salsify	2	8	
Sweetanise	1		
Sweetvetch, Utah	5	8	
Yarrow, western	10	10	
Grasses			
Bunchgrasses	8	10	
Sod grasses	10	10	

^a10 = High percent of establishment can be expected when proper transplanting techniques are used.
 1 = Low percent of establishment can be expected, even when proper transplanting techniques are followed.



Figure 2—Three year old wildling transplants of Wyoming big sagebrush in a crested wheat-grass stand.

reinforced tree planter that requires hand placing of the transplants. Rate of planting bareroot stock, using a hand-fed transplanter, depends on soil conditions, species being transplanted, and condition of plants. Rates can vary from 600 to 1,100 per hour (Stevens and others 1981b). Most shrub and many grass and forb transplants cannot be planted successfully using an automatic pickup and planting system found on many modern tree planters. This is because most transplantable shrubs (fig. 1), and many forbs and grasses, have either wide-spreading, multiple branched, fibrous, or fairly long root systems that will tangle in the fingers and chains of the automatic planting device and subsequently are not placed properly in the soil.

A number of totally automatic transplanters have been developed that include the bandoleer concept



Figure 3—One year old wildling transplants, planted into an intermediate wheatgrass stand.

(Moden and Hansen 1980): the dribbler type (Moden and others 1978a), the steep-slope planter, and the dryland tubling planter (Larson 1980). These systems are designed to automatically transplant container stock grown in specially designed containers.

Many species of grasses, forbs, and shrubs are available as container-grown stock. Container-grown stock has several advantages over bareroot stock. Roots of container-grown stock are established in a growth medium, and plants are available when needed. Bareroot stock is not usually lifted until the frost is out of the soil, delaying the acquisition of planting stock in some years.

Bareroot stock has several advantages over container-grown stock. Bareroot stock, when properly planted, establishes quicker, generally has a higher rate of survival (Crofts and Parkin 1979), and is more evident because of increased plant size (Monsen 1980b; Stevens 1980a). Bareroot stock is generally older (1 to 3 years) (Stevens 1981) than is container stock (3 to 4 months) (Penrose and Hansen 1981), and has strong woody stems and root systems. Container-grown stock has generally been grown under forced conditions, resulting in young, sometimes weak, spindly plants. Bareroot transplants, especially wildings, are truly hardened, having been grown in the out-of-doors. Lack of bulky packaging and soil makes bareroot stock easier to handle, both on and off the planting site. Initial purchase price, transplant cost, and cost per established plant of container stock is greater than that of bareroot stock (Crofts 1980). Cost of bareroot nursery stock is generally low. The cost of wildings can be especially low; most sagebrushes, rabbitbrushes, winterfat, and some grasses and forbs, are locally abundant and require little expenditure and effort to obtain.

Interseeding

Within the Intermountain West, vast areas have been seeded with, and are dominated by crested and intermediate wheatgrass, and other perennial and annual grasses. Hundreds of thousands of acres are also dominated by unproductive shrub and forb communities.

Interseeding of useful shrubs, forbs, and grasses into less productive and single species communities can provide a means for improving animal habitat, forage production, forage quality, community diversity, and soil stability.

The addition of shrubs and forbs into grass communities can actually improve the nutritional quality of a range, especially during periods when grasses are dry (midsummer, fall, and winter), and crude protein value is generally low (Rumbaugh and others 1981; Van Epps and McKell 1978). A monotypic stand

of any one species is poor habitat for most wildlife. Transplanting and interseeding can increase vegetative diversity. As the diversity of a plant community increases, so does the diversity of bird, mammal, reptile, and insect life it can support (Reynolds 1980).

Interseeding has often been done to improve big game and livestock ranges by introducing shrubs and forbs (fig. 4) (Barnes and Nelson 1950; Monsen 1980a,b; Plummer and others 1968; Stevens and others 1981b) into otherwise less productive communities. Interseeding is an effective means for seeding desirable species into cheatgrass and tarweed stands (Arizona Interagency Range Technical Subcommittee 1969; Giunta and others 1975) and for improving native grass ranges (Derscheid and Rumbaugh 1970; Lang 1962; Nyren and others 1980; Rumbaugh and



Figure 4—(A) Four year old stand of alfalfa and bitterbrush, interseeded into cheatgrass. (B) Five year old interseeding of big sagebrush, alfalfa, forage kochia, and small burnet into intermediate wheatgrass.

others 1965). Interseeding can also be a means of reducing forage losses and plant death caused by insects and disease. When erosion hazards are high, when the preparation of a complete seedbed is impractical, or when the purpose of an improvement project is to modify rather than replace the present plant community, interseeding is an alternative to complete community destruction and seedbed preparation (Jordan 1981; Vallentine 1989).

To effectively interseed into existing vegetation, competitive plants within and near the seeding area need to be eliminated. Two effective means to remove competitive vegetation are scalping and herbicides. Removal methods have to: (1) be deep and wide enough to remove or kill all seeds, crowns, and rhizomes of competing vegetation; (2) allow for effective establishment of the seeded species before a reinvasion of competitive vegetation occurs; and (3) be of such a shape and size, when scalping or pitting is used, as to be effective water harvesters (Jordan 1981; Stevens and others 1981b).

Competitive vegetation can be killed in strips or spots with appropriate herbicides (Eckert 1979; Nyren and others 1980; Stevens 1985a). Fall drilling or broadcast seeding can then be done in the sprayed strips or spots. This technique has several advantages. It allows seeding to be done in the most fertile soil, and the litter that is left in place can protect seedlings from frost and heat, provide for retention and detention of surface water, and reduce evaporation.

Mechanical removal of competing vegetation has been done with various types of pitters and scalpers (Giunta and others 1975; Jordan 1981; Larson 1980; Monsen 1980a; Nyren and others 1978; Schumacher 1964; Stevens 1979; Vallentine 1989; Wright and others 1978) and with rototillers (Smoliak and Feldman 1978).

How wide the scalp or pit needs to be to eliminate competition depends on the vigor and type of existing vegetation, species being interseeded, and type of site being interseeded. Care must be taken to ensure that the most fertile soil is not eliminated by scalping too deep (Stevens 1985a). Drier sites require wider scalps because of increased competition for moisture. In arid areas, summer fallowing may even be required (Bement and others 1965). Scalps made on the contour, with cross dams, can catch and hold additional moisture from snow and rain (Branson and others 1962; Stevens 1978) and can enhance chances of seedling establishment and subsequent plant growth. In planting shrubs in cheatgrass, Giunta and others (1975) found that seedling establishment was superior in 24 inch (61.0 cm) wide scalps as opposed to 4, 8, and 16 inch (10.2, 20.3, and 40.6 cm) wide scalps. In the Northern Great Plains (Derscheid and Rumbaugh 1970) it was found that scalps 6 inches (15.2 cm) wide were sufficient for seeding alfalfa and cool season grasses into native sod. Russian wildrye interseeded

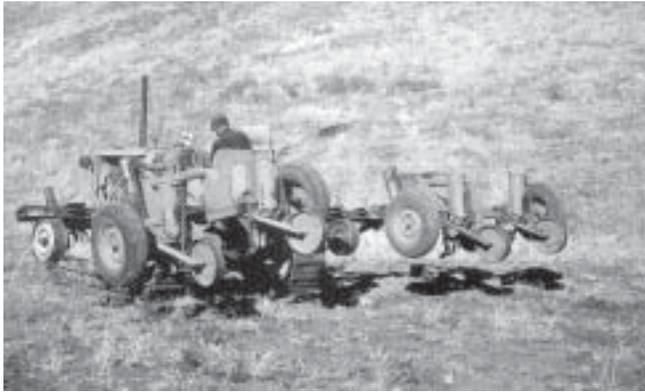


Figure 5—Four Hansen browse seeders being used to establish desirable shrubs and forbs in an annual grass community.



Figure 6—Wyoming big sagebrush seeded in conjunction with crested wheatgrass. Sagebrush was seeded separately through outside seed drops of a rangeland drill.

into native sod in Wyoming did not do well in scalps less than 18 inches (46 cm) wide (Rauzi and others 1965). When seeding native shrubs into crested wheatgrass, Van Epps and McKell (1978) found that the scalps should be at best 40 inches (100 cm) wide, with optimum spacing being 60 inches (150 cm). Seedling establishment varied in three scalp widths in intermediate wheatgrass. The widest scalps (30 inches [76 cm] wide and 9 inches [23 cm] deep) resulted in the most plants per linear foot (30 cm) of scalp. Established plants in the wider scalps were also the largest, and flowered sooner following seeding.

A number of seeding devices have been developed that can be used effectively in conjunction with various types of scalpers. The Hansen browse seeder has been used to establish desirable shrubs and forbs into single species stands (fig. 5). The thimble seeder and the seed dribbler (Larson 1980) are both designed to sow cleaned seed of any size and shape as well as trashy or plumed seed. Seed of selected species can be sown concurrently, yet separately, through various types of drills. This type of seeding reduces interspecies competition and improves establishment (fig. 6).