

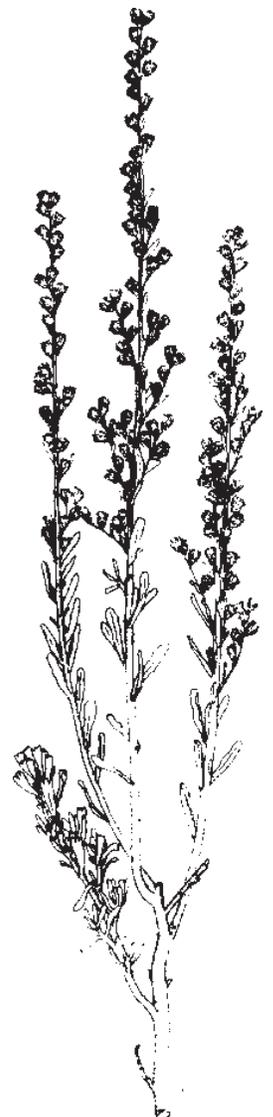
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Chapter

4

Basic Considerations for Range and Wildland Revegetation and Restoration

Plummer and others (1968) proposed 10 principles to follow when planning and implementing rangeland revegetation programs. These principles—or basic considerations for rangeland managers—are applicable to most sites in the Western United States (Jordan 1981; Merkel and Herbal 1973), and many projects in the Intermountain area have been conducted successfully by following them. This chapter provides a discussion of each principle and refers the reader to the other chapters of this book where more information may be found. These should be considered general guidelines and may require modification for local or unusual situations.



Ten Principles of Rangeland Revegetation

Principle 1: The proposed changes to the plant community must be necessary and ecologically attainable

See chapters 5, 6, and 7.

The general goal of most revegetation projects is to change a plant community having undesirable characteristics to one with desirable characteristics. Land managers must determine whether the proposed changes are necessary or desirable and ecologically sustainable (fig. 1). Revegetation normally involves changes in community composition, plant cover and density, and reduction in competition from undesirable species. If the results are to be sustainable, sites targeted for revegetation must have the ecological potential to support the proposed changes and to initiate natural successional processes following treatment. The goal of many wildland revegetation projects is to reestablish native species and restore natural community functions. However, attempts to completely convert one native plant community to another or to a community of introduced species are usually not recommended.

Areas that support a satisfactory number of native species will normally recover with proper management if invasive species are not present. Reduction in competition is best accomplished by selecting the most reliable technique that will have the least impact on existing desirable species. Controlled burning, application of selective herbicides, and various mechanical techniques can be used to remove or reduce competition and permit recovery of understory species.

Principle 2: The terrain and soil must support the desired changes

See chapters 6 and 7.

The potential productivity of a site must be considered when planning revegetation projects. The USDA Natural Resources Conservation Service has completed soil classification surveys and soil descriptions for most range sites in the Intermountain area. These descriptions provide information that can be used to estimate potential productivity of individual sites and to select appropriate species for seeding them. Stevens and others (1974) defined various site characteristics that significantly affect productivity of semiarid juniper-pinyon and sagebrush/grass sites in Utah. The most important features were:

- Depth of the soil surface and subsurface horizons.
- Soil texture and the amount of salt in surface and subsurface horizons.



Figure 1—The maintenance of diverse communities must be a key priority for land management throughout the West. Intact communities should not be altered or disrupted.

- Occurrence and location of hardpans or restrictive layers in the soil profile.

Within these plant communities are areas having coarse, rocky, shallow, alkaline, or saline soils. Restoring native vegetation on these sites may be quite risky and will most likely require considerable investment that may be difficult to justify. Justifications may include controlling erosion, stabilizing disturbances, containing weeds, reducing fire, or providing wildlife habitat. Extremely large disturbances of such environments occur in the Intermountain region, and most continue to degrade, usually through weed invasion. These situations must be addressed, and more reliable practices must be developed to better assure successful restoration (fig. 2).



Figure 2—Low elevation and arid sites commonly occupied by annual weeds are extremely difficult to revegetate. Remedial treatments are required to curtail the spread of weeds.

Species presence, age class distribution, and plant vigor can provide an index of soil types and the productivity and potential of an area to support specific species and communities. For example, sites with a predominance of small, but older pinyon or juniper trees generally have shallow soils. Likewise, relatively low-growing black sagebrush and winterfat occur on specific soil types. The presence or absence of different species may provide indications of specific physical or chemical properties of the soil. The presence of certain chenopods, for example, usually indicates basic and heavy soil textures.

In many cases, terrain and surface conditions determine whether a site can be treated and the techniques and equipment that can be used. Treatment of steep slopes is usually more costly than level areas, but successful chaining has taken place on sites with up to 65 percent slopes. Plowing, disking, harrowing, bulldozing, interseeding, transplanting, and other intensive treatments are usually confined to sites with less than 25 percent slopes.

Principle 3: Precipitation must be adequate to assure establishment and survival of indigenous and planted species

Refer to chapters 6 and 7.

Water is often the most critical factor affecting seedling survival and plant establishment in semiarid and arid regions. Generally, revegetation efforts should not be initiated in areas receiving less than 9 inches (230 mm) of annual precipitation. Before selecting species for a revegetation project, annual precipitation and seasonal distribution of precipitation should be determined (Jordan 1983; Stevens and others 1974). The most critical periods for soil moisture availability are those preceding and during germination (Jordan 1983). Consideration of annual moisture availability on the site must be a major factor in selecting species for planting. Seedling establishment of some species may only be successful during years with unusually high rainfall during the critical periods. Some species may be slow to establish even though they are common or dominant species on low precipitation sites.

Principle 4. Competition must be controlled to ensure that planted species can establish and persist

Refer to chapters 5 and 8.

Young seedlings of most species are usually unable to compete with established vegetation. Undesirable, highly competitive species must be removed or reduced in density to allow seedling establishment of the planted species (fig. 3). Stands of juniper-pinyon,

cheatgrass, medusahead, red brome, cluster tarweed, and various perennial weeds are some of the competitive species that must be reduced in density to better assure establishment of seeded species. Methods developed to reduce competition include:

- application of selective herbicides
- anchor chaining or railing
- disking
- undercutting
- plowing and interseeding
- fire

Individual methods usually do not completely eliminate all plants but can sufficiently reduce competition to allow seeds of the planted species to germinate and establish. Treatments can often be difficult to select and implement where retention of existing and desirable species is desired.

Principle 5: Plant and manage site adapted species, subspecies, and varieties

Refer to chapters 12 and 17.

Factors important in determining which plant materials should be selected for seeding are:

- Use of site-adapted species and populations.
- Presence, density and composition of indigenous plants.
- The availability of seed or planting stock.
- Project objectives.

Successful range improvement projects begin with the selection of species that are adapted to the area proposed for treatment. One must make certain that



Figure 3—Reducing competition from weedy annuals is essential to increase the probability that seeded species will establish.

only adapted sources and strains are used. Generally, seed from populations growing under climatic and edaphic conditions that are similar to those of the proposed treatment area are most likely to survive. Materials selected for planting must be able to establish, persist, and reproduce on the site.

Care must be taken to prevent overseeding species that may be aggressive and dominate the site. Rapidly developing species are often included in seed mixtures to provide ground cover and forage and to modify microclimates while slower developing species become established. Management should seek to maximize establishment of all desired species, whether seeded or present in the existing vegetation. Seeding the right combination of plants is critical to the ultimate community diversity that develops over a number of years.

Principle 6: A multispecies seed mixture should be planted

Refer to chapters 12 and 17.

Many early revegetation projects emphasized the use of a limited number of species. For most wildland revegetation projects today, however, there are many reasons to seed mixtures rather than single species:

- Restoration of native plant communities usually requires the reintroduction of a variety of species to provide community structure and function.
- A combination of species is normally required to initiate natural successional processes.
- A variety of species that are adapted to the diverse microsites occurring within major seedings should be seeded.
- Mixtures reverse the loss of plant diversity and enhance natural recovery processes following natural impacts from insects, disease organisms, and adverse climatic events.
- Chances for successful seeding are often improved when mixtures are planted.
- Mixtures can provide improved ground cover and watershed stability.
- Mixtures produce communities that provide greater potential for reducing weed invasion and for providing for a balance in the use of all resources.
- Combinations of species can provide better quality habitat including cover and seasonal forage.
- Total forage production and seasonal succulence can be increased with mixtures.
- Mixtures are generally more aesthetically pleasing and match natural conditions.
- Mixtures provide diverse habitats required to sustain wildlife species.

Seeded mixtures should include the various growth forms, that is: grasses, forbs, shrubs, and trees that existed prior to disturbance. Seeded and indigenous

species must be compatible and able to establish and develop together. Successional changes must occur that will result in the ultimate development of a desirable plant community.

A few special situations such as providing immediate ground cover to stabilize erosion may occasionally dictate the seeding of only one or a few species. Because some shrubs establish and grow much slower than many herbs, planting individual woody species with plants having similar establishment and growth characteristics is recommended. Selectively planting different species in separate rows or spots is sometimes required.

Principle 7: Sufficient seed of acceptable purity and viability should be planted

Refer to chapters 12 and 17.

It is important to calculate seeding rates carefully. Planting excessive seed is unnecessarily expensive and increases competition among seedlings and indigenous species. Low seeding rates, on the other hand, may jeopardize stand establishment.

It is essential that seeding rates be determined on a pure live seed (PLS) basis. The number of pure live seed (PLS) per unit of weight varies greatly among species and seed lots (fig. 4). If an equal *number* of live seeds of alfalfa, antelope bitterbrush, slender wheatgrass, and fairway crested wheatgrass were seeded, then average *weight* would be 1.5 lb (0.7 kg) of alfalfa, 20.8 lb (9.5 kg) of antelope bitterbrush, and 3.7 lb (1.7 kg) of slender wheatgrass for each pound (0.5 kg) of fairway crested wheatgrass.

Seed must be tested for purity and germination and properly tagged with the current results to enable the buyer to calculate seeding rates. A certified seed laboratory should analyze all seed, including wildland collections. Seed stored for an extended period should



Figure 4—Selecting and properly planting high quality seed is critical to planting success.

be retested before seeding. Care should be taken to ensure that all species can be seeded at the expected rate with the proposed seeding equipment, and that the equipment can function properly over the entire planting site.

Principle 8: Seed must be planted on a well-prepared seedbed and covered properly

Refer to chapters 12 and 17.

Proper seed coverage is essential for successful germination and seedling establishment. Depth of planting is generally determined by seed size. However, it is also influenced by special requirements of individual species. As a general rule, seeds should not be covered more than three times the thickness of the cleaned seed. Seed of certain species including winterfat, rabbitbrush, sagebrush, and asters are best seeded on a disturbed surface with shallow soil coverage. Indian ricegrass on the other hand, should be seeded 2 to 3 inches (5 to 7.6 cm) deep. Soil type and surface conditions also influence seeding depth. Most species benefit from firm seedbeds, but some do well in loose soils. Heavy soils may crust and prevent emergence. Light textured soils are less likely to crust or become compact; however, they dry rapidly and, thus, deeper planting depths are recommended.

Principle 9: Plant during the season that provides the most favorable conditions for establishment

Refer to chapters 12, 17, and 18.

Late fall and winter seedings have been most successful in the Intermountain West. Advantages of late fall and winter seedings include:

- The inherent seed dormancy of many species is released by overwinter stratification.
- Seeds are in place in early spring when soil moisture is most likely to be available for germination, seedling emergence, and growth. Early emerging seedlings are better able to resist high summer temperatures and drought.
- Seed predation by small mammals and birds is less likely to occur if seeds are planted when these animals are less active.

Seeding too early in fall may result in precocious germination following unseasonably warm periods coupled with autumn rains. Seed losses to mammals and birds also can be high during this period.

Transplanting should be completed in early spring when the soil is wet and before active growth of the transplant stock or the native vegetation has begun. Fall transplanting is generally not recommended unless soils are moist and likely will remain moist until they freeze.

Principle 10: Newly seeded areas must be managed properly

Refer to chapter 16.

As a general rule, newly seeded areas should not be grazed for at least two or three growing seasons following planting. Poor sites and slow-growing species may require a much longer period of nonuse. When grazing does occur, it should be carefully regulated.

