

Chapter

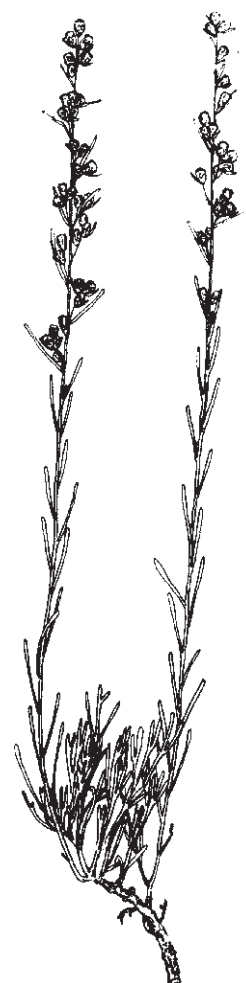
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Restoration or Rehabilitation Through Management or Artificial Treatments

Introduction

Improvement of vegetative and edaphic conditions on some wildland sites can be achieved through proper management as well as by manipulative plantings (Vallentine 1980). Sites that have been subjected to serious abuse or that lack needed cover, habitat, or forage resources can be improved by various methods (Vallentine 1980). Prior to the development of any site improvement program, land managers must first discern the resource needs and suitability of an area for treatment (Plummer and others 1968). Then appropriate methods and techniques can be developed.

Proper management is the key to the improvement or maintenance of acceptable plant cover and soil stability (fig. 1). Successful revegetation may dramatically change plant and watershed conditions. Yet without appropriate management, improvements can be lost (Vallentine 1980). Following are some factors that influence decisions on whether to improve sites



through management schemes, artificial measures, or both. Factors that influence site improvement through management are discussed first. Factors that are of special concern when considering restoration or rehabilitation are presented next. Factors that influence management decisions are also important considerations in developing planting programs.

Management Considerations _____

Status and Condition of Existing Vegetation

Restoration or rehabilitation projects are not usually contemplated unless the native communities have been severely disturbed, resulting in adverse watershed conditions and loss of desirable vegetation. If an

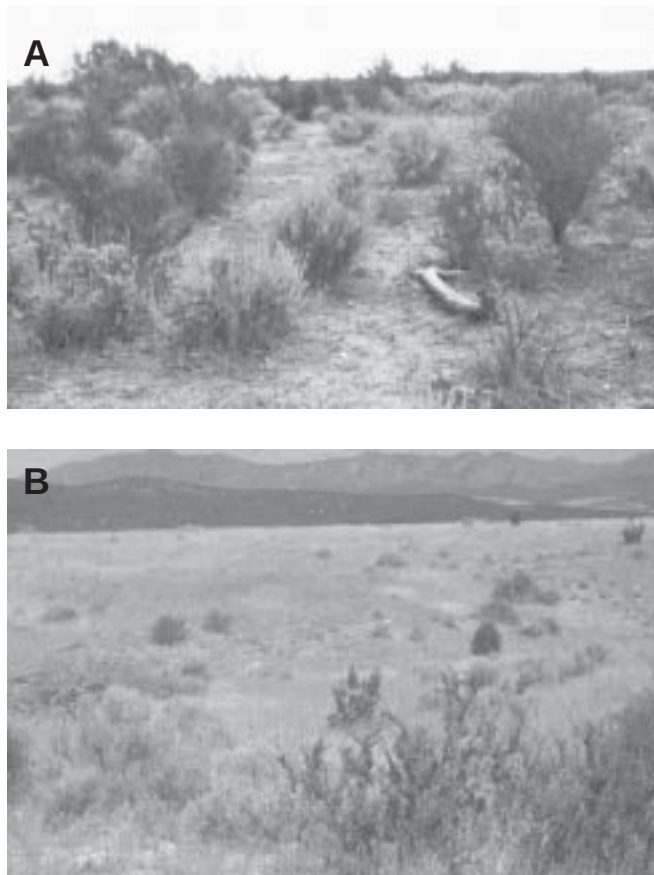


Figure 1—(A) A seeded area that has been properly grazed. (B) A poorly managed site where shrubs are low in vigor and the understory is declining in diversity, density and vigor. Matchbrush and cheatgrass are increasing on this site.



Figure 2—Natural recovery of native species 5 years following a prescribed fire in a pinyon-juniper community.

adequate composition of desirable species that is capable of recovery and natural spread remains, artificial seeding is unnecessary (fig. 2). If properly managed, plants that have been weakened by excessive grazing and browsing can normally recover and begin producing seed within a few years. Plants growing in arid environments may require longer to recover. Protected areas in the blackbrush and Indian ricegrass communities of southern Utah require many years to recover following heavy grazing. Some disturbed areas within the Wyoming big sagebrush zone in southern Idaho have remained in almost a static condition for more than 50 years with protection from grazing. However, considerable improvement resulted following three unusually wet years. Woody species that exist in mountain brush communities normally have the capacity to recover and spread quickly when managed correctly. Woody species growing at lower elevations are usually exposed to more adverse climatic conditions and many are less capable of natural spread. Thus, recovery in salt desert shrublands and low sagebrush foothills is slow.

Many native communities are capable of self regeneration by natural seeding or sprouting. However, replacing individuals that die naturally is an entirely different situation than repopulating a broad area where most species have been depleted by grazing.

A disturbed site may still support some species but not others. This is quite common on most overgrazed rangelands. The more desirable forage plants are often lost by selective grazing (fig. 1). Other remaining, but less desirable species may be capable of recovery, but the important forage species may not reappear without some means of artificial seeding. Controlling

livestock grazing on important game ranges often results in an increase in total herbage production. However, the recovery of important broadleaf herbs frequently does not occur. Species such as nineleaf lomatium, sticky geranium, and bramble vetch usually occurring on specific microsites may not dominate a community, but they are important as seasonal forage. Unfortunately, these same species are often eliminated by grazing and do not persist in sufficient numbers to recover, even when protected for extended periods. If desirable species are not present, improvement by natural means may be unattainable.

Natural recovery processes must be considered in predicting secondary successional changes. Although some desirable species may not be present on a disturbed site, their reentry may depend on factors other than the adverse effects of grazing. For example, some shade dependent plants are not able to survive if overstory species are not present. The shade tolerant species will not appear until overstory plants have become established, assuming a viable seedbank remains.

The recovery capabilities of individual species must be correctly evaluated to decide on methods of improvement. Plants of big sagebrush, rubber rabbitbrush, and sulfur eriogonum spread well from seed, even under stressful situations. By contrast, few seedlings of Saskatoon serviceberry, skunkbush sumac, and true mountain mahogany (fig. 3) are encountered even though abundant seed crops are produced most years. Some species are site specific, existing as pure stands but intermixed with other communities. Such is the case with curleaf mountain mahogany. If these stands are eliminated or seriously diminished, natural recovery is extremely slow (fig. 3). Recovery is affected by limited seed sources, low plant density, and poor distribution of parent plants.

Although more time may be required to achieve natural recovery, this may be the most practical approach. However, land managers must understand that during the period of recovery the vegetation may not furnish desired forage and cover. Until a complete recovery of all species is attained, all resource values may not be provided.

Status of the Soil Conditions

Soil and watershed conditions are critical resources that cannot be allowed to deteriorate. If disturbance has progressed to the extent that soil loss is serious, rehabilitation measures must be implemented (fig. 4). If adequate protection of the soil and watershed through management is not realized within a satisfactory period, artificial revegetation measures will be required.

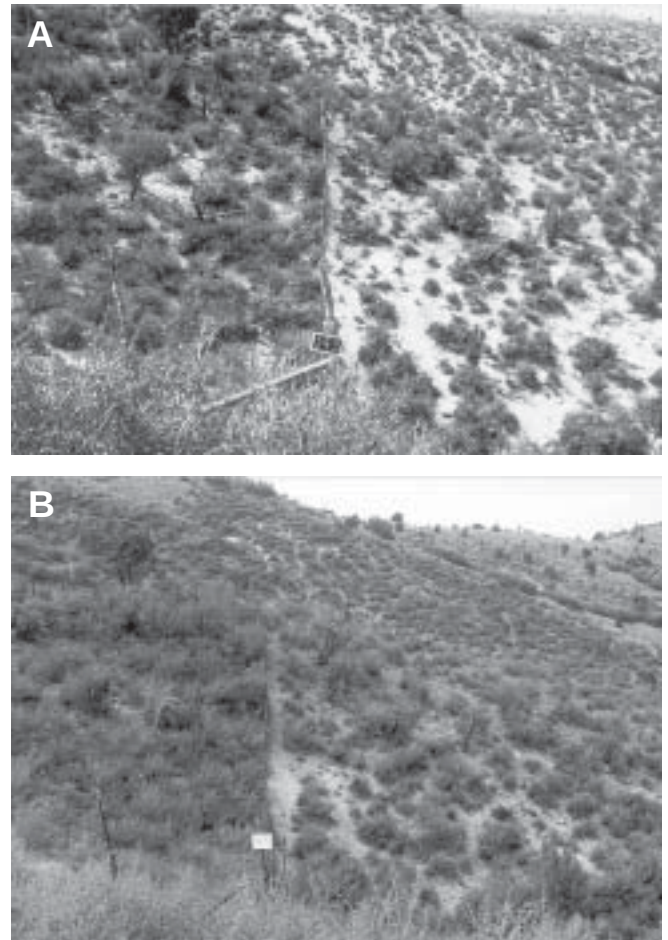


Figure 3—Exclosure (left) established in the 1930s. (A) True mountain mahogany extensively used outside (right) and recovering somewhat without use in the exclosure (left) in 1954. (B) Even with removal of cattle and significant reduction in deer numbers, the condition of the true mountain mahogany outside the exclosure has changed little by 1995. There is little difference in the curleaf mountain mahogany inside or outside the exclosure between 1954 and 1995.

A long recovery can be accepted if the soil and watershed resources do not deteriorate appreciably during the initial stages of natural recovery. However, both the physical and chemical condition of the soil affect seedling establishment and growth. Soil surfaces must be conducive to seedling establishment if the vegetation is to recover. An open, but stable, surface may exist, but surface crusting (Army and Hudspeth 1959) or freezing may prevent seedling establishment (Hull 1966). In addition, lowering of the water table through downcutting of the stream channel can and does influence areas adjacent to the drainage. Wind erosion and lack of surface organic



Figure 4—Soil erosion from an area depleted of vegetation. Establishment of desired species on severely eroding and unstable surfaces can be difficult.

matter (Welch and others 1962) are highly detrimental to seedbed conditions. These and other features must be considered when assessing soil and watershed conditions.

Protecting the soil resource may be necessary before attempts are made to improve habitat or forage conditions. This has been a major concern in many circumstances, particularly along the Wasatch Front, within the Idaho Batholith, and in the Colorado River drainage. The vegetation in these areas can often recover satisfactorily through protection, but eroding areas may respond more slowly. In addition, the occurrence of intense summer storms and other climatic events can be expected and can have devastating and long-lasting impacts.

Management Strategy

Wildland sites in good or fair condition are usually able to recover through natural processes. However, providing protection from human-induced changes is often difficult. Big game wintering sites and spring and fall ranges may constitute small, but important, portions of a broad geographic area. Attempts to restrict use of the broad area for sufficient time to allow recovery of these seasonal ranges may not be practical. In addition, efforts to maintain high populations of game animals, or continued livestock use on these broad areas may not be compatible with natural recovery. A well designed management system to improve habitat conditions may require a long-term commitment.

Management strategies must ensure that the following conditions are created: (1) the development of suitable seedbanks, (2) the creation and protection of adequate seedbeds, (3) the protection of plants for sufficient time to provide an acceptable composition of

species, and (4) the recovery of all sites, especially the most critical areas.

Impacts on Other Resources

Few areas can be managed to support one resource, yet treatment practices are often developed to enhance a single primary resource. In these cases attention must be given to the expected impacts on other resources. For example, the value and impact of management schemes on wildlife populations must be determined as these schemes influence recreation, livestock grazing, and other uses. In addition, management strategies that are used to regulate animal distribution, population numbers, and seasonal use must be developed as part of the rehabilitation program.

The decision to artificially treat an area is normally based on the value of numerous resources. For example, a site essential in maintaining a viable big game herd that may also be an important watershed area might receive treatment priority (fig. 5).

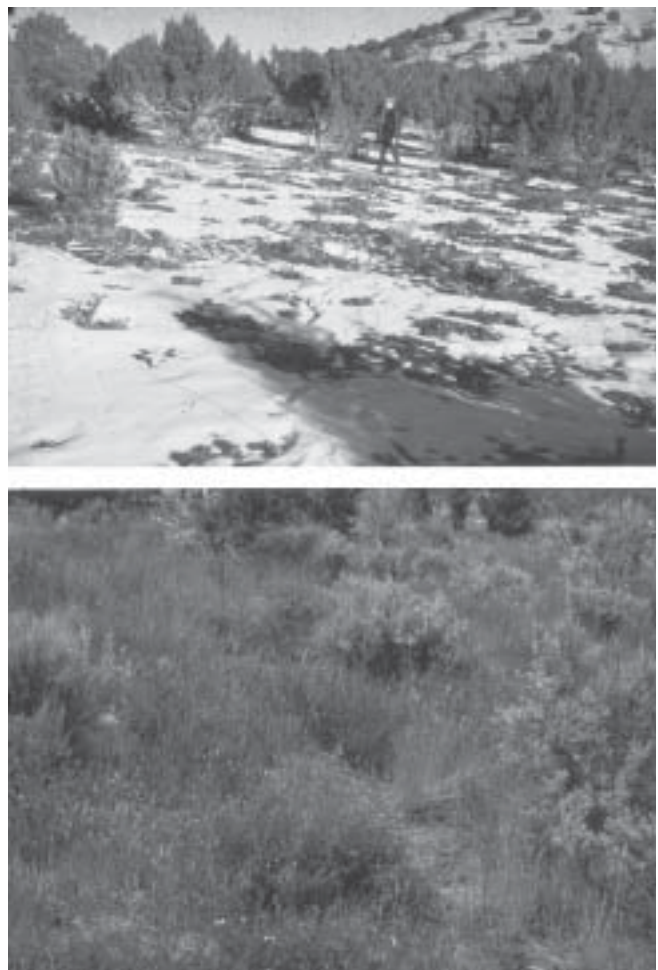


Figure 5—Important watershed and big game winter range prior to and 6 years following chaining and seeding.

Immense Areas

Wildland ranges include extensive and diverse acreage throughout the Western States (McGinnies 1972). The enormous size of this area simply precludes comprehensive treatment of all seriously depleted sites. Many sites support a desirable vegetative cover, and attempts to convert or replace native communities should not be made. Some sites support less productive and undesirable weedy species and unsatisfactory watershed conditions (Blaisdell and Holmgren 1984). However, the cost to of correcting these problems may not always justify extensive artificial treatments. Site improvement may be better attained through careful management.

Numerous sites on steep, inaccessible slopes cannot be treated with existing equipment. Topographic and vegetative conditions are usually very diverse within most areas, and site preparation and planting equipment are not always versatile enough to treat all circumstances. Consequently, some areas cannot be properly treated.

Climatic Conditions

Many arid or semiarid wildlands that occupy extensive areas within the Intermountain States cannot be satisfactorily treated using current revegetation and restoration measures (Blaisdell and Holmgren 1984; Bleak and others 1965). Arid conditions and irregular moisture patterns may not be conducive to seedling establishment. Large acreages are normally treated and seeded only once. Uniform stands may not develop, yet replanting is costly and impracticable. Bleak and others (1965) found sites in regions receiving less than 8 to 10 inches (200 to 250 mm) of annual precipitation are the most difficult to treat (fig. 6). Recent studies have identified and developed promising species for semiarid sites (Asay and Knowles 1985a,b; Rumbaugh and Townsend 1985; Stevens and others 1985c; Stutz and Carlson 1985), however, appropriate planting techniques for successful planting of these species may not be available. Many semiarid ranges, including sites supporting shadscale, winterfat, Nevada ephedra, and budsage need improvement, but changes can often be more easily attained through proper long-term management than through artificial revegetation.

Many species that occupy arid sites are extremely valuable plants, and should be retained or enhanced. However, these plants are not easily cultured and are not well suited to artificial planting. Suitable substitute species that could be used in their place are not known (Hull 1963b; Plummer 1966). Consequently, many arid and semiarid sites must be carefully managed to minimize abuse and stimulate natural recovery.



Figure 6—It is difficult to revegetate desert regions that receive less than 8 to 10 inches of annual precipitation.

Artificial Revegetation Considerations

Similar factors must be considered in determining if management or revegetation should be employed to improve a wildland disturbance. However, certain factors must be looked upon quite differently depending on which approach is used. For example, the size of an area requiring restoration or rehabilitation is a major factor to be considered. A large area may be difficult to manage due to differences in topography, access, or season of use. Consequently, improvements may not be easily achieved by management. Similarly, the area may be so diverse that artificial revegetation may be difficult to achieve using a single method or closely related methods of site preparation and seeding.

Following are some factors to consider in determining the applicability or practicality of artificial revegetation. The list is not considered all-inclusive. Other issues may also be important, particularly in specific areas. However, the factors discussed below must be considered before developing improvement measures.

Site Suitability

Plummer and others (1968) emphasized the importance of correctly discerning the capabilities of a site prior to treatment. Too often, attempts are made to convert a vegetative community to a complex of desirable but unadapted species. The site must be capable of sustaining the selected species. In addition, species included in the seed mixture must be compatible with one another and with the existing native species.

Some attempts have been made to improve shrublands by seeding grasses, or by introducing other

shrub species. Sites with low precipitation, shallow soils, or both, that support black sagebrush, bud sagebrush, or shadscale have been plowed and seeded to introduced grasses. In many cases treatments have failed and less productive plants have invaded (Blaisdell and Holmgren 1984). Failure to recognize the suitability or capability of these sites has resulted in the loss of the adapted native plants.

Sufficient information is available to determine the adaptability of many introduced and native species (Asay and Knowles 1985a,b; Barker and others 1985; Carlson and Schwendiman 1986; Davis 1983a; Hafenrichter and others 1968; McArthur and others 1985; Monsen and Davis 1985; Monsen and Shaw 1983b; Plummer and others 1968; Stevens 1983a, 1987a; Stutz and Carlson 1985). Some species are difficult to establish through artificial seeding, and the desired complex of adapted species is difficult to achieve. However, it is not advisable to seed or plant substitute species that are marginally adapted but easily established.

A site may be capable of sustaining a complex array of species. However, initial attempts to reestablish certain species may be unsuccessful (Jordan 1983). Soil crusting and high salt content in the soil surface often limit seedling establishment of species on sites supporting black greasewood (Naphan 1966; Rollins and others 1968; Roundy and others 1983). Rodent foraging seriously limits seedling survival of curlleaf mountain mahogany (Dealy 1978), antelope bitterbrush (Giunta and others 1978), and Martin ceanothus. Rabbits, livestock, and big game selectively graze some species, particularly broadleaf herbs, limiting their survival even when planted under favorable climatic and soil conditions. Animals tend to concentrate on seeding projects if the adjacent wildlands are void of an adequate forage cover. Weed infestation (Eckert and Evans 1967) and slow or erratic seedling growth (Jordan 1983) of many seeded species often diminish their success. Artificial plantings or natural seedings of black chokecherry, Woods rose (Monsen and Davis 1985), skunkbush sumac, and green ephedra, (Monsen 1975) often are not successful, and attempts to restore large areas from a single planting cannot always be achieved. These factors significantly influence site suitability for improvement either by management or artificial revegetation.

Community development and maturation must also be considered when designing a revegetation program. Newly developed or introduced plant materials must be able to establish, and persist and reproduce. If they are unable to reproduce satisfactorily, stands ultimately deteriorate. Fourwing saltbush, a highly productive and palatable forage plant, has been successfully established on sites once dominated by Wyoming big sagebrush, but it has been short-lived and unable to reproduce by natural seeding.

Similarly, artificial seedings of antelope bitterbrush and Stansbury cliffrose have established satisfactorily on cheatgrass ranges if the understory weeds are reduced at the time of shrub planting. Natural seeding by either shrub species has not occurred with competition from the understory weeds, and stands have slowly disappeared.

Various introduced herbs and shrubs perform favorably from initial plantings on wildland sites. However, some have failed to survive when infrequent insect outbreaks and other unusual stress events occur. Similar situations have been encountered when highly desirable native species, such as blue elderberry, have been planted on sites where the species normally does not exist, even when such sites were quite similar to the origin of collections. Blue elderberry persists when planted on big sagebrush sites unless a series of unusually dry years has occurred. Plants then become weak and disappear. Many years may pass before drought events cause blue elderberry plants to die.

Some ecotypes of a particular species demonstrate specific site adaptability; unadapted ecotypes may then be sorted out quite rapidly (Davis 1983a; McArthur and others 1983b). Other ecotypes may be equally sensitive, but climatic or biological events that affect their survival may not occur frequently. Consequently, these ecotypes may persist for an extended period before being eliminated.

Perhaps the most critical issue to be considered in revegetating semiarid and arid sites is the availability of soil moisture for seedling establishment (Jordan 1983). Attempting to seed areas that receive erratic amounts of moisture is extremely hazardous. Seeds of many species require periods of cold-moist stratification to initiate germination. In addition, developing seedlings must receive sufficient moisture to assure establishment. Attempting to plant in areas dominated by weeds, or during periods when soil moisture is unfavorable for growth, is ill-advised. Seeding species with different germination and growth characteristics can be successful if the moisture requirements of all species are met (Shaw and Monsen 1983a). Problem sites may be capable of supporting a specific array of species, but current planting techniques are not satisfactory for planting many sites. Consequently, the site must be suitable for: (1) maintaining the planted species and (2) applying currently available methods of treatment.

Status of Soil and Watershed Conditions

Sites that have been degraded and subjected to erosion are normally the most critical areas requiring artificial restoration. Protection must be provided for onsite and downstream resources. However, barren and eroding soil surfaces normally are not satisfactory seedbeds (fig. 4). Recovery of natural revegetation is

often prevented because of unstable surface conditions and a limited soil seedbank. Artificial seeding, including site preparation, is difficult and costly to achieve on unstable watersheds. Areas should not be allowed to deteriorate to the point that rehabilitation or other costly measures are necessary to reestablish a plant cover.

Soil conditions must be carefully surveyed to assure that a satisfactory seedbed can be created. Too often stands of juniper-pinyon have been allowed to fully occupy steep hillsides, and woody and herbaceous understory species have been lost. The change in plant composition reduces soil protection. Tree competition must be reduced to allow recovery of the understory species that have been lost. However, control measures must provide soil protection during the period of conversion. In addition, soil conditions must be improved to provide a suitable seedbed. Chaining provides soil protection by leaving both trees and litter on site and a satisfactory seedbed is created. Burning can be used to reduce tree competition, but this control measure does not provide adequate soil protection or create a seedbed.

Problem areas may be ranked depending upon their values and the severity of the disturbance. The most critical areas may then be selected for treatment. The feasibility of treating the candidate sites must be considered in developing rehabilitation plans.

Status of the Vegetation and Presence of Weeds

Regardless of the disturbance, provisions must be made to control existing weeds or prevent their entry onto prepared seedbeds (Hull and Holmgren 1964). Complete elimination of all weedy species is not essential to planting success. Weed control is necessary to ensure seedling establishment; thereafter less desirable plants can be controlled by natural competition (fig. 7). Control may be necessary to reduce the presence of undesirable weeds or diminish the density and influence of desirable natives on establishing seedlings (Blaisdell 1949). Attempting to control weeds, and yet maintain desirable natives, is a difficult task, particularly when working on wildland situations.

In some situations weedy plants may assume dominance and prevent the natural establishment of more desirable species. The weeds may be annuals such as cheatgrass and Russian thistle, or perennials including big sagebrush or Utah juniper. Plant density must be significantly reduced to ensure establishment of seeded species. In addition, control measures must be used to prevent the immediate recurrence of weeds.

Cheatgrass is the most severe weed problem encountered on a wide spectrum of plant types within the Intermountain Region (Klemmedson and Smith 1964; Stewart and Hull 1949). Control is not easily achieved,



Figure 7—Needle-and-thread grass suppressing cheatgrass and other weeds.

but unless competition is reduced to a low level, few seeded species will establish.

Appraisal of Resource Values

Restoration or rehabilitation projects have been completed on various sites to improve wildlife habitat or forage production without carefully determining the best specific locations where these resources are located. Large acreages are often treated assuming “the more acres treated, the more habitat or forage provided.” This assumption is sometimes incorrect. Chaining and seeding pinyon-juniper sites was done to improve critical midwinter deer and elk habitat, even though they were not midwintering areas. The important midwinter sites may be exposed slopes and ridgetops that may support a limited number of species (fig. 5). These small confined locations are the ones that should receive special treatment.

Revegetation projects should be designed to provide cover, forage, and protection on sites where the greatest benefit can be derived. It is obvious that treatments must be done efficiently. Consequently, when chaining or using massive equipment, large acreages can often be treated cheaply. Large tracts of land can be treated easier than isolated sites. However, treatments should be designed to accomplish the goals of the project, and the needs of targeted animals.

Selective Treatment and Impacts on Associated Areas

Artificial treatments can be designed to restore critical areas indirectly. Artificial revegetation can and does benefit both the treated area and adjacent sites. Consequently, areas having good access and highly productive soils can often be treated, leaving

adjacent sites to recover naturally. However, the untreated sites must be able to recover. Highly palatable species, or plants that provide seasonal forage, can be seeded onto specific sites to attract and hold grazing animals on adjacent areas (Stevens 1987b). Treating an area of sufficient size is necessary to disperse animal use and allow the seeded species and untreated areas a chance to develop. Not all untreated sites respond favorably. Areas that are nearly void of desirable species or dominated by weedy plants do not generally respond to a reduction of grazing.

Selective treatment, an important practice, can be used to promote successional changes, and supplement improved habitat, seasonal availability of herbage, and forage quality (Wight and White 1974). Adding an appropriate shrub or herb to the existing vegetation can enhance forage resources, restore specific species, and control weeds. Interseeding selected species into existing stands is an important technique to improve large areas without excessive costs.

Management and Control

Treated sites must be managed to retain species composition, plant vigor, and productiveness. Treated sites may require special protection that cannot be provided. If this occurs, the value of the project is lost. Treated areas must be of appropriate size to accommodate seasonal use during the time of plant establishment and over a long-term maintenance period. Areas must be of sufficient sizes and diversity to respond to climatic conditions and associated biotic factors that influence plant succession. Some treated areas may be heavily grazed to such an extent that weeds are able to invade during stressful periods. The treated sites must be able to accommodate all forms of use, including somewhat abnormal events such as insect attacks and drought.

Treated sites should be managed or used as initially intended. Too often areas are seeded or treated to provide big game habitat, but are then used as grazing pastures for livestock, despite the fact that the areas may not be designed to accommodate these high levels of use. Treated sites regress if not properly managed. Improper use, particularly during the period of seedling establishment, can eliminate certain species and decrease the overall success of the project.

Availability of Adapted Plant Materials

Rehabilitating ranges to benefit wildlife usually requires the inclusion of various native species in the seeding (Stein and others 1986). Restoration projects require seeding diverse mixtures of native species. Seeds of many native species are not always available and substitute species are frequently planted. The lack of adapted ecotypes of many species limits many plantings. The use of introduced grasses has facilitated many rehabilitation projects. However, the more commonly available grasses and broadleaf herbs do not satisfy all resource needs. Seed sources must be developed to assure the use of desirable and adapted native plants.

Site Improvement Costs

The costs incurred in restoration and rehabilitation ultimately determine the site treatment and seeding practices to be employed. However, it is difficult to determine the value of stable plant communities; wildlife habitat, including nongame animals; watershed protection; and recreational uses. Benefits cannot be calculated wholly on the increased production of forage. All benefits must be considered over the entire life of the project.