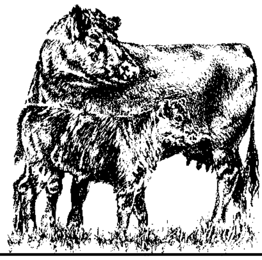

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Range and Pasture Section 540

Range Improvements: Ways to Increase Forage Production

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Range improvements are made by managers to purposefully change the vegetation with the intent to improve and increase forage quantity and quality. Through the range management planning process, livestock producers will have identified their problems and the opportunities for correcting them.

The producer should make a thorough economic analysis of each problem situation and its alternative solutions. Many techniques are available to do this. One that all producers can use was developed by range management staff at Utah State University and published as Utah Agricultural Experiment Station Bulletin 466. It shows, step by step, how various improvement practices can be compared.

The projected total income and the total costs over the life of the range improvement plan need to be developed. From this, the rate of return for each practice can be determined. Correct assumptions are vital to the success of this approach. Producers need to understand clearly what production and management advantages and disadvantages accrue in order to justify using specific practices.

Since there is great variability in conditions, producers are advised to obtain technical assistance for making a study of the alternatives. Some Extension agents, specialists, and Natural Resource Conservation Service technicians are trained in this field. They may know of alternatives that cattle producers hadn't considered.

Overall Consideration

Improving ranch productivity through range improvements has four main components: (1) selecting the most appropriate practices for each site and situation; (2) managing the resource after it has been improved; (3) maintaining productivity by retreatment, if necessary; and (4) integrating and managing the improved areas with the other resources of the ranch.

Producers should consider improving the areas with highest site potential first. Often these will be some of the lowest ecological condition sites, perhaps abandoned cropland, or areas near water. They may require seeding. At the same time, depending on the practices that might be used, producers should try to improve the higher ecological condition areas before tackling the poor and fair condition areas. Good range responds to treatment more rapidly than poor and should have a greater level of biological stability. Producers need to recognize, however, that the total amount of response may not be as great as that from the lower condition sites.

Improved grazing management is a range improvement practice. Range vegetation can improve or decline depending on the kind of grazing management it receives. Consequently, producers need to keep grazing in mind as an improvement practice as well as just a way to maintain forage production and use. In years of over abundant forage production, lack of use may encourage decreased forage utilization in the following years.

Many ranges have been improved initially through brush management or seeding, but productivity hasn't been maintained. The causes of range deterioration in the first place need to be well understood. If they aren't, range improvement may not be as long-lasting as expected. After range improvement has occurred, regardless of practice, producers need to be certain to apply a grazing strategy that will maintain the productivity engendered by the improvement. Producers must recognize that grazing animals can have positive or detrimental impacts on plants.

Finally, most improvements need follow-up. A rancher's thorough understanding of the kind of sites he or she has will give large clues as to the kinds and amount of follow-up that will be needed. Often the same practices can be repeated for follow-up: An example is fire on big sagebrush, where many seedlings emerge. This strategy can be repeated when necessary. Prescribing the correct practice or set of practices for the various ecological sites requires good technical knowledge. Producers who lack knowledge should not be embarrassed to request some assistance.

GIS for Range Improvement Planning

A Geographic Information System (GIS) is not one thing, nor a single analysis; but rather a collection of hardware, software, data, organizations, and professionals that together help people represent and analyze geographic data. With new and advancing technologies producers can easily access GIS and use this tool. Most areas in the United States have data available at little to no cost that can be saved on a disk and loaded onto a home computer. The Natural Resource Conservation Service is a valuable source for gathering such data.

Often times, GIS has been described as computerized mapping, which does not do justice to the technology. GIS is a highly advanced database system that can be used in natural resource management. Within a GIS, both spatial data (physical surface features such as roads and streams) and attribute data (descriptions of physical features, vegetation types, slope, soils) are linked. This linkage enables resource managers and producers to ask the GIS database questions (known as a query) about the spatial data.

Using this technique of querying, multiple data-sets can be layered to answer management questions in a matter of seconds. For example, GIS can be used to identify and calculate the number of acres in a specific pasture. The soils, topography, and vegetation data could be queried to find all sites dominated by a specific type of weed on sandy soils with less than 5° slope.

When producers are laying out a new pasture it might be important to determine where the watering areas are located, what the elevation change is, and how many miles of fence will be needed. All these questions can be examined before a project is implemented. This enables the producer to weigh out different management options and calculate the cost associated with the various project designs.

Therefore, a GIS can combine geographic and other types of data to generate maps and reports, enabling users to collect, manage, and interpret location-based information in a planned and systematic way.

Resource managers have long used GIS for a variety of applications that range from simple inventory and query, to map analysis and overlay, to complex spatial decision-making systems. Recently with reduction in costs and ease of use, GIS technology has expanded to the producer level, making it possible for producers to map vegetation, weeds, water sources, utilization, fencelines, and more. These new technologies add a new dimension to resource management planning.

Control of Undesirable Plants

Many practices can be used to control plants. All result in opening the plant community to some extent. Closing the plant community with desirable species is the goal. This needs to take place correctly and rapidly. Therefore, the conditions under which these practices apply need to be clear.

Producers should not expect some desirable native plants to come back in rapidly just because the undesirable plants were removed, unless there is a sufficient population of the desirable plants already present. If there isn't, then the rancher needs to consider seeding the desired species along with controlling the undesirable plants. Some of the most successful seedings incorporate a practice such as spraying sagebrush ahead of planting. Herbicides for chemical fallow employ the same principle.

Controlling undesirable plants, in and of itself, has several advantages and some disadvantages. Range improvement will be accelerated under the right conditions. Often forage yield and availability improve. Stock has more access to forage and is easier to handle when trees and brush are controlled. Poisonous plants may be controlled. Weed seeds may be reduced. Fire hazards should be reduced. Often plant control improves habitat for game animals as well.

Although not necessarily disadvantages, plant control *per se* might not be appropriate when site potential is too low, when costs are too high and can't be spread out over a long enough time period, when serious erosion hazards exist, and when drift from sprays would cause problems where chemicals are the only solution.

For each general category of plant control, both advantages and disadvantages occur. A partial list is given here for each category.

Manual and Mechanical Control

Obviously, this means getting at the plant physically. Thus, the approach applies primarily to shrub and tree species. Manual means hand grubbing or chain sawing. Mechanical methods, usually bulldozing or dragging with a heavy chain, often are used because no other practice is either effective or economical.

Advantages and disadvantages are not obvious. Some techniques are highly selective (bulldozing); others are not (chaining). Mechanical control often is a way to prepare seedbeds before seeding.

Advantages

- Timing is not critical. It can be done when ranch labor is available.
- Generally considered the most convenient method.
- Some plants are more and/or less sensitive at particular times of year (e.g., rotobeating sagebrush in the fall is generally less successful).

Disadvantages

- May not have the desired equipment.
- Costs may be rather high.
- Often enough soil disturbance to require seeding (an advantage if seeding is desired).
- Terrain.

Chemical Control

This method has been phenomenally successful in achieving range improvement. Only chemicals that are registered by the Environmental Protection Administration (EPA) for the specific application can be used. Because of this, most chemical applications will probably be made under contract by licensed applicators. This, in itself, doesn't relieve a producer of liability, as label instructions on the chemicals still must be followed.

If contracted, less ranch labor will be used than in the past, at least for spraying. Chemicals come in a wide variety of forms, and can be applied in liquid (sprays or injected as into trees) and solid (primarily granules) forms.

Advantages

- Very site-specific.
- Rapid in terms of ease of application.
- Generally low to moderate cost.
- No erosion hazard.
- Selective as to species.
- Terrain not limiting as a rule.
- Generally some moisture conservation benefits.
- Ranch labor not needed, generally.
- Safe if done properly.

Disadvantages

- Timing is critical for many herbicides.
- Weather and environmental conditions can limit (e.g., soil moisture too low).
- No chemicals are yet available for several major species.
- Potential damage to crops in area.

Use of Prescribed Fire

When conditions for burning are accurately prescribed and adhered to, predictable results occur. The techniques, overall, are being developed to make burning a skillful management technique. Fire is environmentally accepted. It can be used as part of an overall management program, as well as just for range improvement (e.g., to burn off old forage residue as an encouragement for better livestock distribution).

A prescribed fire can be practiced on a periodic but planned basis. Studies are now revealing more information on times of fire tolerance as well as susceptibility of various forage species. Fire can be used effectively in maintaining productivity of an improved range.

Advantages

- Relatively low cost.
- Forage plants preferred after burning.
- Good seedbed preparation in white ash (shrubs and trees).
- Releases nutrients for plant growth so forage plants may be more nutritious.
- Controls insect populations. Insects prefer old residue, which fire removes.
- Improves game habitat.
- Opens up areas for access.

Disadvantages

- Liability when escapes occur.
- Requires good preparation—often more than just fire lines.
- Often damaging to nontarget as well as target species.
- Timing is important.
- Dangerous.
- Some erosion hazard on steep slopes.
- May not burn evenly; not as site specific.
- Often vegetation is not dense enough to carry fire.
- Environmental concerns.

Biological Control

Grazing for particular purposes is a form of biological control. Such biological forms as insects and diseases are, however, more often considered primary for this overall approach. Many attempts are made to discover insects and plant diseases that will attack only one undesirable plant species. Few examples of good success occur.

To be considered for biological control, the organism must be specific for the host plant and should be controllable. Most such organisms are not native to the problem area.

Some natural biological control takes place. Notable is the sagebrush defoliator *(Aroga websteri)*. Unfortunately, no one knows what factors control populations of the defoliator; it is unpredictable, and populations ebb and flow through time. Two parasites work on both the larvae and pupae stages.

Undoubtedly, biological control agents will be found in the future for more and more undesirable weeds. This form of control will not likely be allowed on native species, however, unless the control organism can be controlled effectively itself.

Range Seeding

Seeding is second to brush control in terms of number of improved rangeland acres. Producers turn to seeding for range improvement because it can offer at least as much palatable and nutritious forage as unseeded native range, and usually more, often at times when native species are less palatable and nutritious. Seedings for early spring use offer a source of feed for cows in early lactation, which need abundant good nutrition to recover well from calving and to start to cycle on time. Seedings for early spring use permit management to defer use of native ranges, which may allow more rapid range improvement than would come about otherwise.

Seeded species often are not only more productive than the natives they replace; they are usually more tolerant to grazing. This will be especially true if the planted species is introduced and not native. Crested wheatgrass, used since the mid-1930s, is the model for this purpose. Early, palatable, and nutritious, it consistently allows the producer to get cows and newborn spring calves off meadows before native species are ready to utilize.

Seeding is indicated under many situations, but most seeding is done for one or both of these reasons: (1) a need for forage that the present species composition and site characteristics cannot fulfill, and (2) the current ecological condition is poor and site potential is high. In such situations, sites with deepest soils, moderate to no slopes, and sandy loam to loamy surface soil should be the first candidates.

As with any other range improvement practice, seedings should be scheduled far in advance. Since finances are generally limiting, a schedule of planned activities might include seedings spread over a period of several years. Species can be planted for more or less specific cases. This should give a manager much more flexibility than having to operate on native range alone.

Seeding success will be limited when annual precipitation averages less than 9 inches. This is particularly so if soils are saline or alkaline as well. Opportunities for range improvement on such sites are limited mostly to improved grazing management, unless the soil moisture supply can be augmented.

In species selection, the primary consideration is: Will it establish, grow, and reproduce under my specific conditions? Such characteristics as drought tolerance, winter hardiness, and season of growth take on great significance. Once a list of adapted species is found, the remaining characteristics center on its use under a rancher's conditions. Will it be productive when needed? How much use will it take and how does this vary from season to season? What is its relative palatability? Will cattle eat and like it? Is its forage value enough to promote desired levels of animal performance?

Broadcast seeding, except immediately after a forest-type fire, usually is not successful. Seed must have soil or some water-holding or retaining material around it to germinate and establish. The competing vegetation will need to be removed, a shallow but firm seedbed should be prepared, and the seeding must be done at the proper season. Rate of seeding, depth of seeding, width of drill rows, and season of seeding all need attention to accomplish success. Attention to detail can be the difference between phenomenal success and absolute failure.

Seeded pastures should be fenced separately from other rangeland to permit grazing management. Producers should not graze until the plants are well established. This is usually reflected by development of a seed crop. There is one exception to this: If the initial stand has many weeds, such as cheatgrass, grazing for a few days with a large enough herd will significantly aid weed control and stand establishment. Grazing should occur when soil moisture is available, and stock should be removed long before moisture is gone. Such short duration grazing should not exceed 10 days. Close management will result in a strong stand.

Recovering investment costs is a function of both the cost itself and the management of the seeding. Seeded pastures can be used much more flexibly than native species. If correct grazing occurs at least once per year, old growth will not build up and poor use should not occur. Frequently, the entire pasture is not seeded**.**

After two years of nonuse, grasses present in the pasture will not be nearly as palatable as newly seeded grasses. This should be considered in a grazing management program. Although many of the seeded species are quite tolerant of grazing, paying attention to amount and time of grazing pressure will be economically important.

Mechanical Range Improvement

In areas where high intensity storms occur during the growing season, opportunity exists for a good deal of the water to run off, even when good vegetation cover is present. Several practices have evolved to solve the problem on rangeland. All were designed to aid range improvement by decreasing water runoff, conserving soil moisture, and increasing efficiency of water use.

Practices include contour furrowing and terraces, ripping, pitting, and water spreading. Only furrowing, pitting, and perhaps water spreading can be recommended as economical. They work well for medium- to heavy-textured soils, but don't show much promise for sandy soils.

Contour Furrows

These are furrows 2 to 5 feet apart and about 8 inches deep, laid on the contour. Newer equipment places small dams in the furrow at periodic intervals. Water is held at its source, increasing soil moisture storage at relatively low cost. It is most applicable to medium to medium-fine-textured soils.

Pitting

Pits are relatively shallow depressions in the soil surface. The objective is to hold water where it falls. Production on shortgrass range increased 30 to 50 percent after pitting, with a change to midgrass, mostly western wheatgrass. Life of pits is limited, however, since sediment builds up over time and reduces their effectiveness.

Water Spreading

This is a form of irrigation where water is diverted from areas of concentration to nearby relatively flat, smooth areas to augment the natural moisture. A good knowledge of runoff characteristics is needed to decide whether water spreading is feasible, since dikes must be constructed to funnel the floodwaters over the land. Often, the area should be seeded and perhaps even fertilized, since the moisture regime, on average, will be better than it was before water spreading.

An important consideration is the probability of floods each year. The cost of system development must be borne by increased productivity, and the number of floods per year strongly influences its profitability.

Range Fertilization

Fertilization is a practice that must produce returns the year the fertilizer is applied. From that standpoint it is a different kind of range improvement practice. In areas of less than about 15 inches of annual precipitation, the plant's growth-limiting factors are mostly weather-related. Nitrogen has been shown to increase a plant's ability to use water, but cost may not justify this increase. Additionally, native species in these and other semi-arid environments evolved under those conditions are often just not economically responsive to increased levels of plant nutrients.

Fertilizers are not effective unless growing season moisture occurs, which generally limits their use to the Great Plains and mountain valleys. Species such as crested wheatgrass have been fertilized economically with nitrogen in precipitation areas less than 15 inches, but results are erratic from year to year.

Benefits of fertilization include increased forage yield, higher nutritive value and forage quality, somewhat longer green forage period, and increased soil moisture efficiency. As a rule, the species composition will be affected by nitrogen fertilization. In areas where both cool- and warm-season grasses exist, a shift toward more cool-season grasses probably will occur if the area is fertilized either in fall or early spring.

Where both annual grasses and perennials are fertilized, annual grass yield will increase to the detriment of the perennials. Nitrogen and sulfur are commonly deficient in western semi-arid areas. Phosphorus may or may not be deficient. Producers should obtain soil tests to determine the major deficiencies.

Grazing animals must be on hand to consume the extra forage from fertilization. If a rancher is in an area of consistently good late spring moisture and could use more forage then and in summer, fertilization, especially of seeded pastures, could be desirable. The range could be stocked with animals to that expected level of forage production.

Conversely, if moisture is consistently the most limiting factor, the stocking level should be in relation to the average, or slightly below average, forage supply. Fertilization would only stimulate more forage in the above average moisture years when more forage is generally available than can be used anyway. Consequently, fertilization on dryland ranges, whether native or seeded, is often a questionable practice.

Mountain meadow vegetation, whether seeded or not, should respond to nitrogen and sulfur, and perhaps phosphorus also, depending on the legumes present. Legumes need relatively more phosphorus and sulfur than do grasses and grass-like plants. Thus, to maintain legume production, the need for phosphorus must be satisfied.

With the cost of all fertilizer certain to increase, the practice of fertilization requires close economic scrutiny. Usually a producer can profit by fertilizing irrigated hay meadows and pastures.

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