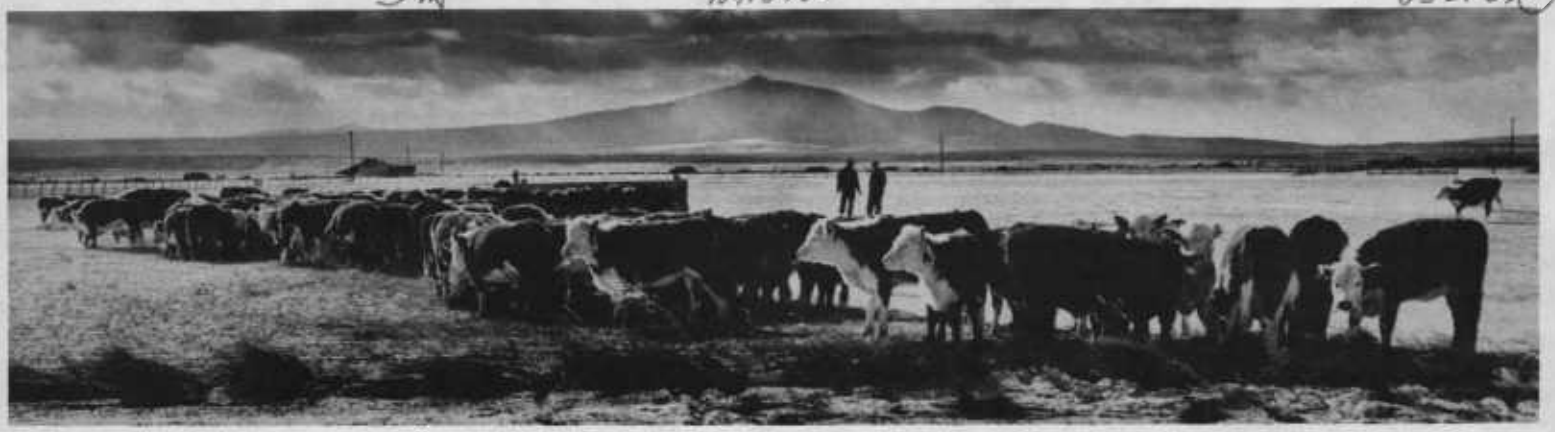

Range Improvements— Ways to Increase Forage Production

Range improvements are changes 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, producers will have identified their problems and the opportunities for correcting them. Some form of range improvement probably will be considered.

The producer should make a thorough economic analysis of each problem situation and its alternative solutions. A number of 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. Projected total income and the total costs over the life of the range improvement project 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. You need to understand clearly what production and management advantages and disadvantages accrue to use of specific practices. Since there is great variability in conditions, you are advised to obtain technical assistance for making a study of the alternatives. Some Extension agents and specialists and Soil Conservation Service technicians are trained in this field. They may know of alternatives you hadn't thought about.

Overall Consideration

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

Consider improving the highest site potential areas 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, consider improving the higher ecological condition areas before tackling the poor and fair condition ones. Good range responds to treatment more rapidly than poor, and there should be a greater level of biological stability. You also need to recognize, however, that the total amount of response may not be as great as 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, keep grazing in mind as an improvement practice as well as just a way to maintain forage production and utilization. Maintaining use on all areas is essential. In years of too much grass, lack of use may encourage no use 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, be certain to apply a grazing strategy that will maintain the productivity engendered by the improvement. Producers must recognize that grazing animals can have good impacts or detrimental impacts on plants.

Finally, most improvements need followup. Understanding the kind of sites one works with will give large clues as to the kinds and amount of followup that will be needed. Often the same practices can be repeated for followup: for example, fire on big sagebrush, where many seedlings emerge. Repeat when necessary.

Prescribing the correct practice or set of practices for the various ecological sites requires good technical knowl-

---

Prepared by Thomas E. Bedell, Extension rangeland resources specialist, Oregon State University, Corvallis.

Extension Circular 1044 **December 1980**

OREGON STATE UNIVERSITY EXTENSION SERVICE

Extension Service, Oregon State University, Corvallis, Henry A. Wadsworth, director. Produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties. Extension invites participation in its programs and offers them equally to all people.

edge. If you feel you don't have that know-how yet, don't be embarrassed to request some assistance.

Control of Undesirable Plants

A number of 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 fairly rapidly. Therefore, the conditions under which these practices apply need to be clear. Do not expect some desirable native plants to come back in rapidly just because you remove the bad ones, unless there is a sufficient population of the desirable ones already present. If there isn't, then consider seeding the desired species along with plant control of the undesirable. Some of the most successful seedings incorporate a practice like 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 water yield and availability improves. Stock have more accessability to forage and they are easier to handle when trees and brush are controlled. Poisonous plants may be controlled. Weed seeds may be reduced. Fire hazards should be reduced and 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 means, usually bulldozing or dragging with a heavy chain, often are utilized because no other practice is either effective or economical.

Advantages and disadvantages are not clear cut. Depending on the technique, high selectivity can occur (bulldozing) or low selectivity (chaining). Mechanical control often is a means of seedbed preparation prior to seeding.

Advantages

- Timing not critical. Can do when ranch labor available.
- Generally considered most convenient of methods.
- However, 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

This general category of methods has been phenomenally successful in achieving range improvement. Use only chemicals that are registered by the Environmental Protection Administration (EPA) for that specific application. Because of this regulation, it is more and more likely that most chemical application will 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 (granules primarily).

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 as long as done properly.

Disadvantages

- Timing is very critical for many herbicides.
- Weather and environmental conditions can limit, e.g., soil moisture too low.
- No chemicals yet for several major species.
- Damage to crops in area.

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 an overall part of a management program, as well as just for range improvement—as for example, to burn off old forage residue as an encouragement for better livestock distribution. This 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—forage plants may be more nutritious.
- Controls insect populations—insects prefer old residue; removes that.
- Improves game habitat.
- Opens up areas for access.

Disadvantages

- Liability when escapes occur.
- Need good preparation; i.e., often more than just firelines.
- Does not kill sprouting plants.
- Often damaging to non-target species as well as target ones.
- Timing important.
- Dangerous.
- Some erosion hazard on steep slopes.
- May not burn evenly—not as site specific.
- Often vegetation not dense enough to carry fire.

Biological

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

Undoubtedly, biological control agents will be found for more and more undesirable weeds in the future. However, it is unlikely that this form of control will be allowed on native species, 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, and usually more, forage that is palatable and nutritious than unseeded native range, 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 start to cycle on time. Additionally, seedings for early spring use permit deferment of use on native ranges, which may allow more rapid range improvement than would come about otherwise. Often, seeded species are not only more productive than the natives they replace; but 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 1930's, 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 for use.

Seeding is indicated under a large number of situations, but most seeding is done for one or both of these reasons: (1) there is a need for forage that the present species composition and site characteristics cannot fulfill, (2) the current ecological condition is poor and site potential is high. In such situations, those sites with deepest soils, moderate to no slopes, and sites of 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 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 around its use under your conditions. Will it be productive when I want to use it? How much use will it take and how does this vary from season to season? What is its relative palatability? Will my cattle eat and like it? Is its forage value enough to promote desired levels of animal performance?

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

Seeded pastures should be fenced separately from other rangeland to permit grazing management. Don't 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, like cheatgrass, grazing for a *very short time* (few days) with a large enough herd will significantly aid weed control and stand establishment. Graze when soil moisture is available and remove stock long before moisture is gone. Such short-duration grazing should not exceed about 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. A great deal of flexibility in use exists as compared to native species. A number of grazing plans may be used. If correct grazing occurs at least once per year, old growth will not build up and poor utilization should not occur. Frequently the entire pasture is not seeded. After 2 years of non-use, 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 to 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. A number of different practices have evolved to solve that 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, contour 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 a period of time, which reduces the effectiveness.

Water spreading

This is a form of irrigation whereby 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 in order 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 limiting growth factors are mostly weather-related. Nitrogen has been shown to increase a plant's ability to utilize water, but cost may not justify this increase. Additionally, native species in these arid to semi-arid environments evolved under those conditions and often are just not economically responsive to additional 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, a 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. Or, 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. Phosphorous may or may not be deficient. Obtain soil tests to determine the major deficiencies.

Grazing animals must be on hand to consume the extra forage from fertilization. If you are 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 phosphorous also, depending on the legumes present. Legumes need relatively more phosphorus and sulfur than do grasses and grass-like plants. Thus, to keep legume production, the need for phosphorous must be satisfied.

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