2. The "International Working Group" would be formed, *Ad-Interim,* by the persons participating in the Round Table. The members would remain as such until ratified by their governments.
3. The FAO Regional Office publish a proceedings of the papers presented at the Round Table.
4. The FAO Regional Office support the conducting of national and/or international courses to train leaders in range management.
5. Argentina's Instituto Nacional de Tecnalogia Agropecuria (INTA) publish the Range Management Training Manual prepared for a course on the subject that was conducted in Argentina in 1982.
6. The University of Chile, through its Centro de Estudias de Zonas Aridas of the Facultad de Ciencias Agraras y Forestales organize, publish and distribute a newsletter on the activities related to the rangelands of Latin America and the Working Group.

A midweek break in the Round Table agenda was a field trip to the livestock farms of Ricardo Aristia de Castro and Juan Edwardo Castillo to observe livestock production and Mediterranean rangeland. Both range and tame pastures were utilized for range in the programs. Mr. Aristia de Castro had purebred Herefords, but was beginning to use Charolais bulls in a cross breeding program. Mr. Castillo had a fine wool sheep operation (13,000 high quality breeding ewes) but also grazed cattle (Clavel and Freisian).

Diversification of enterprises was noted on both ranches. With the Pacific Ocean serving as a boundary on Mr. Castillo's Station Lucia Farm, sea water was being evaporated to produce salt. Alfalfa, wheat and chick peas were also being produced on the farm. Mr. Aristia de Castro had swine, corn, and a charcoal operation which utilized a species of *Acacia* that was being cleared from certain range sites.

The field trip afforded the opportunity to observe the agronomical and horticultural production in the Santiago area. A wide range of vegetable and fruit crops was being produced; a major portion of some of the crops is exported to the United States. ●

Good Range-Good Forages: Are They Equal?

R.D. Pettit

Every range manager, agronomist, rancher, or technician has a favorite forage which they "swear" will alleviate many agricultural-forage problems. Because of many different opinions, I wonder if there is a "perfect" forage. Do we really have any common standards to judge the quality of plants or plant communities? A favorite story about forages was one by my barber in Corvallis, Oregon. He always mentioned that black-tailed deer liked his garden! For two years he swore that deer only ate tomato plants! In Texas I hear the same story but with a more drought tolerant plant! A lot of folks do not agree on the components of a good forage.

Frequently we note that some grasses, forbs, shrubs, or trees are relished by grazing animals. When asked why, no one can give a definite answer. We cannot ask the animal why it ate a weed one day and our favorite forage the next. Once I noted a heifer feeding exclusively on pine tree seedlings. Two weeks later, ninebark was the preferred forage. Also, cattle relish weedy primrose and ragweed! Quite frankly, we cannot give a good answer as to why animals graze *what* and *when* they do. We can only conclude they like *variety* in their diet.

There is increasing interest in "weed ranching." Some feel that weeds, whether grasses or broadleaves, are the way to make money in the ranching business. Others believe in the "good" plant theory. Many are tempted to judge the management skills of their neighbors based upon the way his pastures or range look. Sometimes "Joe" makes more net profit than his neighbor who stocks moderately and/or rotates his grazing allotments and has good range. Who is the best or perhaps wisest manager?

Many rate alfalfa as near perfect. Can you think of any better species? We all know at least one or more weakness. For example, bloat, weevil damage, dodder, and other problems come to mind. Is this a manager's problem rather than a forage weakness? Occasionally, we get a big head in lambs from grazing kleingrass or emphysema in cattle from grazing Bermuda grass. Johnson grass also has received "bad press" because of prussic acid poisoning, particularly on regrowth after frost or drought. Many forages, in every state, occasionally receive bad publicity from ranchers. It is interesting that one rancher's nightmare might be another's "gold mine".

In a plenary session of the Soil Science and Agronomy meeting in 1976, an animal scientist was "jabbing" agronomists for not breeding forages with lower fiber and higher digestibility. One gentleman from the audience got up and with all the modulation he could muster, shouted, "Why do not animal scientists seek a breed of cattle with smaller bones"? You can imagine the audience's response! A good point, nevertheless, animal scientists and agronomists have not often worked collectively to provide efficient production of a salable product.

We have come a long way in a few years to develop inter-

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In the native state sand shinnery oak makes up 80 to 90% of the production. An occasional grass plant can be seen but cattle have to spend considerable time grazing to get their daily dry matter requirements.

disciplinary programs to minimize criticisms between and strengthen the disciplines. Coordinated efforts among agronomy, range and wildlife science, animal science, agricultural economics, and engineering are being used at Texas Tech and elsewhere to integrate available knowledge into economically feasible plans. We try to tailor this to individual ranch needs.

This article points out some evaluation characteristics of forages using a modified European approach (Molen and Koelstra 1956). If an area consists of several communities, each is rated separately than adjusted or weighted to get an average pasture quality worth. Although subjective, as most ratings are, it might provide a new perspective about what we see on the land. The score sheet after the pasture was evaluated ranges between 0 to 10 with 0 to 3 being bad; 3.1 to 5 rates insufficient; 5.1 to 6 as medium; 6.1 to 7 was sufficient; 7.1 to 8 rated good; and 8.1 to 10 was considered excellent.

Evaluation Characteristics of Forages

Most plants have both desirable and objectionable traits. Consequently, it is difficult to assess a plant's forage value. Just when we feel we know the best forage, the animal no longer selects "our" preferred forage or forages. Has the preference changed, or are we dealing with a forage palatability factor not understood?

The criteria I use for evaluation are modified from Molen and Koeltra (1956). Guidelines for this evaluation are from observing cattle on a grazing study for 2 years on a tebuthiuron-treated and untreated sand shinnery oak range. Second, studies on the eco-physiology of this community for 15 years looking at roots, growth, carbohydrate storage, etc., have been used.

1. *Longevity of species.* Is the forage an annual or perennial? If a perennial, does it live for only a few years or is it going to be around for many years? Annuals will receive a low rating here but if they are palatable and grow every year, other criteria ratings can be high.
2. *Palatability factors.* Do animals readily accept the forage through the grazing period or do they try to find other plants before they graze it? Is the plant tender (succulent) or coarse? Does the plant have spines or other features affecting its palatability?
3. *Regenerative ability.* The forage produces many viable seeds, has stolons and/or rhizomes, and can regenerate quickly; or the species spreads slowly and has a low seed crop and/or germinability.
4. *Quality components.* This is primarily related to digestible protein, phosphorus, cellulose, and other nutritional parameters.
5. *Yield.* Often genetics control the potential dry matter yield of a species. Superimposed on this are the environmental factors; precipitation, air and soil temperature, and soil nutrients. Growth, with little precipitation, is especially important on arid-semiarid ranges.
6. *Seedling vigor and establishment ease.* Many seedings fail because too much time is required from seeding date to first root emergence. Such seedlings may be especially vulnerable to environmental stresses. Also insects and small mammals may clip off the first leaves. For example, 2 or 3 days may be sufficient to germinate weeping lovegrass, while buffalograss is slow to germi-

Table 1. Ratings of more important forages on sandhill rangeland in west Texas using 10 forage quality factors.

Quality factors	Little bluestem	Purple threeawn	Sand dropseed	Thin paspalum	Red lovegrass	Hairy grama	Other grasses	Perennial forbs	Annual forbs	Shin oak	Other shrubs
Longevity	10[1]	7	8	5	5	9	5	7	0	10	7
Palatability	7	4	9	9	2	10	4	10	3	2	3
Regeneration	7	4	8	7	8	8	4	7	9	9	1
Quality	7	4	7	8	2	10	5	10	4	1	3
Yield	10	6	6	3	2	3	2	2	4	10	1
Vigor	5	6	8	7	7	6	2	4	9	1	1
Resistances	10	10	9	5	8	9	7	9	9	8	9
Grazing tolerance	8	8	8	9	10	10	7	8	3	9	8
Root structure	9	4	6	5	3	7	4	6	2	10	2
Management	7	3	7	6	4	9	3	9	6	Ç8[2]	1
Average[3]	8	5.6	7.6	6.4	5.1	6.2	4.3	7.4	4.9	5.4	3.6

[1]Quality rating on a 1 to 10 scale with 10 representing the highest rating and 1 the lowest.
[2]Rated as such because of toxic property.
[3]These averages are multiplied × composition to derive species values.

Much of this range can be converted to a midgrass prairie after treatment with tebuthiuron. This typical view was taken three years after herbicide application. Dominant grasses here are little bluestem and the light-colored purple threeawn. Average height of the bluestem is over three feet. No range seeding has been used.

nate. Seeding depth, rate of first root elongation, seed coat characteristics, available endosperm tissue, amount and frequency of precipitation, and other factors affect vigor and establishment. Millions of dehisced seeds in the oak type germinate but rarely do any survive when the sandy surface becomes dry and hot—over 150° F.

7. *Resistances.* Many forages are more resistant to parasites, drought, freezing, insects, etc., than are others. The biochemical makeup (gallotannins, terpenes, etc.) of the plant is important to species tolerance of these external influences. Removal of all branches from sand sagebrush and placement below the canopy leaves bare areas; allelopathic, I believe.
8. *Tolerance to grazing or defoliation.* Timing and elevation of growing points and the amount of leaf or stem tissue that may be harvested without injuring the plant are important characteristics. Effect of grazing on root growth and tiller formation need to be considered in an appraisal program.
9. *Rooting structures.* Deeply rooted plants or those with large taproots and/or rhizomes are more desirable in many areas than are weakly fibrous roots that penetrate only into the topsoil. Plants with a high root to shoot ratio have several advantages over those with a low ratio. Large underground rooting structures not only store water during wet periods, but vast amounts of energy are stored as "insurance" against drought and defoliation.
10. *Management problems.* This may be the most important criterion for evaluating a forage. It takes into consideration many of the above criteria and it considers the expertise of the manager. Time of grazing, toxic properties, bloating, and spines-thorns are among the many factors to be considered here.

An experienced manager can rate each species in the pasture or range based upon these criteria and determine its relative worth. Using a scale of 1 to 10 for each criterion, a perfect forage in a pure stand would receive 100 points (10 × 10) in this system.

An example of forage parameters and the rating system follows. The setting is an untreated and tebuthiuron treated sand shinnery oak type which predominates on sandy soils in west Texas, southeastern New Mexico, and western Oklahoma.

This is a deciduous mini-forest in a semiarid environment. Most "trees" only grow 1 to 2 ft. tall. Its extensive rhizome system gives a root-shoot rato of up to 16:1 and has up to 10,000 stems per acre. Current year yields show the oak to be about 80% of the herbage.

When oak is killed by herbicides, this type is converted to a midgrass prairie with little bluestem dominant. A secondary decreaser is sand bluestem while major increasers are sand dropseed, thin paspalum, red lovegrass and purple threeawn. From 20 to 30 other grasses, forbs, and shrubs make up the remaining components of this community.

Table 1 gives species ratings using the 10 evaluation characteristics. The community evaluation (range value) is in

Table 2. Yield, composition, and average value of forages on sand shinnery oak range treated (Tr) and untreated (Untr) with tebuthiuron. Data taken August 1979, Cochran, County, Texas.

Species	Yield		Composition (A)[1]		Rating (B)[2]	(A) × (B)[3]	
	Untr.	Tr.	Untr.	Tr.		Untr.	Tr.
Little bluestem	60	500	4.8	29.6	8.0	38.4	236.8
Purple threeawan	61	150	4.8	8.9	5.6	26.9	49.8
Sand dropseed	28	270	2.2	16.0	7.6	16.7	121.6
Thin paspalum	10	70	0.8	4.1	6.4	5.1	26.2
Red lovegrass	24	180	1.9	10.7	5.1	9.7	54.6
Hairy grama	33	100	2.6	5.9	6.2	16.1	36.6
Other grasses	50	120	4.0	7.1	4.3	17.2	30.5
Perennial forbs	50	105	4.0	6.2	7.4	29.6	45.9
Annual forbs	10	180	0.8	10.7	4.9	3.9	52.4
Shinnery oak	906	15	72.0	0.9	5.4	388.8	5.6
Other shrubs	25	0	2.0	0.0	3.6	7.2	0.0
Totals	1257	1690	99.9	100.1	64.5	559.6	660.0

[1]Composition is based upon dry weight (current years growth) of plants.
[2]Ratings came from averages in Table 1.
[3]Total divided by 100 gives average range value.

Table 2. Because oak contains considerable tannin-like compounds, it often kills animals, thus receives a negative rating for management. We know that forage quality is slightly improved after herbicide treatment but for this analysis the forage rating scale has remained the same. One conclusion from this appraisal is that treated sand shinnery oak range is more valuable after oak is controlled than without control. After dividing the weighted ratings by 100, untreated oak pasturage rates 5.6 whereas the treated range scores 6.6. When the contribution of oak is removed, untreated range scores 1.7 points, consequently the quality factor has increased following oak removal and is 3.9 times better if oak is not considered a forage resource.

Consumption of too much oak causes cattle to become "shinnered". When in this condition, the animal will seldom recover. Occasionally 25 or more percent of the animals are poisoned.

Because grass yields increase from 250 lb/acre in untreated to over 1,300 on treated areas, our assumption is that the range is more than two times as desirable after oak is killed. Our study suggests that we can more than double the stocking rates after oak is killed. Then we have other problems: the threeawn and little bluestem become unpalatable, forage quality diminishes in the fall, and cow condition starts to decline. So we have corrected one problem, the brush; *now* we have a grazing management problem.

In this evaluation I used composition percentages determined from herbage yields; however, other composition data would be just as applicable. This system rates little bluestem, hairy grama, and perennial forbs as quality components of the forage resource. The shrubs, sand sagebrush and Southwest rabbitbrush, are equally unpalatable as is the oak but not toxic; consequently a rating of 2 was given. For sheep and goats, these evaluations would change; however, few of these grazers are used in this specific oak type.

My Evaluation of the Method

I know this is a subjective approach to evaluate rangelands. It works for me because of the information gained from observation and research studies. Watch what your animals eat *throughout* the year and assign a preference rating; adjust it up or down as you desire; it makes no difference whether you rate high or low, as all plants will be on the same scaling system. Use a shovel to examine underground root structure and soil characteristics and take good notes of everything you observe. You must read the literature to gain as much information about your range type as possible. Ask others questions about what you observed.

Although not an unbiased technique, I find it helpful in our area. It can also be applied for ranch appraisal to compare prices for the "best buy." Currently, ranch appraisers have few guidelines to determine fair market value in this area. Use of this technique can also give a better approximation of stocking rate after oak is killed.

Details of how a rancher can use this evaluation technique are not possible without considerably lengthening this report. The 3 key factors in making it work are: (1) the same general range site needs to be compared. You cannot compare a wet meadow to grassy forest opening, (2) you need an experienced or educated guess of the rating each major forage should receive, and (3) a "ball park" or better estimate of forage composition must be available.

Readers desiring to do so are free to send me their estimates and I believe that I could make a fairly accurate evalua-

tion of the sites. Except in the short grass prairie where grama-buffalograss and dropseeds make up a high percent of the composition, a diverse mixture of good grasses (annual or perennial-cool and warm season), forbs (annual and perennial), and several palatable shrubs with persistent leaves is my choice. Many experienced cowmen in the Southwest claim to have better condition animals coming off range with a variety of these plants. Consequently, I do not believe that good range and good forages are equatable. Soil-site potential, livestock performance, and managerial skills are the master keys to successful ranch management.

'Lassen' Antelope Bitterbrush: a Browse Plant for Game and Livestock Ranges

Nancy Shaw and Stephen B. Monsen

A unique selection of antelope bitterbrush (*Purshia tridentata* [Pursh] DC) recently became the first accession of this valuable western shrub species to be released for commercial seed collection and production. Chosen for its productivity, palatability, winter leafiness, cover value, and seedling vigor, 'Lassen' antelope bitterbrush is a useful shrub for wildlife and livestock ranges, conservation plantings, and reclamation projects on adapted sites in the Intermountain and Pacific Northwest regions.

'Lassen' antelope bitterbrush growing near Johnstonville, Lassen County, California.

The release of 'Lassen' resulted from cooperative efforts of the USDA Forest Service, Intermountain Forest and Range Experiment Station; USDA Soil Conservation Service; Utah Division of Wildlife Resources; Nevada Division of Forestry; California Department of Fish and Game; California Department of Forestry; California Agricultural Experiment Station; Idaho Agricultural Experiment Station; Nevada Agricultural Experiment Station; and Oregon Agricultural Experiment Station.

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Description

'Lassen' antelope bitterbrush is unusual in its large size, uniform growth habit, and morphology of mature plants. Shrubs are upright with a spreading, leafy crown. Depending on site conditions, plants vary from 5 to 9 feet tall with crown diameters often exceeding the height. In early spring and summer, numerous solitary flowers and large achenes develop over the periphery of the crown on stems produced the previous years. Seeds ripen in early July and are quickly disseminated. In fall, fascicles of small, pubescent overwintering leaves replace the more abundant summer foliage. 'Lassen' tends to be leafier in fall and winter than many sources of antelope bitterbrush, which may account for its relatively high nutrient value during this season. On a dry weight basis, Welch et al. (1983) obtained in vitro protein content and digestibility value of 7.9 and 30.6 percent, respectively, for leaders collected in February. These were higher than values obtained for other sources of antelope bitterbrush and lower than Stansbury cliffrose or desert bitterbrush. Leaves constituted 15.1 percent of the new growth.

Origin and Development

In the 1940's, concern over deterioration of big-game and livestock ranges in northeastern California spurred researchers from the Pacific Southwest Forest and Range Experiment Station and the California Department of Fish and Game to begin investigations of antelope bitterbrush ecology and use of the shrub in range revegetation programs. In 1952, E.C. Nord made initial collections of 'Lassen' for inclusion in selection trials and seeding studies from stands near Janesville, Lassen County, California. The elevation at Janesville is approximately 4,200 feet with a mean annual precipitation of 14 inches. The temperature averages 49° F with summer highs of 100° F and winter lows of 15° F, although extremes of 106 and -17° F are on record. Associated species are basin big sagebrush, rubber rabbitbrush, and on moister sites, ponderosa pine (Nord 1965, Alderfer 1977).

In 1953, A.P. Plummer and A.T. Bleak obtained seed from the Janesville area for testing in Utah and Nevada. Plantings were extended to Idaho in 1956 by R.C. Holmgren. Interest in the characteristics and adaptability of this source led to