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George E. Hull, Director of Extension Service,
The University of Arizona College of Agriculture.
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MAP — Yavapai County Forage Types...................... Inside Back Cover
Range forage production on any area cannot be set down as an exact figure to be used and relied on year after year. Rainfall differences may increase or decrease forage production from one year to the next. Grasshoppers or crickets may destroy a forage crop almost overnight that was relied on to give many months grazing. Game animals may increase to a point where they overgraze the range and reduce forage production; or, management of domestic livestock may improve or deplete a range and radically change its grazing capacity within a few years. These continual changes in forage production may make any tabulation of forage resources of little value from one year to the next.

In contrast with grazing capacity tabulations that may mean very little, it is highly important to a rancher that he be able to tell whether the various parts of his ranch are producing as they should. He is also in a better position than anyone else to tell whether his range is improving or deteriorating. It is the purpose of this bulletin to present such a method for classifying the principal range areas of Yavapai County.

Four range types are included in this classification: Pinyon-juniper, chaparral, grassland, and desert grassland. A fifth type, desert shrub, occupies some of the lower portions of the county. Because of its small area and low grazing value condition descriptions for the desert shrub have not been included here. There are also limited areas that support a stand of ponderosa pine or Douglas fir. The pine-fir type occupies so little of the county that it has not been included in the forage types described.

RANGE CONDITION — WHAT IT MEANS

The value of range lands commonly depends on the quality and quantity of forage produced. This is reflected indirectly in livestock production. Forage production can be expressed as range condition; in general, the more forage produced on a given site the better the range condition.

The Yavapai County range lands included in this publication are classified into four condition classes. Each class is determined largely by the amount of forage produced expressed in terms of the amount the same site could produce. The four condition classes and the forage produced on each are:

Excellent: Producing from 75 to 100 per cent of all the forage the site could produce.

1 Department of Agronomy and Range Management, College of Agriculture, University of Arizona, Tucson.
Good: Producing from 50 to 75 per cent of the forage the site could produce.
Fair: Producing from 25 to 50 per cent of the forage the site could produce.
Poor: Producing less than 25 per cent of the forage the site could produce.

FORAGE PRODUCTION NOT THE WHOLE STORY

Although the condition of a range is defined in terms of the amount of forage being produced, several other factors are also involved. The most important factors are erosion, ground cover or density, litter or dead plant material on the ground, forage vigor, and seed production. All of these may not be involved in every case but each one should be considered.

CURRENT EROSION

Nothing is more essential to the ultimate productivity of a range than its soil. When a range is classed as being in excellent condition this means that for practical purposes it cannot be improved. Any range that is actively eroding has something wrong with it and is not in excellent condition. Current erosion, therefore, is highly important as a factor that affects range condition. A range that is being severely eroded is not in excellent condition even though it might still be producing 75 per cent or more of all the forage possible on this site.

GROUND COVER

The amount of ground covered by vegetation, sometimes called "density," may affect both forage production and erosion. In general, ranges producing a large amount of forage have a denser ground cover than less productive areas. This is not true in some extreme cases where grasses have become sod-bound. Under such a condition the greatest forage production may occur on comparatively open stands. As a general rule, however, high densities mean high forage production and little erosion. These combine to indicate an excellent condition range. Similarly, a decrease in density is generally associated with poorer range condition.

LITTER

The amount of litter or undecayed dead plant material on the ground helps to indicate condition. Moisture penetration and seed germination are both increased where litter is abundant. Ranges with a good cover of litter, therefore, generally produce more forage and are less eroded than ranges where litter is thin or lacking. Large amounts of litter are generally associated with good or excellent condition; smaller amounts with fair or poor condition.

PLANT VIGOR

The vigor of plants is often useful in determining condition. A vigorously growing plant produces more forage than one that
is weak and is more effective in controlling erosion.

Vigorous forage plants usually indicate a good or excellent condition, or at least an improving range. When the poor forage plants are vigorous, and the good forage plants are weak, this is an indication of a low range condition or a range that is on the downgrade.

SEED PRODUCTION

Seed production is frequently of value as a criterion of range condition. This is true particularly on run-down ranges where seed production is important in revegetation. On the other hand, very little seed may be produced on top-condition ranges, most of the plant’s energy going into vegetative growth. The low seed production in these cases does not affect range condition since the areas are already producing all the forage the climate will support and seed production, except to make richer feed, is of little importance.

VEGETATION TYPES

GRASSLAND

The true grassland or short-grass range in Yavapai County lies largely at elevations between 4,000 and 5,000 feet. Typical areas occur in the Verde Valley north of Prescott, in Chino and Lonesome valleys, and along Highway 66 between Ashfork and Seligman (Plate I).

Plate I.—Grassland range north of Prescott.
On the better condition grassland ranges blue grama, galleta grass, black grama, hairy grama, and side-oats grama predominate. Ring muhly and red three-awn may be present but make up only a small part of the total vegetation. Such weeds as tumblemustard and Russian thistle rarely come in on top-condition ranges.

On run-down grassland, although blue grama may still be abundant, there is little side-oats grama. Ring muhly and red three-awn are usually plentiful. Weeds, including Russian thistle, tumblemustard, and sunflower are frequently common. Snakeweed, which occurs only occasionally and on shallow soils on the better-condition ranges, may be very abundant on deteriorated ranges.

PINYON-JUNIPER

Rather extensive areas in Yavapai County support a stand of juniper or juniper and pinyon pine (Plate II). Most of the range where pinyon pine occurs today mixed with juniper grew these same species before white settlement. Typical stands occur in the higher country south of Seligman, in some of the range south of Ashfork and in much of the country between Sedona and Stone- man Lake.

The better-condition pinyon-juniper ranges produce a good understory of blue grama often intermixed with side-oats grama. Winterfat, cliffrose, and silktassel may be locally abundant. As

Plate II.—Pinyon-juniper range south of Seligman.
the range deteriorates the grass stand becomes thinner. Low value
weeds such as annual goldeneye and clubflower fill in the open-
ings. Snakeweed and threadleaf groundsel may become common.

Many pinyon-juniper ranges produce so little forage that they
are almost valueless for grazing. The ground is largely bare and
erosion may have washed away much of the topsoil leaving a
rocky-appearing surface. These ranges will continue to produce
little or no forage as long as the juniper remains.

Much of the area where juniper grows today as pure stands
was once open grassland. These former grassland ranges can be
told from those that originally supported pinyon and juniper by
the general absence of the pines and by the age of the junipers.
Few or none of the trees are old and gnarled and the oldest all
appear to be about the same age.

Most of the grassland ranges invaded by juniper occur at ele-
vations just above the open grassland. Typical areas can be seen
north of Chino Valley toward Ashfork, between Ashfork and
Seligman, and south of Seligman on the old road to Prescott.
Much, though not all, of the juniper-covered range in these areas
was once grassland. Although many of these ranges are still
highly productive, in some places the grasses have largely disap-
peared. In years of good rainfall the ground may be covered with
a stand of low-value annual weeds such as annual goldeneye and
clubflower. Other areas, in good years and bad, may support an
understory of snakeweed and threadleaf groundsel.

CHAPARRAL

The chaparral type occurs for the most part below the grass-
land and above the desert shrub or desert grassland, generally at
elevations between 2,000 and 4,000 feet. Chaparral is a brush type,
very thick in some places, rather open in others. In some areas
grasses may grow between the bushes; in others, grasses are com-
pletely lacking (Plate III).

An extensive stand of chaparral lies in the area between
Cherry and Dewey and extends south past Humbolt and Mayer.
Other typical areas lie between Prescott and Skull Valley.

Shrubs of many kinds are common in the chaparral type but
none more so than scrub oak. Other abundant shrubs are man-
zanita, squawbush, mountain mahogany, Apache plume, catclaw,
buckbrush, mountain laurel and silktassel.

Although grasses are usually thinly scattered, there are several
that are valuable forage producers. Some of the commonest of
these are blue grama, side-oats grama, black grama and wolftail.
On the pooper sites or where the range has deteriorated, low-
value red three-awn and red brome may be common.

A few half-shrubs are typical of the type. Two of these, twin-
berry and shrubby buckwheat, are valuable forage plants. A
third, snakeweed, is often abundant on run-down ranges where
the grass cover is thin. This undesirable half-shrub rarely occurs
on the better-condition chaparral ranges and, except on shallow
or very low fertility soils, is a reliable indicator of range that can be improved.

DESERt GRASSLAND

The desert grassland is the most arid of the true grazing types in Yavapai County (Plate IV). The type occurs extensively in the southwest corner of the county in the Date Creek and Hassayampa River drainages and west of the Weaver and Date Creek Mountains. As the country becomes drier the grassland grades off into desert shrub, particularly in hilly or shallow-soil areas.

Forage production of the desert grassland, as well as the area covered by it, was originally considerably greater than it is today. Many of the grasses have been thinned out or entirely killed. In many places unpalatable shrubs such as creosote bush and cacti have come in as the grasses have gone out. This has changed the aspect from one of grassland, or grassland with scattered shrubs, to one of shrubs with or without grass. Occasional flats may contain neither grass nor shrubs but only a stand of seasonal annuals.

Tobosa grass is the dominant grass in the desert grassland. Other valuable grasses in the type are black grama and curly mesquite. Filaree is abundant in the spring of good years and may produce a large amount of feed for short periods. Two low-growing shrubs, shrubby buckwheat and bur sage, are locally abundant and produce fair forage. Larger shrubs, principally
mesquite, whitethorn, Joshua tree and creosote bush may be common locally.

**DESERT SHRUB**

The desert-shrub type (Plate V) generally lies at lower elevations than the other vegetation types in Yavapai County. In comparison with the others it is poorly suited to grazing. This is due in part to lack of forage; in part to inadequate water.

Some grasses are scattered through the desert shrub but these are frequently restricted to the shelter of bushes where they are protected from grazing animals.

Some of the more common shrubs in the type are palo verde, catclaw, whitethorn, creosote bush, bur sage and various cacti. Bush muhly is probably the most palatable grass though it generally occurs too sparsely to provide much forage. Tobosa grass is also common in low places where runoff waters accumulate.

Although used for grazing, forage production in the desert-shrub type is so low that this area can hardly be classed as a grazing type. Such annuals as filaree and Indianwheat may produce abundantly in local areas during wet springs. At other times these annuals produce almost nothing.

Because of its low forage production the desert-shrub type changes little even under prolonged drought or heavy grazing. For this reason no attempt has been made here to classify it as to condition.
RANGE TRENDS

It is of great practical importance to know not only the present condition of a range but also whether that range is improving or deteriorating. Range forage production never stands still, never remains the same year after year. These changes may have many causes, some of which can be controlled, some of which cannot be. Management methods that are improving a range should be continued if at all possible. On the other hand, when a range is on the downgrade because of management, the need for a change is evident. The ability to determine trends helps a rancher to see where his ranch and, consequently, his own finances and future are headed.

Factors other than grazing, such as drought or fire, may affect the size and vigor of vegetation. The effect of these factors has no relation to palatability or the value of a species for forage.

Even when a range deteriorates because of drought, the ability to detect the direction of trend early may permit management changes that will help to check the damage being done. Or, when a range is improving as a result of abnormally heavy rains, the ability to recognize this improvement may permit increased stocking or other changes in management to take advantage of the extra forage being produced.
INDICATORS OF AN IMPROVING RANGE

EROSION

Old gullies that are becoming grassed over indicate a range that is improving or that has improved at some recent time. The amount of runoff from grazing lands is usually in rather direct proportion to the condition of those lands. Loss of both soil and water is generally excessive from run-down range but as the condition improves more water is held where it falls. Gullies that before were actively cutting will carry less water and soil, and will have a chance to start healing.

PLANT VIGOR

Vigorous growth on the better forage plants generally indicates range that is on the upgrade or that is already in top condition. Range condition is literally range health, and a range is no more healthy than the forage-producing plants growing there.

DEGREE OF USE

Moderate to light grazing of the better forage plants will lead to improvement of a run-down range or maintenance of a range already in top condition. Vegetation weakened by too-heavy grazing cannot produce the feed that it would were it growing vigorously. Weakened plants must be grazed lightly or at least not overgrazed if they are to be brought back to a healthy and vigorous state.

LITTER

Accumulation of litter on a range is an indication of improvement. This litter may serve also as a highly effective means of erosion control. The dead stems and leaves lying on the ground slow down the rate of runoff and cause soil to be deposited that would otherwise be carried off. Water is slowed down as it moves across the ground and has a longer time to penetrate the soil. A range without enough litter to control erosion cannot be on the upgrade even though some of the other indicators may seem to point that way.

SEEDLING ESTABLISHMENT

Establishment of many new plants of the better forage species and few plants of the poorer species indicates an improving range. Most run-down ranges do not have a sufficient ground cover of forage-producing species. Establishment of seedlings of these species indicates that conditions for seed production and germination were favorable and points toward an increase in forage production. On the other hand, when undesirable plants are not maintaining themselves by establishment of new plants, this may indicate that these undesirables are being replaced by plants of some value as feed and that the range is improving.
INDICATORS OF A RANGE ON THE DOWNGRADE

EROSION

Active erosion (with gullies that are not becoming vegetated) is one of the best indications that a range is on the downgrade. A range that is losing soil faster than it is being formed is deteriorating and will gradually produce less and less feed. Rain striking bare soil soon washes silt and clay into the soil pores and seals over the surface. This greatly reduces moisture penetration and increases runoff and erosion. This water loss is directly reflected in the amount of forage produced since plant growth on most Arizona ranges is limited primarily by available moisture. Ground that is not bare but that is protected by a cover of either living or dead plant material does not seal over during rains but remains porous and absorbs moisture more readily.

LITTER

A range with little or no dead plant material or litter on the ground is generally on the downgrade. This is in part because there is little accumulation of organic matter to build topsoil or to retard runoff. Forage production is related very closely to soil fertility and soil tilth. Both fertility and tilth are the direct result of organic-matter accumulation, and any litter that is allowed to accumulate and build topsoil increases the ability of that range to produce.

PLANT VIGOR

Full forage production is not obtained from small, weak plants. Consequently, weak growth of the better forage plants or vigorous growth on those that have little or no value also indicate a range on the downgrade.

DEGREE OF USE

Excessive use of the better forage plants is another indication that a range may be on the downgrade. Most species can stand occasional heavy grazing with little harm. When heavy grazing is continued year after year, on the other hand, the plants become weaker, the soil is exposed to excessive erosion, and the range is deteriorating.

SEEDLING ESTABLISHMENT

Unless a range is in top condition it is on the downgrade when few or no young plants of the better forage species are present. A range can be maintained or improved only by maintaining or increasing the quality and quantity of forage. When death losses of the better plants more than equal replacements, that range is deteriorating.

Similarly, when young plants of poor or worthless species are much in evidence this is also an indication of a range that is on the downgrade.
YAVAPAII COUNTY FORAGE TYPES IN PICTURES

Each condition class in the principal forage types of Yavapai County is pictured and discussed in the following pages. Where different sites occur within a given type these sites are shown individually. All the possible sites in an area the size of Yavapai County cannot be covered in a few pages, but the most important ones are included.

Forage type:

**Desert grassland.**

Range condition:

Excellent, producing all the forage this range can produce.

Reason for condition rating:

Forage density is high. Forage species consist largely of tobosa grass and range ratany. There is no measurable erosion.

Comments:

A few shrubs from the adjacent desert-shrub type are present here that do not normally grow in excellent-condition desert-grassland ranges.

Forage production:

Full forage production can be maintained with management practices that maintain this good grass cover and that prevent further encroachment of shrubs.
Forage type:

Desert grassland.

Range condition:

Excellent, producing all the forage this range can produce.

Reason for condition rating:

There is a good cover of tobosa grass which is the native grass best adapted to this site. There are very few non-palatable shrubs and no measurable erosion.

Comments:

Tobosa stands such as this can best be grazed during the summer when the grass is actively growing.

Forage production:

Although drought may lower forage production here as on all dryland ranges, this will be only temporary if corresponding adjustments are made in the number of livestock being grazed.
Forage type:

Desert grassland.

Range condition:

Good, producing from 50 to 75 per cent of the possible amount of forage.

Reason for condition rating:

There is a rather good ground cover of forage plants. Most of these make good to excellent feed when grazed in season. They consist largely of tobosa grass and filaree. There is very little erosion; most of the rain that falls goes into the ground.

Comments:

Prickley year, mesquite, and catclaw are more abundant than on excellent-condition ranges.

Forage production:

Ranges in this condition can be improved through grazing management combined with occasional burning to control the shrubs.
Forage type:

Desert grassland.

Range condition:

Fair. This range is producing from 25 to 50 per cent of all the forage that could be produced here.

Reason for condition rating:

Only about half the number of forage plants are growing here that should. In good years filaree is abundant in the spring but the grazing season is short and uncertain. There is not enough vegetation to control erosion.

Comments:

Grass seedlings are not becoming established here to replace the old plants that have died.

Forage production:

Forage production is highly variable on ranges of this sort. Filaree may produce large amounts of feed one spring and very little the next. The tobosa grass is more reliable, though it, too, may produce little feed in abnormally dry summers.
Forage type:

Desert grassland.

Range condition:

Fair. This range is producing somewhat more than 25 per cent, but considerably less than 50 per cent of the forage that could be produced here.

Reason for condition rating:

Perennial grasses are present but widely spaced. Low-value plants such as prickly pear and snakeweed are replacing the grasses. Vegetation is inadequate to hold the soil, and erosion is active during summer storms.

Comments:

Perennial grasses that produce most of the forage on sloping sites of this sort are curly mesquite, black grama and tobosa grass. An inferior annual grass, red brome, partly replaces the better grasses as the range deteriorates.

Forage production:

Deferment or light grazing for a short summer period while the grasses are growing most actively and setting seed should restore this range to full production.
Forage type:

Desert grassland.

Range condition:

Poor, producing less than 25 per cent of the forage that could be produced here.

Reason for condition rating:

Most of the grasses that once grew here have died or have been replaced by fluffgrass and snakeweed which produce no forage. The area is eroded rather severely.

Comments:

The snakeweed and prickly pear growing here use up water that should go into grass production. Because of the poor grass cover much of the rain that falls runs off, taking topsoil with it. Excessive runoff produces no forage; worse yet, it destroys the land.

Forage production:

Areas of this sort will require artificial reseeding to restore them to top condition and full production. If much soil has been lost they may never again produce what they once did. They can, however, be greatly improved.
Forage type:

    Desert grassland.

Range condition:

    Poor, producing almost no forage.

Reason for condition rating:

    There is little vegetation here to produce forage or control erosion. Only scattered plants of the original tobosa grass remain. Filaree, even during good years, is scattered.

Comments:

    This area, and others like it, once grew a heavy stand of tobosa grass that provided grazing for livestock and controlled erosion.

Forage production:

    Although desert grassland areas in this condition can be brought back by management practices alone, artificial reseeding, though difficult in dry years, and costly, may greatly speed up the rate of recovery.
Forage type:

Desert grassland.

Range condition:

Poor, producing almost no forage.

Reason for condition rating:

There is an almost complete absence of forage plants. Wind erosion is severe.

Comments:

This area, and others like it, once grew a heavy stand of tobosa grass that provided grazing for livestock and controlled erosion. When photographed it was growing only scattered plants of mallow with no forage value.

Forage production:

Except for filaree produced during wet years this area is worthless for grazing. It might be reseeded, although at considerable cost, with Lehmann lovegrass or other adapted species.
Forage type:

Chaparral.

Range condition:

Excellent, producing as much forage as can be expected on this type unless the brush can be removed to make way for more grass.

Reason for condition rating:

The grasses here include some of the best forage species in the region. Black grama, blue grama and side-oats grama predominate. Erosion is controlled in part by vegetation and in part by a protective layer of rocks and gravel.

Comments:

Most of the rainfall in chaparral is used by the brush. Consequently, only a thin stand of grasses can be expected and that largely in the openings between the bushes. If the brush could be killed, a large increase in grass production should result.

Forage production:

Forage production on chaparral ranges in excellent condition can be increased only by removal of the brush. Economical methods of doing this have not yet been developed.
Forage type:

Chaparral.

Range condition:

Good, producing from 50 to 75 per cent of all the forage that could be produced on this site.

Reason for condition rating:

The vegetation contains a large proportion of good forage species. Areas between the shrubs have a good coverage of palatable grasses. Several of the shrubs growing here provide fair to good forage. The open areas between the shrubs produce such palatable grasses as side-oats grama, blue grama and black grama.
Forage type:
Chaparral.

Range condition:
Fair, producing from 25 to 50 per cent of the forage that might be grown here.

Reason for condition rating:
Little forage is being produced. Much of the grass cover is made up of red three-awn. Although there is some side-oats grama and blue grama, these grasses are scattered and low in vigor.

Comments:
Although the soil here is derived from granite and dries out quickly after rains, grasses are present where the shrubs are not too thick.

Forage production:
Though deferred grazing and conservative stocking, areas of this sort can be made to produce more than twice the forage they now do.
Forage type:

Chaparral.

Range condition:

Poor, producing less than 25 per cent of the possible amount of forage.

Reason for condition rating:

Vegetation here consists almost entirely of red three-awn which has very little forage value. Signs of erosion indicate that water that should soak into the ground to produce forage is lost as runoff.

Comments:

Swales of this sort occur in the chaparral but are not typical of most of the type. Although the indications are that this area is now being properly managed, management alone is not driving out the three-awn or bringing back the better grasses.

Forage production:

If areas of this sort are improved through plowing and reseeding to good forage grasses, they will produce four times the feed
Forage type:

Chaparral.

Range condition:

Poor, producing no more than 25 per cent of the forage that this area might produce if a part of the brush were replaced by grasses.

Reason for condition rating:

The brush consists largely of species with moderate to low value as forage. The stand is so thick that animals can penetrate it only with difficulty. No grass is growing beneath the shrubs.

Comments:

Brush eradication methods that are economically practical have not yet been developed. When adequate sprays or other techniques are perfected, areas of this sort may become valuable range land.

Forage production:

Forage production on brush range of this sort cannot be increased by ordinary range management methods. Brush control, reseeding, and management are all necessary.
Forage type:

Grassland.

Range condition:

Excellent. This range is producing essentially all the feed that it can be made to produce.

Reason for condition rating:

Forage density is high. Forage species consist largely of palatable grasses containing a large proportion of side-oats grama with blue grama between the side-oats plants. There is no erosion.

Forage production:

Maximum forage production can be maintained with grazing practices that maintain a good cover of such desirable grasses as are growing here.
Forage type:

Grassland.

Range condition:

Excellent, producing as much forage as this site can produce.

Reason for condition rating:

There is a good ground cover of nutritious grasses. These grasses are in thrifty condition and cover the ground so well that there is little or no erosion.

Comments:

The grass stand shown here is made up almost entirely of black grama. Its sod-forming habit makes it a good erosion-control plant. In addition, it is one of the best forage grasses of the Southwest.

Forage production:

Maintaining this kind of cover will keep the carrying capacity of the range at the highest level possible.
Forage type:

Grassland.

Range condition:

Good, producing very nearly 75 per cent of all the forage possible on this site.

Reason for condition rating:

The vegetation here consists of a good cover of such forage species as blue grama and shrubby buckwheat. The presence of some red three-awn, the absence of side-oats grama, and an over-abundance of buckwheat keep this area from being rated excellent.

Comments:

Junipers are beginning to encroach on the grassland. Unless eradicated, they will continue to spread.

Forage production:

A reduction in the amount of red three-awn and an increase in side-oats grama will increase forage production here about 30 per cent. Juniper eradication also is essential if forage production is to be maintained or increased. Otherwise, the junipers may in time take over here as they have in other places.
Forage type:

Grassland.

Range condition:

Good, producing from 50 to 75 per cent of all the forage possible on this site.

Reason for condition rating:

There is a rather good cover of such valuable forage grasses as blue grama, black grama and side-oats grama. Ring grass and red three-awn in moderate amounts keep this range from being rated as in excellent condition.

Comments:

Because of the rather abundant forage and litter here most of the rain and snow that falls goes into the ground to produce forage rather than being lost as run-off. When this range is improved to excellent condition even more moisture will be retained and more forage produced.

Forage production:

This range can be improved to produce at full capacity by management alone. Drought may retard the process or good rains may speed it up.
Forage type:

Grassland.

Range condition:

Fair, producing from 25 to 50 per cent of the forage that this site should produce.

Reason for condition rating:

Not enough of the plant cover is made up of good forage-producing grasses. There is a rather large amount of bare soil exposed to erosion. Much of the rain goes into production of poisonous snakeweed. The forage grasses present are small and set little viable seed.

Comments:

Destruction of the grasses has left bare soil on which the snakeweed has become established. Careful management can reverse the process.

Forage production:

Ranges of this sort will never produce at full capacity as long as worthless half-shrubs like snakeweed are left to use part of the always inadequate moisture.
Forage type:

Grassland.

Range condition:

Poor. Ranges of this sort are producing no more than one-fourth of the forage they should.

Reason for condition rating:

The better forage grasses are being replaced by such low-value grasses as ring grass and red three-awn. Large amounts of bare ground have been exposed, making it possible for snakeweed and annuals such as Russian thistle to come in.

Comments:

Thinning of the cover has resulted in increased runoff and a reduction in the amount of water available for plant growth.

Forage production:

This range can be built up to carry 75 per cent more livestock than it now does.
Forage type:

Grassland.

Range condition:

Poor, producing less than one-quarter of the forage that this site could produce.

Reason for condition rating:

Most of the better grasses have been replaced by ring grass which is largely worthless and by low-value annual weeds. Erosion-controlling litter is scarce and there is a large amount of bare ground exposed to erosion and producing no feed.

Comments:

Ring grass in stands like this always indicates a run-down range. Ring grass does not drive the better grasses out but comes in after they have been weakened or killed.

Forage production:

Ranges of this sort can be improved to produce at least 75 per cent more feed than they now do.
Forage type:

Grassland.

Range condition:

Poor, producing less than 25 per cent of the forage that this site should produce.

Reason for condition rating:

The better forage grasses are widely spaced and are small and weak. Cacti, milkweed, snakeweed, ring grass and other undesirable plants are rather abundant and are replacing the better species.

Comments:

The abundance of rocks indicates that a large amount of topsoil has been lost by erosion.

Forage production:

Areas of this sort can be made to produce about four times as much feed as they now do.
Forage type:

Grassland.

Range condition:

Poor, producing less than one-fourth the forage that this range should produce.

Reason for condition rating:

Most of the forage grasses have been killed or so weakened that they produce little forage. The grasses have been replaced in part by such low-value weeds as mustard and Mexican poppy.

Comments:

There is little chance for grasses to set seed or seedlings to become established on ranges maintained in this condition.

Forage production:

Ranges like this that still have a thin stand of grass can usually be improved without reseeding. In some cases there are so few of the better forage plants left that artificial reseeding will be required. A range in this condition is more of a liability than an asset.
Forage type:

Pinyon-juniper.

Range condition:

Excellent in the foreground; poor under the trees.

Reason for condition rating:

The foreground is producing a vigorous stand of such valuable forage grasses as side-oats grama and blue grama. The grasses are setting abundant seed and there is no erosion. Beneath the trees the grasses are thin and erosion is active.

Comments:

On the excellent-condition range in the foreground most of the precipitation soaks into the ground and produces forage rather than being lost as runoff. Unless the junipers are controlled, they will replace the grasses on valuable range of this sort.

Forage production:

The range in the foreground is producing as much forage as can be expected on this site. That in the background is producing only about one-fourth the amount it should.
Forage type:

**Pinyon-juniper.**

Range condition:

Excellent, producing essentially all the forage possible on this type of range.

Reason for condition rating:

There is good cover of tobosa grass. The plants are vigorous and close growing. There is no erosion, indicating that most of the snow and rain water soaks into the ground and produces forage.

Comments:

Although tobosa grass is poorer feed than many grasses, it would rarely be practical to attempt to grow other species in the low-lying, heavy soil areas where it generally grows. The junipers coming in here may eventually drive out most of the grasses.

Forage production:

Tobosa-grass flats of this sort are producing all the forage they should except where the grasses have been replaced by junipers.
Forage type:

**Pinyon-juniper.**

Range condition:

Good, producing from 50 to 75 per cent of the possible amount of forage.

Reason for condition rating:

There is a rather good ground cover of forage plants. Most of these make good feed. They consist largely of blue grama, side-oats grama, and winterfat (white sage). There is very little erosion; most of the water that falls soaks into the ground.

Comments:

Old charred stumps indicate that this area was once burned. Junipers have come back since fires have been controlled and in time will drive out most of the forage plants.

Forage production:

Ranges of this sort can be improved through management and juniper control to produce 25 to 50 per cent more feed than they now do.
Forage type:

Pinyon-juniper.

Range condition:

Fair, producing from 25 to 50 per cent of the possible amount of forage.

Reason for condition rating:

There is a rather poor ground cover of forage plants. Most of the forage is obtained from blue grama and side-oats grama, but the plants are low in vigor and are rather widely spaced. Signs of erosion indicate that water that should soak into the ground to produce feed is lost as runoff.

Comments:

Juniper is increasing on ranges of this sort and, unless controlled, will eventually drive out most of the grasses.

Forage production:

This range can be improved through range management and juniper control to produce from 50 to 75 per cent more forage.
Forage type:

**Pinyon-juniper.**

Range condition:

Fair, producing from 25 to 50 per cent of the forage possible on this site.

Reason for condition rating:

Although this range has a rather heavy cover of vegetation, it is made up largely of annual weeds. These hide a thin stand of blue grama and side-oats grama. Active erosion, concealed here by the weeds, indicates that much of the rain and snow that should soak into the ground to produce feed is lost as runoff.

Comments:

The large number of young junipers indicates that the grasses are gradually being replaced. Without juniper control, this will continue until the range becomes essentially worthless for grazing.

Forage production:

Areas of this sort can be improved through range management and juniper control to produce from 50 to 75 per cent more forage than they now do.
Forage type:

**Pinyon-juniper.**

Range condition:

Poor on the near side of the fence; good on the far side except under the junipers where it is again poor.

*Reason for condition rating:*

On the near side of the fence very little vegetation except unpalatable weeds remains. In the opening across the fence there is a good cover of blue grama and side-oats grama. Beneath the junipers the trees get most of the moisture and little forage is produced.

Forage production:

Ranges of this sort that are in poor condition can be improved through range management and juniper control to produce at least 75 per cent more feed than they now do; those in good condition can be improved by the same practices to produce from 25 to 50 per cent more feed.
Forage type:

Pinyon-juniper.

Range condition:

Poor, producing almost no forage.

Reason for condition rating:

The forage plants that originally grew here have been replaced almost entirely by juniper. The few blue grama plants that remain are small and weak. Erosion is active and most of the rainfall and snow melt is lost as runoff.

Comments:

The lack of forage here is due in large part to the junipers which use most of the moisture that manages to soak into the soil.

Forage production:

Areas of this sort can be improved only by getting rid of the juniper. This treatment, followed in some cases by reseeding, will increase production many times from its present low level.
MAINTAINING A HIGH LEVEL OF FORAGE PRODUCTION

If it were not possible to improve the condition of a range, there would be no point in a range-condition classification. Run-down ranges can be improved, however, and ranges that are already in top condition can be kept that way. Since the degree to which a range has deteriorated (as indicated by its condition class) determines the steps needed to restore it, a knowledge of range condition is basic to recommendation of the improvement measures needed.

The greater the range deterioration, the more difficult it is to bring that range back to excellent and the more drastic the measures that must be taken. A range in good condition can usually be improved by a slight reduction in stocking or better distribution of stock. A range in poor condition is usually not materially benefited by these practices. The grass remnants are not sufficient to revegetate the range. Instead, it is usually necessary to remove the brush, reseed, or use other mechanical treatments.

Except for occasional short periods when unfavorable conditions prevail, a range in excellent condition can be kept in that condition permanently. This will not require stocking at a reduced rate since an excellent-condition range will support more livestock than one in any other condition.

It may be necessary in emergencies to hold over more stock than the range or a portion of it will support continuously. When such overstocking happens frequently, this is generally a sign of mismanagement; when it happens only occasionally no mismanagement is indicated. When overstocking of this sort is infrequent, the range will suffer little or no permanent damage. There may, however, be inadequate forage to carry the stock through in good shape.

Drought may temporarily cause a drop in range condition by reducing forage production on a range. A drought may last a season, a year, or several years. Because of the consequent reduction in forage production it is frequently necessary to reduce the number of stock grazing the affected area.

On timbered ranges, logging may be very destructive of forage. Even on excellent-condition range the effects of this may be long lasting unless local artificial reseeding is resorted to. When such reseeding is necessary, care should be taken to reseed to species that are shade tolerant and that will do well on forest soils. Because there is only a small amount of saw timber in Yavapai County the effect of logging is of minor importance.

Fire may temporarily or rather permanently destroy forage. This does not mean that fires are always harmful from a forage-production viewpoint. An occasional fire in grassland is natural and many grass species seem to have become acclimated to burning as a result of fires that apparently occurred from time to time down through the centuries. Many shrubs and trees, on the other
hand, are killed by fire and it is probable that periodic burning originally maintained extensive portions of Yavapai County as grassland that are not grassland today.

Juniper, most species of which are killed by fire, has taken over many thousand acres in the county that were formerly grassland. This juniper invasion probably could have been prevented by an occasional fire. Today, because of grazing and competition from juniper, the ground cover over much of this area is too thin to carry fire and more expensive means of control must be resorted to.

It is doubtful whether fire in chaparral range in Yavapai County is ever beneficial. The grass cover, even in the best chaparral, is thin and the shrubs are large and often thick. Fires in such areas are usually extremely hot and most of the grasses may be destroyed. Few of the shrubs are killed since most of them stump sprout. Before they grow up again there is no ground cover to protect the soil from erosion and, as these soils are usually highly erodible, severe erosion damage may result.

Chaparral ranges that contain grass should not be stocked so heavily as to destroy the grasses. Full forage production on these ranges is obtained only where there is a mixture of grasses and shrubs.

Future research may develop a form of 2,4-D or some other chemical that will eradicate shrubs such as those that make up Yavapai County’s chaparral. If this occurs, it is probable that these lands will produce more forage from grass than from the present vegetation. Until that time, however, these ranges should be managed to maintain a mixture of grass and shrubs.

MANAGEMENT OF THE RANGE

Certain practices are necessary for maintaining a high level of forage production. These practices produce the most forage, the heaviest and most rapid livestock gains, the best calf or lamb crops, and the best wool crops.

DEGREE OF GRAZING USE

The first concern of the rancher over a long period should be to maintain a degree of grazing use that will maintain or increase his better forage plants.

On grass ranges grazed during the growing season, about one-third of the seed stalks should be left at the end of the grazing season. If grazed during the dormant period, grazing can be closer and only enough vegetation needs to be left to prevent erosion.

On chaparral ranges that contain no grass, at least one-fourth of the growth on the current year’s twigs should be left at the end of the season.

Degree of use cannot be gauged exactly. For this reason, the condition of the range should be checked occasionally, even though every attempt has been made to prevent overgrazing. If
this check indicates a downward trend, grazing has been too heavy for the amount of forage produced, and lighter use on the affected area is indicated.

**DEFERRED GRAZING**

Run-down ranges require a rest period during which the grasses can set seed and new seedlings can become established. This deferment or rest period must come during the growing season and must allow time for seed development. After seed formation the pasture may again be grazed. Care must be exercised not to overgraze another portion of the range while resting one part.

The poorer the condition of the range the more frequently it should be deferred. Poor-condition areas should be deferred every summer until they improve at least one condition class. Fair-condition ranges should be deferred every other year. Ranges in good condition will benefit from deferment once in three years. Although excellent-condition areas do not require deferment, a rest during the growing season once every three to five years will help them keep in top condition.

Deferment benefits forage plants in two ways. It permits them to set seed and to produce new plants and it allows the old plants to become larger and more vigorous. These add up to greater forage production, i.e., better range condition.

**DISTRIBUTION OF STOCK**

Distribution of livestock over the range to make the best use of forage may be a major problem with cattle; it is generally a minor one with sheep. Certain basic methods of distributing livestock have been successful. These include herding, relocation of fences, providing additional temporary and permanent water, and distributing salt grounds to pull the livestock out from water. When using salt to get better distribution, it is essential to place all salt away from water. Otherwise, stock will use those salt grounds close to water, and will not be drawn out to the other locations.

**RESEEDING**

Artificial reseeding should be resorted to only where few or none of the better native species are left to produce seed. Although cost of reseeding is high and chances of success are sometimes low, seeding is sometimes desirable and may be employed to advantage.

Areas with a high potential for forage production should be seeded before less productive areas. Range that formerly grew abundant forage usually has a high potential.

Areas where erosion is a problem should be reseeded. Benefits from erosion control added to increased forage production should soon offset the cost of seeding. Burns in timber, juniper or chaparral that have destroyed most of the forage plants fall into this class.
Several precautions should be observed to minimize the possibility of failure: (1) Plant species adapted to the site and climate; (2) Prepare a clean seedbed if at all possible, eliminating competition from weeds; (3) Seed at the right season of the year; (4) Seed at the proper rate, being particularly careful not to overseed; (5) Seed at the correct depth, taking special care not to seed too deeply; (6) Cover the seed and pack the soil when possible; (7) Protect the new seeding from grazing for two growing seasons after the seeds germinate; (8) Graze at a proper rate after the seeding has become established.

Lehmann lovegrass has given better stands than any other species in the desert grassland and chaparral types. Crested wheatgrass is one of the best in the grassland and the pinyon-juniper, though there are several others that may give good stands in these types.

The best results in seeding tests have been obtained by using an eccentric or cutaway disc in combination with a cultipacker seeder. This equipment prepares a seedbed that catches and holds rainfall, plants the seed properly, and packs the soil. Good stands have been obtained with this equipment where other methods have failed.

**BRUSH CONTROL**

Most shrubs produce less forage than grass and make cattle-working difficult. For these reasons their control is advisable when practical control methods are available.

*Juniper.*—The juniper invasion of some of Yavapai County's best grassland is one of the county's most pressing range problems. Carrying capacities and land values have decreased wherever this tree has invaded grassland. All of the reasons for this invasion are not known, but there is little doubt that juniper was originally prevented from spreading to grassland by fires set by lightning or Indians. Breakdown of the grass cover by domestic livestock grazing has probably helped to make it harder for fire to run and easier for the young trees to get started.

Several methods of juniper control are economically feasible. Hand grubbing when the young plants first appear is probably the cheapest and most effective. This method can be used to prevent further spread, but has little use on old stands.

Cabling has given rather effective and cheap control on the Whiteriver and San Carlos Indian Reservations. A length of heavy cable is dragged between two crawler-type tractors. Satisfactory results were obtained by dragging 550 feet of 1¾-inch cable between two TD-18 diesel tractors. The tractors traveled 250 feet apart in the thinner stands and were able to cover 50 to 60 acres per hour. Unusually large trees were by-passed. This method, tested on alligator-bark juniper on the Mescalero Indian Reservation resulted in a 70 per cent or better kill of all trees. Effectiveness varied with density of the juniper stand, the highest kill being obtained in thin stands. Cabling back in the opposite
direction resulted in a considerably higher kill but greatly increased the cost.

When a heavy ship’s anchor chain was used rather than a cable, results were less effective and more costly.

Removal of juniper with a bulldozer has been effective in several places in the county. High costs of bulldozing may be prohibitive in thick stands.

Hand chopping is a slow but thorough method of eradication that may be combined very well with hand grubbing. Small trees and limbs may be piled around the larger trees and burned.

*Chaparral.*—Most brush ranges in Yavapai County are in the chaparral type. Unlike many brush ranges where shrubs have invaded grasslands, the greater part of the chaparral is a natural shrub area. No economical control methods have yet been developed to get rid of the shrubs. Until such control methods are available the chaparral range should be handled to make the best possible use of the brush and grasses now growing there.

*Mesquite.*—Mesquite is the most important noxious plant in the desert grassland type. A small number of mesquites give variety to the forage and are desirable. Large numbers are objectionable. Although mesquite furnishes some forage, it requires so much water that little grass will ordinarily grow where the trees are thick. Grass alone will produce more forage on a mesquite-free range than mesquite and grass together on an infested range.

Effective methods of mesquite control include hand grubbing of seedlings, power grubbing of trees with bulldozers, cabling, and poisoning with sodium arsenite or diesel oil. On old stands the diesel-oil treatment has generally proved more practical than other methods, though good results have been obtained in Texas from cabling.

*Snakeweed.*—Snakeweed has invaded most of the rangelands of Yavapai County. This half-shrub usually occurs on run-down ranges where the grass cover is thin. It can be kept under control by maintaining a good stand of grass.

*Burning.*—Fire was undoubtedly one of the major factors that originally kept the grassland of Yavapai County in a brush-free state. As a means of juniper or snakeweed control, it still has advantages where sufficient grass remains to carry a fire.

All species of juniper except alligator-bark can be killed by burning. Where there is enough grass to carry a fire, this method may be used to advantage. Where the grasses will not carry a fire, it is sometimes possible, by closing an area to grazing for a season, to build the cover up to a point where it will burn. In all such controlled burns, care should be taken to see that the fire does not escape to adjacent areas.

Snakeweed is also readily killed by fire. Thick stands where there is enough grass to carry a fire may be eradicated by broadcast burning. Tops of most species of oak, and other chaparral
shrubs are killed by burning, but these plants resprout vigorously. Control of susceptible plants by fire is cheap and can be used on large, relatively inaccessible range areas.

Fire, as a means of shrub control must be used with care. If allowed to run wild, it can cause widespread destruction of fences, buildings, or reserve forage. Burning at the wrong season of the year may kill the grasses as well as the shrubs and result in severe erosion. Burning at any time destroys the current year's crop of forage.

GRAZING VALUE OF SOME COMMON YAVAPAI COUNTY PLANTS

ANNUAL GOLDEN EYE (Viguiera annua)

Annual goldeneye occurs as a common weed in the pinyon-juniper and grassland types where the perennial grasses have been destroyed.

It has little or no forage value for cattle and is only slightly better for sheep. Although the flowers are grazed more than any other part of the plant, even these are taken largely when other feed is scarce.

In the pinyon-juniper type, where it occurs most commonly, goldeneye is a reliable indicator of range deterioration. With few exceptions, areas that support this weed originally grew highly productive stands of grass.

APACHE PLUME (Fallugia paradoxa)

Apache plume is one of the more productive shrubs in the chaparral type. It also grows along drainages in the grassland and is widely distributed in the pinyon-juniper type.

Apache plume withstands grazing well. The plant is considered fair forage for cattle, horses and sheep and good feed for goats.

BIG GALLETA (Hilaria rigida)

Big galleta, a large, very coarse bunchgrass, is restricted to the lower, drier portions of the county. It is so coarse as to be largely worthless except when actively growing during the summer rainy season.

During wet springs, an abundance of filaree on big-galleta ranges gives these areas a rather high carrying capacity for a short period. Like tobosa flats, however, they make poor year-long ranges.

BLACK GRAMA (Bouteloua eriopoda)

Black grama is one of the better forage grasses of the county and occurs abundantly over a wide altitudinal range. On the better-condition rangelands in the pinyon-juniper type it may be one of the principal forage producers. In the higher grassland areas, such as those of Chino and Lonesome valleys, it may also be abundant, occurring locally in pure stands. In the chaparral type
it is one of the principal grasses. From these higher elevations it extends down through the desert grassland into the desert-shrub type.

Black grama remains green over a long season, even during drought periods. It is readily grazed by all classes of livestock.

This is one of the few sod grasses in the county. Although never forming a close sod, it spreads by runners that root and form new plants at the nodes. Like most sod grasses, it is a poor seed producer.

**BLUE GRAMA (Bouteloua gracilis)**

Blue grama probably produces more forage than any other species in Yavapai County. Other grasses may produce a greater volume of forage per acre, but no others so palatable are as widespread and make as dense a ground cover.

Blue grama grows largely at medium altitudes in the county and is most important in the open grassland, juniper, and chaparral types.

Although this grass is most productive during, and for a short time after, the summer rains, it cures well and provides some forage year around. It often appears sod-bound in old stands that have been heavily grazed for many years. This condition is probably due either to root starvation through too heavy grazing, to a deficiency in certain essential elements, or to a compacted condition of the soil that permits much of the rainfall to be lost as runoff. Harrowing, diskimg, or other methods of loosening the sod have been effectively used to increase growth on stagnated stands.

**BUCKBRUSH (Ceanothus greggii)**

Buckbrush is a common shrub in the chaparral type. It makes fair forage for cattle, good for sheep and good to excellent for goats. The evergreen leaves provide a fair quality of forage even during the winter months.

**BUR SAGE (Franseria dumosa)**

Bur sage occurs in the drier portions of the desert-shrub type in Yavapai County. It is moderately palatable to cattle and sheep and slightly better for horses. The plants may be rather closely cropped on heavily stocked range, but this indicates inadequate forage rather than high palatability.

**BUSH MUHLY (Muhlenbergia porteri)**

Bush muhly is a fine-stemmed bunchgrass that used to be one of the most abundant grasses in the desert-shrub and desert grassland types. Because of its high palatability and extreme susceptibility to grazing injury the plant now grows principally under bushes where it gets some protection from livestock.

The stems tend to remain alive the year around. It is grazed particularly heavily during drought periods when other grasses are dry.
CATCLAW (Acacia greggii)

Catclaw is a common shrub in the lower portions of the county. It is most abundant in the lower chaparral type and along drainages in the desert-grassland and desert-shrub types.

Catclaw makes poor forage. It may be browsed to some extent in dry years when little else is available or when the better species have been killed. It provides the most forage in the spring when the young leaves, flowers, and young twigs are available. Forage value decreases as the branches become hard and spiny. The mature pods are almost worthless as feed.

CLIFFROSE (Cowania stansburiana)

Cliffrose is common in much of the chaparral type. It also occurs fairly abundantly in the pinyon-juniper and lower ponderosa-pine types.

Cliffrose is a valuable forage plant for cattle and sheep and is particularly relished by deer. Because of its evergreen habit the plant makes good winter browse.

Cliffrose stands up well under grazing. The lateral buds develop and produce more leaves and fine branches under moderate grazing than when ungrazed.

CLUBFLOWER (Cordylanthus spp)

Clubflower is a weed that springs up after the summer rains. All the species that occur in Yavapai County are annuals with little or no value as forage. They are common in deteriorated pinyon-juniper range, particularly in wet years.

Like annual goldeneye, with which it is often associated, clubflower indicates a run-down range. Where it occurs in abundance one can be almost certain that grasses, particularly blue grama and side-oats grama, were formerly the principal vegetation.

CREOSOTE BUSH (Larrea tridentata)

Creosote bush is the most abundant shrub of the desert-shrub type. It has no forage value for any kind of livestock.

CURLY MESQUITE (Hilaria belangeri)

Curly mesquite, the most palatable and the smallest of the galleta grasses, is a sod grass with runners that root at the nodes. Because of this sod habit, it makes rapid recovery after severe drought or heavy grazing.

Curly mesquite is fine-leaved and fine stemmed and does not have the coarse bunchy habit of tobosa. It is highly palatable when green, cures well, and is a valuable grass even when dry.

Curly mesquite is most common at middle elevations in Yavapai County. It usually grows on heavy clay soils in the desert grassland or lower chaparral types.

FILAREE (Erodium cicutarium)

Filaree is a winter and spring annual that germinates in the fall as soon as the rains set in. Most of the growth is made during
a short period in the spring when temperatures are moderately high and while soil moisture is still plentiful.

Aside from some of the grasses, filaree is probably the most valuable forage plant in the county. It makes excellent feed for all classes of livestock, but it most valued as sheep feed. It grows close to the ground much of the time, making it difficult for cattle to graze. In favorable locations and in years of abundant rainfall, it makes rapid growth and may reach a height of 12 to 18 inches.

Filaree is most abundant at the lower elevations. In the desert-grassland type it produces large quantities of forage in wet years. It yields moderately in all years except those of extreme drought.

**FLUFF GRASS (Tridens pulchellus)**

Fluff grass is a small, cottony-looking perennial bunch grass common on calcareous soils in the desert-shrub type. It has little or no forage value even when growing most actively. Although fluff grass tends to thicken when other vegetation has been killed, it cannot be relied on to indicate a run-down range.

**GUAJILLA (Calliandra erophylla)**

Guajilla rates as one of the best shrubs in the desert grassland and lower chaparral ranges. This plant makes very good forage and is highly resistant to drought and grazing. The fine stems, even though woody, are palatable to all classes of livestock, particularly when actively growing.

**INDIAN WHEAT (Plantago purshii)**

Indian wheat is one of the most valuable of our spring annuals. It is most abundant in the chaparral, grassland, and pinyon-juniper types, but occurs also at lower elevations. It is highly valued as sheep feed; not rated quite so high for cattle.

Forage production from Indian wheat, like that from most annuals, is undependable because it fluctuates greatly from year to year, varying with rainfall. In good years more feed may be produced than can be used; in poor years there may be almost none.

**JOSHUA TREE (Yucca brevifolia)**

Joshua tree occurs in Yavapai County on tobosa flats north of Congress Junction. The plant has almost no value as forage. The flowers, which might be eaten, are usually borne too high for livestock to reach.

Most of the range that supports Joshua trees is in poor condition. Grazing and drought have greatly reduced or killed out the tobosa grass that originally grew beneath the trees. Runoff has increased as the grasses have gone and much less moisture penetrates the soil to grow vegetation than formerly.

**MANZANITA (Arctostaphylos pungens, A. pringlei)**

Manzanita is one of the principal shrubs in the chaparral type. It also occurs abundantly in the pinyon-juniper and lower pon-
derosa-pine types. It provides no forage for cattle or horses and very little for sheep or goats. Deer make some use of the plant and the berries are a valuable food source for quail and other birds.

Although manzanita is readily killed by burning, the numerous seeds germinate readily after fire. This has led many to assume that the young seedlings were growing from the old roots. As a matter of fact, both the tops and roots of the old plants are killed with the result that there is no stump or root sprouting.

**MESQUITE** (*Prosopis juliflora, var. velutina*)

Mesquite occurs in Yavapai County as a shrub or small tree. It is found primarily in the desert-grassland type or along the washes in the desert-shrub. Occasional plants occur in the lower pinyon-juniper.

Where mesquite has invaded grassland it has seriously reduced carrying capacities because of its ability to compete with the grasses for moisture. Under these conditions it is considered as a noxious shrub. In desert swales an open stand of mesquite lends variety to the forage and provides green feed during the spring and fall when the grasses are dry. The seed pods, leaves and young twigs are palatable to all classes of livestock. During years of heavy bean production, on the other hand, the pods have been known to kill horses.

**MEXICAN POPPY** (*Argemone intermedia*)

Mexican poppy occurs along roadsides and on run-down range from the desert-shrub type up into the grassland. This plant has no value as forage for livestock and when abundant on the open range, indicates severe deterioration.

**MOUNTAIN LAUREL** (*Rhus ovata*)

Mountain laurel is most common in the chaparral type but occurs occasionally in the pinyon-juniper.

The plant has almost no grazing value for cattle or sheep. Goats may graze it lightly if other feed is scarce.

**MOUNTAIN MAHOGANY** (*Cercocarpus spp.*)

Mountain mahogany is a common shrub or tree of the chaparral type. It occurs less abundantly in the pinyon-juniper.

Mountain mahogany rates among the best shrubs of the county as feed-for livestock. It is taken readily by all classes of livestock, particularly sheep and goats. The evergreen leaves provide good feed during the winter. The broad-leaved species make better forage than those with narrow, thick leaves.

**PALO VERDE** (*Cercidium microphyllum*)

Palo verde, a small tree with green stems and twigs, is one of the most characteristic plants of the desert-shrub type. It grows best on well-drained sites, commonly occurring on desert hills or the gently-sloping outwash plains at the bases of mountains.
The smaller twigs are browsed a little, but the plant can hardly be classed as a forage species.

**RANGE RATANY (Krameria parvifolia)**

Range ratany is one of the more abundant forage-producing shrubs in the desert-grassland and desert-shrub types. It is low growing, seldom reaching a height of more than 18 inches. Range ratany provides good forage for all classes of livestock. Part of its value lies in an ability to produce green forage during drought when most plants are dry.

**RED BROME (Bromus rubens)**

Red brome is a spring-annual grass with little forage value. The numerous, long, sharp awns on the seeds are injurious to livestock when the seeds are ripe. Red brome is not native to the United States but was brought to the West Coast from the Mediterranean region. The plant can properly be classed as a range weed. It has come to Arizona rather recently but has spread rapidly on run-down ranges. This spread has taken place largely on low-elevation ranges in the chaparral and desert-grassland types.

**RED THREE-AWN (Aristida longiseta)**

Red three-awn is a bunch grass that occurs in the chaparral, grassland, and pinyon-juniper types. It derives its name from the reddish color of the awns while the plants are in flower and seed is ripening. Red three-awn is almost worthless as a forage species. Livestock graze it very lightly unless little else is available. This unpalatability enables it to come in as the more palatable grasses go out and makes it one of the best indicators of run-down grassland range. It is unable to compete with such grasses as blue and side-oats grama unless these grasses are harmed by too-heavy grazing or drought. Because of this, ranges that have become infested with red three-awn can be improved and the three-awn controlled by good grazing management.

On good- or excellent-condition ranges red three-awn is abundant only on poor, gravelly soils.

**RING GRASS (Muhlenbergia torreyi)**

Ring grass is a sod-type wiry-stemmed grass that is almost worthless as forage. On depleted juniper or grassland ranges, where it occurs most commonly, ring grass is a good indicator of deterioration. Because the plant has almost no palatability it is affected very little by heavy grazing and may gradually take over on heavily-grazed ranges.

**SCRUB OAK (Quercus turbinella)**

Scrub oak is the principal shrub in the chapparal type of Yavapai County. It has spread into the adjacent grassland to some extent.
Scrub oak is highly rated as forage, particularly for goats, even though it is not particularly palatable. There are several reasons for this. The plant is evergreen and provides forage during the winter when the grasses are dry. It can survive heavy grazing that destroys the understory vegetation, and on deteriorated ranges may remain as almost the only forage.

Goats graze scrub oak better than other domestic livestock, but it still rates as fair feed for cattle and sheep. Some of its value is derived from the leaves; some from the acorns. Deer, also, use both leaves and acorns.

**SHRUBBY BUCKWHEAT (Eriogonum wrightii)**

Shrubby buckwheat is a half-shrub that occurs commonly in the county from the upper parts of the desert grassland up through the chaparral and grassland and into the pinyon-juniper. In grassland it becomes more abundant when grazing or drought reduces the grass cover. It occurs less abundantly on good- and excellent-condition ranges than on those that are in only fair condition.

Shrubby buckwheat makes fair forage for cattle and horses and somewhat better than this for sheep and goats. It provides a greater portion of the total forage on the lower ranges, where less forage from other species is available, than at higher elevations.

**SIDE-OATS GRAMA (Bouteloua curtipendula)**

Side-oats grama is a high-producing perennial bunch grass of average to better-than-average palatability. Although not taken as readily as blue grama, it is equally valuable, especially for cattle and horses, because of its greater forage production. Ranges that have an abundance of side-oats mixed with blue grama are much more productive than those with blue grama alone.

Side-oats grama grows over a wider range of altitude and rainfall than blue grama, occurring throughout the types covered by this bulletin. It is most productive when growing under conditions most favorable for blue grama. Most blue-grama ranges in the county at one time supported a good stand of side-oats grama. Heavy grazing has removed the side-oats and left the blue grama. Although side-oats is more resistant to grazing than most of our palatable grasses, it is not as resistant as blue grama. Consequently side-oats has gradually disappeared from much of the area where it was formerly abundant.

**SILKTASSEL (Garrya flavescens)**

Silktassel is a large shrub that occurs in the chaparral type. Although widespread in the type, it is less common than most of the shrubs with which it grows.

Silktassel has a bitter, quinine-like taste and, possibly for this reason, it is lightly grazed.
This publication is issued by the Cooperative Extension Service and the Agricultural Experiment Station of The University of Arizona. See your local County Extension Agent for additional information.