



CALCULATING AVAILABLE FORAGE

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Range Management Fact Sheet

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An important part of calculating Stocking Rate is knowing the amount of available forage you have. An average pounds of production can be obtained from the Range Site description (obtainable from local NRCS offices) for your pasture or allotment. A Range Site Description lists the total pounds of production for a range site in good, fair, and poor condition. Remember this is only an estimate, and that individual sites can vary tremendously. It is more accurate to determine the available forage by actually measuring the forage. Doing this enables you to determine the amount of edible forage on your pasture. A Stocking Rate which is determined after measuring your forage, greatly reduces the chances of under- or over-grazing. The forage is measured by clipping and weighing a specified number of plots. The average weight of the plots is then multiplied by a conversion factor to determine the pounds of production. In order to clip plots, a few supplies are needed:

- Range Hoop (one of the sizes listed in Table 5)
- Scale to measure weight in grams
- Paper/plastic bag to weigh forage in
- Clippers
- Paper or forms to record data

1. Select plots

- a) Plots should be selected randomly.
- b) The number of plots selected depends on the purpose for which the estimates are to be used, uniformity of vegetation, and other factors. It is best to sample a minimum of 10 plots. If vegetation distribution is irregular and 10 plots will not give an adequate sampling, more plots can be selected.
- c) Adapt the size and shape of the plots to the kind of plant cover to be sampled. Plots can be circular, square, or rectangular. The area of the plot can be expressed in square feet, in acres, or in square meters.

- If vegetation is relatively short, the 1.92-, 2.40-, 4.80-, and 9.60-ft² plots are the best to use.
- If vegetation density and production are relatively light, the 9.60 ft² plots work well.
- In areas of homogeneous, relatively dense, vegetation, such as in wet meadows, the smaller plots work best.
- Plots with area expressed in square meters are used if production is to be determined in kilograms per hectare.

2. After plots are selected, clip those species within the plot that will be used by livestock and wildlife. Total biomass can be clipped by harvesting the whole plant.

- a) When clipping, include plants whose stems originate in the plot, including all aboveground parts that extend beyond the plot boundary. Exclude all parts of herbaceous plants and shrubs whose stems originate outside of the plot, even though their foliage may overlap into the plot.

3. Harvest, weigh, and record the weight of each species in the plots. On shrubs, harvest all current leaf, twig, and fruit production. Calculate average weight of each species. (total grams collected divided by number of plots sampled)

4. After all forage is weighed, air-dried percentages are determined by air-drying the harvested material (the most accurate) or by selecting the appropriate factor from an air-dry percentage table (see Table 3a-3d), and multiplying by this percentage to get air-dry weight.

5. Using the average weight for each species, multiply by the given conversion factor for plot size (in Table 5). This number will be equal to the weight of each species in pounds per acre or kilograms per hectare.

If you have questions, contact your local natural resource specialist.

TABLE 1: Percentage of air dry matter in harvested grass at various stages of growth

GRASSES	Before heading; initial growth to boot stage (%)	Headed out; boot stage to flowering (%)	Seed Ripe; leaf tips drying (%)	Leaves dry; stems partly dry (%)	Apparent dormancy (%)
Cool Season (Wheatgrass, perennial brome, bluegrass, prairie junegrass)	35	45	60	85	95
Warm Season					
Tall Grasses: (Bush muhly, tall dropseed)	30	45	60	85	95
Midgrasses: (Side-oats grama, oniongrass)	40	55	65	90	95
Short grasses: (Blue grama, saltgrass, short three-awns)	45	60	80	90	95

(from USDA NRCS National Range and Pasture Handbook)

TABLE 2: Percentage of air dry matter in harvested forbs at various stages of growth

FORBS	Initial growth to flowering (%)	Flowering to seed maturity (%)	Seed Ripe; leaf tips dry (%)	Leaves dry; stems dry (%)	Dry (%)
Succulent (violet, waterleaf, buttercup, bluebells, onion, lillies)	15	35	60	90	100
Leafy (lupine, balsamroot, tickclover)	20	40	60	90	100
Fibrous leaves or mat (phlox, mat eriogonum, pussytoes)	30	50	75	90	100

(from USDA NRCS National Range and Pasture Handbook)

TABLE 3: Percentage of air dry matter in harvested shrubs at various stages of growth

SHRUBS	New leaf and twig growth until leaves are full size (%)	Older and full-size green leaves (%)	Green Fruit (%)	Dry Fruit (%)
Evergreen (big sagebrush, bitterbrush, ephedra, algerita, gallberry)	55	65	35	85
Deciduous (snowberry, rabbitbrush, snakeweed, Gambel oak, mesquite)	35	50	30	85
Yucca and yucca-like plants (yucca, sotol, saw-palmetto)	55	65	35	85

(from USDA NRCS National Range and Pasture Handbook)

TABLE 4: Percentage of air dry matter in harvested trees at various stages of growth

TREES	New leaf and twig growth until leaves are full size (%)	Older and full-size green leaves (%)	Green Fruit (%)	Dry Fruit (%)
Evergreen Coniferous (Pine, Juniper, Spruce)	45	55	35	85
Live Oak	40	55	40	80
Deciduous (blackjack oak, post oak, hickory)	40	55	35	85

(from USDA NRCS National Range and Pasture Handbook)

TABLE 5: Range Hoop and Square Conversions and Dimensions

<p>0.96 ft² Plot: Conversion Factor: Grams collected X 100 = pounds per acre Radius = 0.55 feet Circumference of Hoop = 3.5 ft Dimensions of Square Plot = .98 ft x .98 ft</p>
<p>1.92 ft² Plot: Conversion Factor: Grams collected X 50 = pounds per acre Radius = 0.78 feet Circumference of Hoop = 4.9 ft Dimensions of Square Plot = 1.386 ft x 1.386 ft</p>
<p>2.40 ft² Plot: Conversion Factor: Grams collected X 40 = pounds per acre Radius = 0.87 feet Circumference of Hoop = 5.5 ft Dimensions of Square Plot = 1.55 ft x 1.55 ft</p>
<p>4.80 ft² Plot: Conversion Factor: Grams collected X 20 = pounds per acre Radius = 1.24 feet Circumference of Hoop = 7.77 ft Dimensions of Square Plot = 2.19 ft x 2.19 ft</p>
<p>9.6 ft² Plot: Conversion Factor: Grams collected X 10 = pounds per acre Radius = 1.75 feet Circumference of Hoop = 10.996 ft Dimensions of Square Plot = 3.098 ft x 3.098 ft</p>
<p>0.25 m² Plot: Conversion Factor: Grams collected X 40 = kilograms per hectare Radius = 0.282 m Circumference of Hoop = 1.77 m Dimensions of Square Plot: 50 cm x 50 cm</p>
<p>0.50 m² Plot: Conversion Factor: Grams collected X 20 = kilograms per hectare Radius = 0.399 m Circumference of Hoop = 2.51 m Dimensions of Square Plot: 50 cm x 100 cm (1 meter)</p>
<p>1 m² Plot: Conversion Factor: Grams collected X 10 = kilograms per hectare Radius = 0.564 m Circumference of Hoop = 3.545 m Dimension of Square Plot: 1 meter x 1 meter</p>

(from USDA NRCS National Range and Pasture Handbook)

EXAMPLE ON HOW TO CALCULATE TOTAL FORAGE

1. *Select Plots:*

10 plots have been randomly selected and sampled using a 4.80 ft² plot.

2. *Clip Plots:*

Clip all vegetation.

3. *Harvest, weigh, and record the weight (in grams) of each species.*

Species composition and weight (in grams) are below:

Plant Species:	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Average (grams)
Grasses											
<i>Crested Wheatgrass</i>	15	12	20	5	5	10	12	10	15	14	11.8
<i>Bluebunch Wheatgrass</i>	8	12	6	10	5	T	10	12	5	10	7.8
<i>Indian Rice Grass</i>	12	8	T	2	0	15	4	0	10	10	6.1
<i>Needle and Thread</i>	T	5	8	15	10	2	0	5	4	T	4.9
Forbs											
<i>Arrowleaf Balsamroot</i>	2	0	5	0	0	10	6	15	0	0	3.8
<i>Geranium</i>	0	2	6	0	0	0	0	0	2	5	1.5
<i>Globemallow</i>	0	0	0	6	10	5	0	10	5	0	5.1
Shrubs											
<i>Big Sagebrush</i>	0	0	0	0	5	0	0	0	0	0	0.5
<i>Fourwing Saltbush</i>	0	0	0	3	0	0	0	0	0	0	0.3

4. *After all forage is weighed, convert to air dry weight*

After plots are clipped and averaged, air-dry weight needs to be determined. Using tables 3-A through 3-C, the following was determined:

Grasses: headed out; boot stage to flowering

Forbs: Flowering to Seed Maturity

Shrubs: Older and full size green leaves

To acquire the air dry matter (in grams), multiply the average weight by the air-dry conversion percentage (found in tables 3-A through 3-C).

5. *Calculate pounds per acre of forage:*

After determining air dry matter, multiply the figure by the conversion factor for the plot size used (in table 4). We used a 4.80 ft² plot, with a conversion factor of 20.

<i>Plant Species:</i>	<i>Average (grams)</i>	<i>Air-dry conversion percentage (Tables 3a – 3d)</i>	<i>Air dry matter (in grams)</i>	<i>Conversion factor for plot size (Table 4)</i>	<i>Total forage in pounds per acre</i>
<i>Grasses</i>					
<i>Crested Wheatgrass</i>	11.8	45%	5.31	20	106.2
<i>Bluebunch Wheatgrass</i>	7.8	45%	3.512	20	70.24
<i>Indian Rice Grass</i>	6.1	45%	2.745	20	54.9
<i>Needle and Thread</i>	4.9	45%	2.205	20	44.1
<i>Total Grasses:</i>					275.44
<i>Forbs</i>					
<i>Arrowleaf Balsamroot</i>	3.8	40%	1.52	20	30.4
<i>Geranium</i>	1.5	40%	0.6	20	12.0
<i>Globemallow</i>	5.1	40%	2.04	20	40.8
<i>Total Forbs:</i>					83.2
<i>Shrubs</i>					
<i>Big Sagebrush</i>	0.5	65%	0.325	20	6.5
<i>Fourwing Saltbush</i>	0.3	50%	0.15	20	3.0
<i>Total Shrubs:</i>					9.5
<i>Total Available Forage:</i>					368.14

Generally, it is recommended that only half of the total forage be used for animal grazing. However, based on your grazing system and plants, different levels can be used. Consult your local Natural Resource Specialist for these numbers.

REFERENCES:

USDA Natural Resources Conservation Service. National Range and Pasture Handbook. 1997.

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<i>Plant Species:</i>	<i>Plot 1</i>	<i>Plot 2</i>	<i>Plot 3</i>	<i>Plot 4</i>	<i>Plot 5</i>	<i>Plot 6</i>	<i>Plot 7</i>	<i>Plot 8</i>	<i>Plot 9</i>	<i>Plot 10</i>	<i>Average (grams)</i>
<i>Grasses</i>											
<i>Forbs</i>											
<i>Shrubs</i>											

<i>Plant Species:</i>	<i>Average (grams)</i>	<i>Air-dry conversion percentage (Tables 3a – 3d)</i>	<i>Air dry matter (in grams)</i>	<i>Conversion factor for plot size (Table 4)</i>	<i>Total forage in pounds per acre</i>
<i>Grasses</i>					
<i>Forbs</i>					
<i>Shrubs</i>					
<i>Total Available Forage:</i>					