A Method of Determining Stocking Rate Based on Monthly Standing Herbage Biomass

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Stocking rate is the number of animals (animal unit) for which a grassland unit (acre) can provide adequate dry matter forage for a specified length of time (month). Stocking rate depends on the amount of herbage biomass available to grazing animals, the time of year, the type of grazing system used, and the amount of forage consumed by livestock per month. Stocking rate is commonly presented as acres per animal unit month (AUM) or its reciprocal, AUM's per acre.

Forage dry matter intake of grazing animals is affected by the size of the cow. Large cows consume more forage than do medium- and standard-sized cows. A more accurate estimate of daily or monthly forage demand of livestock on grazinglands can be determined with the metabolic weight of the animal than with its live weight. Metabolic weight is live weight to the 0.75 power. A 1000-pound cow with a calf is the standard, which is defined as 1.00 animal unit (AU) and has a daily dry matter allocation of 26 pounds of pasture forage. The metabolic weight of a 1200-pound cow with a calf is 1.147 animal unit equivalent (AUE), which has a daily dry matter allocation of 30 pounds of pasture forage. The metabolic weight of a 1400-pound cow with a calf is 1.287 animal unit equivalent (AUE), which has a daily dry matter allocation of 33 pounds of pasture forage. The amount of forage dry matter consumed in one month by one animal unit, a 1000-pound cow with a calf, is an animal unit month (AUM). The daily dry matter allocation for a cow with a calf on pasture is different from the daily dry matter requirement for just the cow during the same production periods. During the grazing season from May through November, the length of the average month is 30.5 days.

The mathematical process used to determine stocking rate from herbage biomass is presented in table 1. The amount of herbage available during the grazing season is the average value of the mean monthly standing herbage biomass values for the grazing-season months. The mean monthly standing herbage biomass should be determined by clipping and weighing the dry herbage from each pasture and averaging the weights over several years. If these values are not available, the generalized values for western North Dakota native rangeland (table 2) can be substituted. The general monthly herbage values on the herbage weight curve in table 2 are averages of herbage production on well-managed pastures during years with normal precipitation.

The average monthly herbage biomass is determined by adding the monthly herbage biomass for the months of the grazing season and dividing the sum by the number of grazing-season months (step 1).

Not all of the average herbage biomass for the planned months of the grazing season is consumable forage. Perennial plants must retain a portion of the leaf material to conduct photosynthesis and provide carbohydrates and other products necessary to sustain healthy and productive growth. The grass plant must retain 50% of the peak leaf material biomass produced that growing season. This value implies that the plant retains half the herbage and half the herbage is available for utilization (step 2, 1st process).

Not all standing herbage available for proper utilization is ingested by grazing animals. Grazing livestock consume only about 50% of herbage available for utilization. The remainder of the utilized herbage is senescent leaves broken from the plant, soiled by animal waste, consumed by insects and wildlife, and lost to other natural processes. Data to allow comparison of forage-harvest efficiency on different grazing systems are not available. However, the quantity of herbage ingested by livestock would be expected to increase with improvement in efficiency of harvest from some grazing systems (step 2, 2nd process).

The differences in daily dry matter allocation for cows of different weights are used to adjust stocking rates for cow size. The standard 1000-lb cow requires 26 lbs of dry matter per day. The dry matter allocation for lighter or heavier cows can be determined by multiplying 26 lbs by the

animal unit equivalent (table 3), which is based on the metabolic weight of the cow (step 3, 1st process).

The amount of forage dry matter allocation per cow per month is the daily amount of dry matter allocation per day adjusted for cow size multiplied by the number of days per average month (30.5 days) (step 3, 2nd process).

The stocking rate, presented as AUM's per acre, is the pounds of available monthly forage, as determined in step 2, divided by the amount of dry matter allocation needed per cow per month, as determined in step 3.

Regions of the country that have forage production per acre sufficient for more than one AUM use stocking rates as AUM's/acre. Arid and semiarid regions of the country that require more than one acre to produce the need forage for one AUM use stocking rates as acres/AUM. The reciprocal stocking rate of acres per AUM can be determined by dividing the stocking rate as AUM's/acre into 1 (one) (step 5). This is the number of acres required to provide forage for one month for a cow of the adjust size with a calf.

Stocking rates vary with the amount of herbage production and are determined from the average monthly herbage biomass for the months of the grazing season and the weight of the cows. The quantity of the standing herbage in grassland pastures is not constant during the period grazed. The weight of the herbage dry matter per acre increases during the early growth stages until the maximum plant height is reached, and then the dry matter weight decreases as the mature plants dry during senescence. Table 4 shows the stocking rates for different average monthly herbage biomass quantities and cow sizes.

The number of cows to turn onto the grazing system is determined by dividing the total number of acres in the pastures of a grazing system by the acres per AUM value and dividing this total number of AUM's by the number of months of the grazing season (step 6). The number of cows that can graze the pastures subtracted from the total number of cows in the herd will show any forage shortfall.

The stocking rate value determined by this mathematical process is based on the average monthly standing herbage biomass for the grazing-season months and has been adjusted for percentage utilization, percentage forage intake, and cow size.

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Table 1. Process to determine stocking rate from monthly herbage biomass.

1. Average monthly herbage biomass is equal to the sum of monthly herbage biomass for the months of the grazing season (from table 2) divided by the number of grazing season months.
2. Pounds of available monthly forage is the average monthly herbage biomass (Step 1) multiplied by % proper utilization (50%) and multiplied by % forage consumed (50%).
3. Pounds of forage dry matter per Animal Unit Month (AUM) is the dry matter required per 1000 lb cow per day (26 lbs) multiplied by the Animal Unit Equivalent (AUE) for the herd cow size (from table 3) multiplied by 30.5 days (for average grazing season month).
4. Animal Unit Months per acre is equal to the pounds of available monthly forage (Step 2) divided by the pounds of forage dry matter per AUM (Step 3).
5. Acres per AUM is equal to 1 divided by AUM/ac (Step 4).
6. The number of cows that can graze the available forage is equal to the total number of acres in the grazing system divided by the acres/AUM (Step 5) and then divided by the number of grazing season months.

Table 2. Generalized Standing Herbage Biomass for Well-Managed Native Rangeland during Normal Precipitation Years

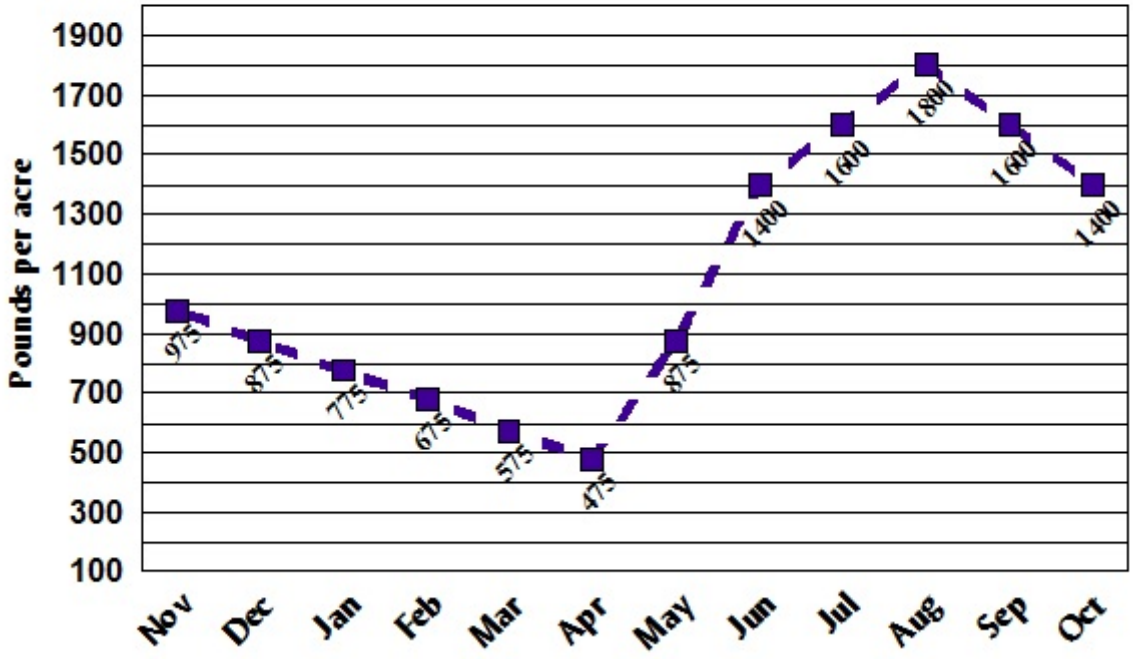

Table 3. Animal Unit Equivalent (AUE) and pounds of dry matter allocation per day.

Animal Live Weight (lbs)	Animal Unit Equivalent $y^{x\ 0.75}$ (% of 1000 lbs)	Dry Matter Allocation (lbs/Day)
600	0.682	18
650	0.724	19
700	0.765	20
750	0.806	21
800	0.846	22
850	0.885	23
900	0.924	24
950	0.962	25
1000	**1.000**	26
1100	1.074	28
1200	1.147	30
1300	1.217	32
1400	1.287	33
1500	1.355	35
1600	1.423	37
1700	1.489	39
1800	1.554	40
1900	1.618	42
2000	1.682	44
2200	1.806	47
2400	1.928	50
2600	2.048	53
2800	2.165	56
3000	2.280	59

Table 4. Stocking rates (acre/AUM) for different quantities of average monthly herbage dry matter biomass (DM lb/acre) and three weights of cows.

Stocking Rates acre/AUM	1000 lb Cows Herbage Biomass DM lb/acre	1200 lb Cows Herbage Biomass DM lb/acre	1400 lb Cows Herbage Biomass DM lb/acre
1.00	3172	3660	4084
1.25	2538	2928	3267
1.50	2115	2440	2723
1.75	1813	2091	2334
2.00	1586	1830	2042
2.25	1410	1627	1815
2.50	1269	1464	1634
2.75	1153	1331	1485
3.00	1057	1220	1361
3.25	976	1126	1257
3.50	906	1046	1167
3.75	846	976	1089
4.00	793	915	1021
4.25	746	861	961
4.50	705	813	908
4.75	668	771	860
5.00	634	732	817