

What Is an Animal-Unit? A Time to Conform.

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A third generation owner of a ranch in central Texas talks about stocking rate. Ten years ago, I leased my ranch to a fellow in a neighboring county. My family had been running 100 cows on our ranch for 63 years. Range condition had been evaluated and was considered to be High Good. I leased the ranch to the fellow to run 100 cows at \$100/cow/year. It is now time to renew the lease. When I went out to the ranch, I could not believe my eyes. It looked overgrazed, even worse than I remembered it looked back in the 50's. The SCS range conservationist and an Extension range specialist now consider my range condition to be Low Fair. What on earth happened? We did not have any drought years and rainfall was about normal for the 10 years. My family could run 100 cows easily for 63 years and now my lessee has deteriorated my ranch in just 10 years with exactly the same number of cows. How can this be? My Extension specialist did not seem as perplexed as I did. He explained that we ran 100 small frame Hereford cows and my lessee ran 100 large frame Beefmaster cows. He further explained that if the cows ate at the rate of 2.5% of their body weight, the 900 lb Herefords would eat 22.5 lb/day and the 1,450 lb Beefmaster cows would eat 36.25 lb/day. The Beefmaster cows ate approximately 38% more feed (grass, forbs, and browse) than the Hereford cows. Thus, my lessee has had 38% greater demand on my ranch for the last 10 years.

I considered an animal-unit to be a cow and I assumed that the stocking rate (carrying capacity) of my ranch was 16 acres/cow. I really made a mistake!

Standard Unit of Measure

Physical sciences deal with elemental units of measure (such as measures of mass, length, and time). These elemental units are called **standard units of measurement**. To measure physical quantities requires that we have some standard for comparison. The yard was first defined as the distance from the tip of the nose to the thumb of an extended hand of the English King Henry I (A.D. 1068–1135). This worked great as long as King Henry I was in close proximity to that which needed measuring. Obviously, a standard unit of measure needed to be developed.

1. The standard should be readily and widely accessible.
2. The standard should be easy to use.
3. The standard should be invariable.

Thus, using King Henry I's yard meets one but not the first two criteria. Using a metal bar to measure King Henry I's arm and copying the bar for others to use created a measuring device meeting all three criteria.

The establishment of any system of standard units of measure is completely arbitrary. Several such arbitrary systems are currently used. Obvious examples are the British Absolute system, the British Engineering system, and the Metric system (Woodruff 1966).

An Example:

I have a bucket in my garage which will hold liquid material. If I pour water into the bucket, it will only hold so much water, and the excess will run over the top and spill onto the ground. How much water will my bucket hold? The answer is, "**what standard unit of measure do I want to use?**"

My bucket will hold an amount of water. It will contain one gallon, four quarts, or 16 pints with the British system and 3.7853 liters in the Metric system. In this example the gallon, quart and liter are all standard units of measure of volume. One gallon, 4 quarts, or 3.7853 liters all represent the amount of water or any liquid my bucket will hold. Because I use a different standard unit of measurement does not change the laws of physics. One unit can be interchanged with other units of measurement.

What is An Animal-Unit?

The term "animal-unit" was coined to be a standard unit of measure. Vivien G. Allen, Chair, The Forage and Grazing Terminology Committee, 1991, stated "As the science and industry of grazing animals has grown in recent years, there has been a parallel growth of terminology, but definitions of terms have sometimes been obscure and inappropriate, and there has been a proliferation of terms used for a single meaning or definition." This has certainly been true of the use of the term animal-unit. Rangeland managers have faced this dilemma since the origin of the profession. Stoddart and Smith, as early as 1943, defined grazing capacity in terms of cow-days and then went on to define an average relationship of 6 sheep to 1 cow. Harrington et al. 1984 (Management of Australia's Rangelands) continued this method by stating that 1 head of cow is equivalent to 8 sheep, 11 goats, 13 kangaroos or 133 rabbits. Neither of these sources recognized the difference in a "cow". Stoddart and Smith (1955) defined an animal-unit as a 1,000 lb live weight cow and a

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calf. This was fine as long as you had 1,000 lb cows with calves, but what adjustments could you make for an operation which had 1,220 lb cows without calves or 600 lb steers? The need for a standardized animal-unit which does not equate to a particular animal has become extremely important for communication with other grazing managers.

The Society for Range Management (1964) defined animal-unit as one mature cow with calf or their equivalent. Ten years later, the Society for Range Management (1974) defined animal-unit as one mature cow (1,000 lb) based upon an average daily forage consumption of 26 lbs dry matter per day. This allowed for an animal-unit to be used as a conversion factor for kinds and classes of animals based on their demand for forage dry matter. This definition of an animal-unit has been used primarily by SRM members in the United States. Unfortunately, many different definitions of animal-unit are being used around the country and around the world.

The Forage and Grazing Terminology Committee (Terminology for grazing lands and grazing animals 1991) was charged with standardizing grazing terminology. Committee members were appointed by 8 different agencies (USDA SCS, BLM, Forest Service, BIA, ARS, and others), 5 professional societies (SRM, Animal Science, Dairy Science, and others), and representatives of New Zealand and Australia. They defined an animal-unit as a non-lactating bovine which weighed 500 kg. They also recognized that describing an animal-unit as a 500 kg bovine, would not allow for comparison to other kinds and classes of animals. This committee then recommended that assuming an **animal-unit** has a dry matter intake rate of 8 kg/day (17.6 lbs/day), "any animal may be represented as a certain fraction or multiple of the animal-unit, based solely on its rate of forage intake per day." You can obtain estimates of forage demand rates from many sources such as your county agent or SCS personnel, or use a percent of body weight if you prefer. This defined a standard unit of measurement of an animal-unit. **An animal-unit is a unit of measurement, not a particular animal!**

Yet Another Example:

Several years ago, Congress passed a law creating day-light-savings time. Each spring, clocks are moved ahead one hour and then back one hour each fall. A quiz question in an ecology class asked "What is the effect of adding one hour of extra daylight in the evening on forage growth?". Some students actually expounded on the scientific "basis" for a change in forage growth due to day-light-savings time. Obviously, they were tricked or did not understand that an hour is only a standard unit of measure for time. Because we move our clock ahead one hour in the spring does not change the rotation of the sun. Thus, we have the same number of hours of daylight whether we are on day-light-savings time or not. Believe it or not, if you understand the concept of an animal-unit, a change from demand for forage at a 26 lb/day rate to a

17.6 lb/day rate will not increase your stocking rate 33%! There are a few large ranches in Texas which ignore day-light-savings time just as you can the new value for an animal-unit; but be careful—you could end up an hour late for church in town.

If the central Texas rancher had used the animal-unit concept, he would have discovered that his carrying capacity was actually 12.5 AC/animal-unit-year (AUY) [$16 \times (17.6/22.5)$] and that his lessee was stocking his ranch at 7.75 AC/AUY [$16 \times (17.6/36.25)$]. No wonder his ranch looks like it does today. **This is not an academic dream, this is a real world ranch example, folks!!** The animal-unit concept allows for comparison of stocking rates across kinds, classes and weights of grazing animals and may explain why some rangelands look as they do today.

Carrying Capacity, Stocking Rate Conversion Chart

To Convert from a 26 lb/day Animal-Unit to a 17.6 lb/day Animal-Unit:

Old Standard 26 lb/day		New Standard 17.6 lb/day
AC/AUY	multiply by	.67
AUY/SECTION	divide by	.67
AUY/AC	divide by	.67
AUM/AC	divide by	.67

Example:

Convert an estimated average annual carrying capacity of 25 AUY/-
Section based on a 26 lb/day animal-unit to a 17.6 lb/day animal-unit:

$$25 \text{ AUY/SECTION} \quad (25/.67) = 37 \text{ AUY/SECTION}$$

Conclusions

In order for a standard unit of measure to be of lasting value, it must meet the three criteria. The latest attempt of individuals involved in grazing management, is the "Terminology for Grazing Lands and Grazing Animals" (1991) which attempts to standardize the animal-unit as a demand for 8 kg/day of forage. All three of the criteria are satisfied.

1. The standard should be readily and widely accessible. (*It was the consensus of professionals in grazing management from many disciplines from all over the world*).
2. The standard should be easy to use. (This standard should be no more difficult than the previous standard and should not pose a problem of ease of use).
3. The standard should be invariable. (Set at 8 kg of forage demand rate per day will have no variation).

It will require some effort to make the appropriate calculations to convert to the animal-unit 17.6 lbs/day. However, it will force the manager to evaluate how his grazing animals compare to the new unit of measure and perhaps more appropriately reflect their actual demand for forage.

We must also remember that there will be further discussion and deliberation concerning establishment of the standard unit of measure for an animal-unit. For now, the 17.6 lbs/day animal-unit is more standard than anything we had previously. The important thing is to understand

the concept, not whether we use 26 lbs/day or 17.6 lbs/day as the standard unit of measurement. The concept of a standard unit of measure must prevail, and we should all strive to conform to the new standard. The sooner we drop the connection of animal-unit with a particular animal, the better we will understand the concept of a standard unit of measure and how we can apply it to grazing management.

Literature Cited

- Harrington, G.N., A.D. Wilson, and M.D. Young. 1984.** Management of Australia's rangelands. Commonwealth Scientific and Industrial Research Organization. Australia.
- Society for Range Management. 1964.** A glossary of terms used in range management.
- Society for Range Management. 1974.** A glossary of terms used in range management. 2nd ed.
- Stoddart, L.A., and A.D. Smith. 1943.** Range management. McGraw-Hill Book Co., Inc. New York and London.
- Stoddart, L.A., and A.D. Smith. 1955.** Range management. McGraw-Hill Book Co., Inc. New York and London.
- Terminology for grazing lands and grazing animals. 1991.** The forage and grazing terminology committee. Pocahontas Press, Inc. Blacksburg, Va.
- Woodruff, Bobby J. 1966.** Terms, table, and skills for the physical science. Silver Burdett Co. Morristown, N.J.

Locoweed Effects on a Calf Crop

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Locoweed causes neurologic disturbances and emaciation in livestock, but its most devastating economic impact results from damage to reproduction (James et al. 1981). Swainsonine, the toxic alkaloid in locoweed, occurs in very low levels (.01–.2% of dry weight) in *Astragalus* and *Oxytropis* species. Swainsonine inhibits an essential enzyme in glycoprotein metabolism resulting in unmetabolizable hybrid sugar molecules that build up in vacuoles in cells and physically retard the cell function (Broquist 1985). Eventually, the organs and systems of the body lose their function, resulting in the many different clinical signs of poisoning.

The developing fetus is particularly susceptible to locoweed. Locoweed fed to pregnant ewes decreased fetal heart rate, caused cardiac irregularity, and decreased the strength of heart contractions (Panter et al. 1987). The weakened heart, in combination with right-heart failure, contributed to fluid accumulation in the anionic sack and placenta (hydrops amnii or allantois, commonly known as waterbelly). In other instances, the fetus dies and is aborted (James et al. 1967). Skeletal deformities of the limbs and spine have also been observed (James et al. 1967) and may be due to reduced fetal movement in ewes consuming locoweed (Panter et al. 1992).

Astorga (1993) found lambs born to ewes fed locoweed were developmentally impaired. They were slow to get up following birth, lacked the nursing instinct, and would not seek their mothers. Without assistance, all lambs from locoed ewes would have perished. Other research also reported small, weak offspring with low survivability (Balls and James 1973, James 1971).

Swainsonine, is excreted in the mothers milk (Molyneux et al. 1985), so offspring that survive birth may become intoxicated later. Calves, lambs, and even cats fed milk from cows that consumed locoweed, developed lesions of locoweed poisoning (James and Hartley 1977).

Locoweed also reduces fertility in both the male and female. It decreased spermatogenesis in rams and caused a complete loss of libido (Panter et al. 1989, James and Van Kampen 1971); and suppressed estrus and conception rates in ewes (Balls and James 1973).

Overall, the pre- and post-natal survival of offspring can be seriously jeopardized by the mother consuming locoweed. The purpose of this paper is to describe an incidence of reproductive failure that occurred during a locoweed grazing study (Ralphs et al. 1992). It illustrates the potential effect locoweed can have on a calf crop.

Cattle Grazing Study

The study was conducted in western Union County in northeastern New Mexico. Sixteen mature cows (Hereford, Angus, Charolais, and their crosses, 800 to 1,100 lb)

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