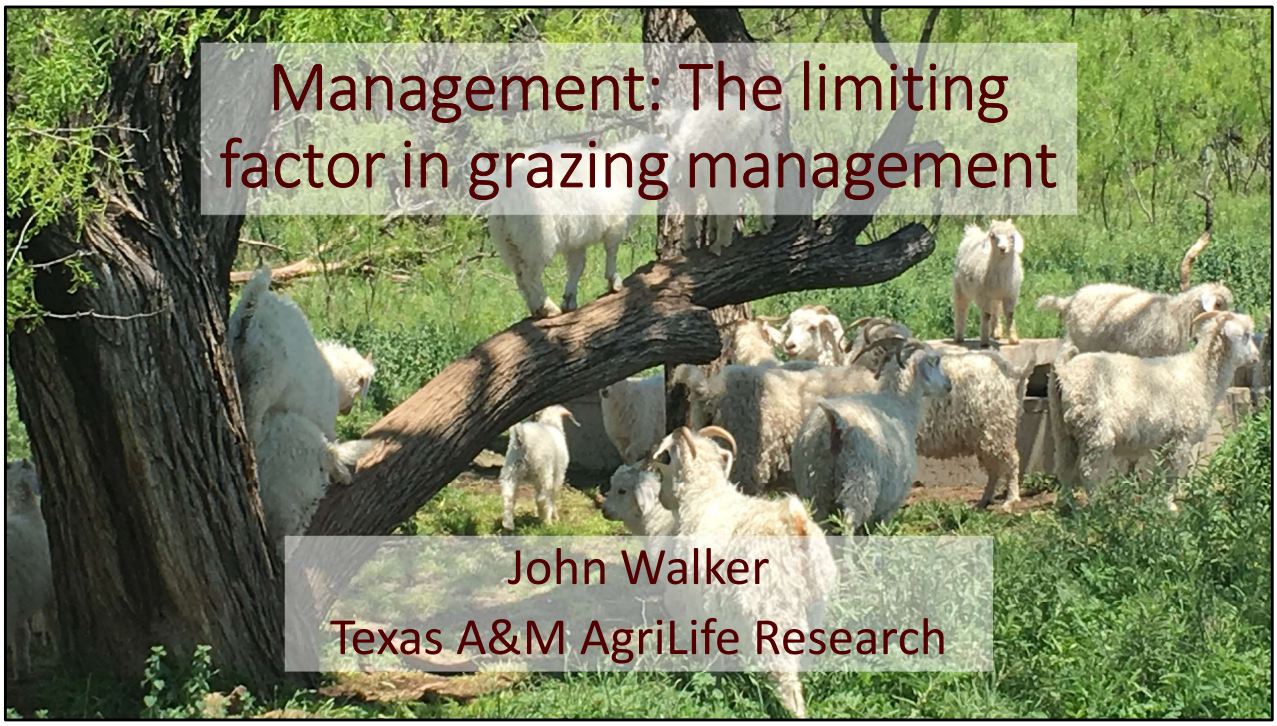


I started my career in rangeland management and grazing management in eastern Colorado doing a M.S. project on forage fed beef using complementary grazing systems or integrated crop and pasture grazing systems in the late 1970's

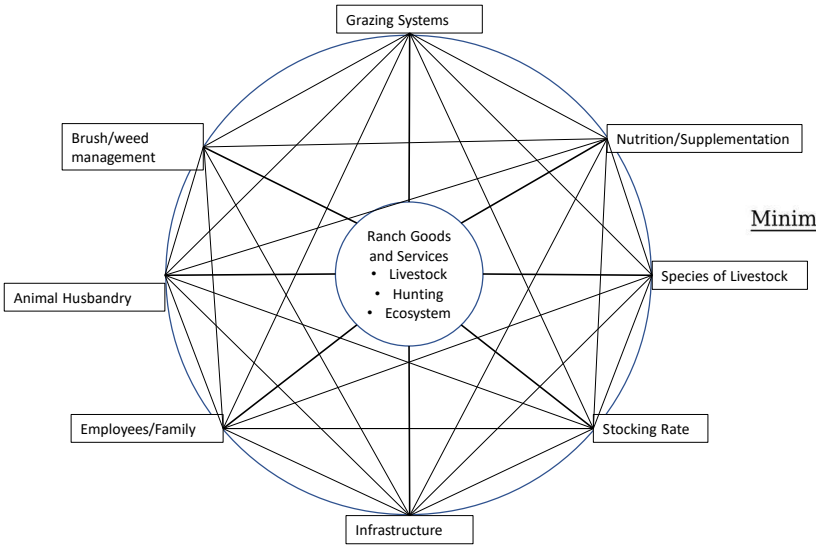
Then I moved to Texas and worked on short duration grazing at a time when Allan Savory was promoting rotational grazing as a way to double the carrying capacity of rangelands.

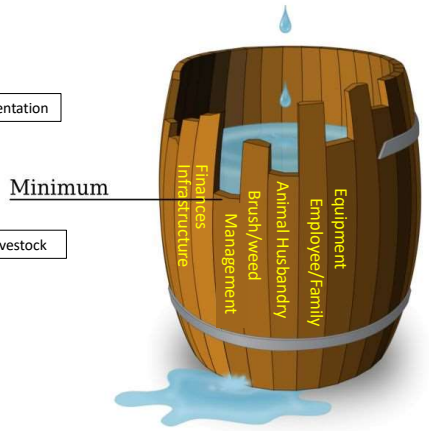
Following my Ph.D. I worked at the U.S. Sheep Experiment Station in southeast Idaho for 10 years and worked on using livestock to manage invasive weeds.

For the last 24 years I have worked in Texas primarily as an administrator responsible for managing 5 different ranches in 5 different counties.

Most recently I have been working on a sustainable ag project in cooperation with Oklahoma State University and University of Nebraska to use fire and goat browsing to control woody plant encroachment.

Management the limiting resource





Liebig's Law of the Minimum

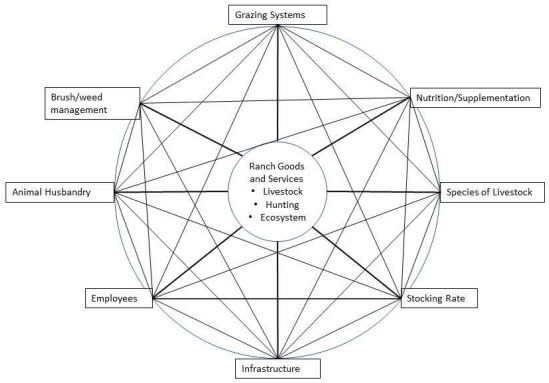
Ranch management is complex and there is only so much complexity that we can deal with.

Management

The organization and coordination of the activities of a business in order to achieve defined objectives. Management is often included as a factor of production along with machines (grazing animals), materials (rangeland resource, infrastructure), and money.

TEXAS A&M AGRILIFE RESEARCH

I like this definition of management that Jack Welch wrote. He was the CEO of GE and would not let his employees call him Mister, so don't call me Dr.



Because of the Complexity Agriculture producers are not profit maximizers.

TEXAS A&M AGRILIFE RESEARCH

Because of the complexity of agricultural systems Agriculture producers are not profit maximizers. So if you hear a talk including this one that states you could make more money if you did this or that there are likely to be good reason why you are not going to adopt the suggested practices.

Having said that: Earl Ainsworth an editor of the Farm Journal back when LISA, i.e., Low Input Sustainable Agriculture, was a catch phrase (you can see I have been doing this for a long time) said that the only sustainable agriculture is profitable agriculture. So the premise of this talk is that although you are not profit maximizers you do not want to go broke.

Principles of Grazing Management

- Distribution (rotational grazing)
- Species of Livestock
- Stocking Rate

TEXAS A&M AGRILIFE RESEARCH

This list of principles of grazing management, i.e., Distribution, Species of livestock, and stocking rate are listed reverse order of importance. However, most managers choose the kind of livestock and grazing system for many different reasons and are not likely to change.

HIGH PLAINS JOURNAL™

TOP STORY

The great debate of grazing systems

By Lacey Newlin Jul 10, 2020 Updated Nov 18, 2020 0

Which grazing system to use has been a long-standing debate for years. (Journal photo by Lacey Newlin.)

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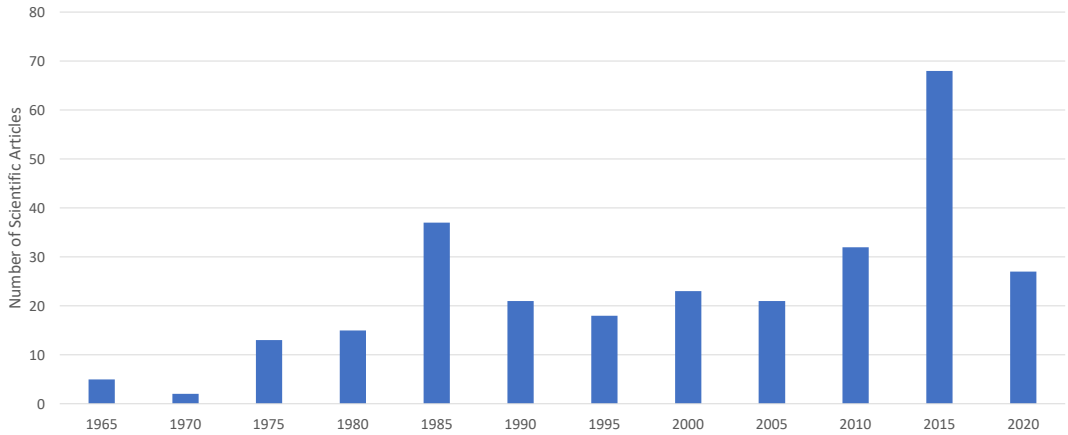
Scientific Articles on Rotational vs Continuous Grazing

source: Web of Science



TEXAS A&M AGRILIFE RESEARCH

Primarily because of Allen Savory promoting rotational grazing beginning in the late 1970's and at that time suggesting that it could double stocking rate, research was started in many places to investigate rotational grazing, which resulted in a lot of publication in the late 1980's and early 1990's. Then interest died down until 2008 when David Briske and colleagues published a paper that said the scientific evidence was that there was not advantage to rotational grazing.

“Realistically the only point of controversy is rate of stocking.”

Rangelands 5(4), August 1983 147

Short Duration Grazing and the Savory Grazing Method in Perspective

Rod Heitschmidt and John Walker

The primary objective of most grazing management practices is to maximize livestock and/or wildlife production per unit area of rangeland. But in order to satisfy this objective, management practices must insure that the forage resource is maintained over time. Currently, considerable controversy exists concerning the relative merits of short duration grazing systems in general and specifically the Savory Grazing Method as viable grazing management concepts. The primary objective of this presentation is to establish a balance between traditional concepts of range and ranch management and those associated with the Savory Grazing Method. We hope to satisfy this objective by first reviewing some of the basic principles of grazing management and then addressing points of controversy in an open and direct manner. First, let's review some of the basic principles.

Rangeland Productivity

Rangeland productivity, relative to salable livestock products, is primarily a function of three factors: (a) amount of forage produced; (b) forage quality; and (c) the efficiency by which the forage is harvested (Heitschmidt et al. 1982). The primary objective of essentially all grazing management practices is centered around the manipulation of these factors. For example, common methods of management used to increase quantity and quality of forage produced include irrigation, fertilization, and seeding of more productive species. Fencing and strategic location of water facilities and mineral boxes are common methods of management that enhance efficiency of harvest.

But in many instances, the relative increase in production that is attainable from the application of present technology to native rangeland, does not economically justify the implementation of such practices as irrigation and fertilization. Thus, various grazing management systems are often utilized as a method for increasing productivity. But just as the relative success of irrigation and fertilization is related to these three factors, so is the relative success of any grazing system; only the method differs.

Basic Principle of Grazing Management

All systems of grazing management are centered around the basic principle of grazing management which is the *control of frequency and severity of defoliation of individual plants*. Scientific research has repeatedly documented the adverse effects that frequent and severe defoliation of plants have on entire rangeland ecosystems. But to understand these effects, one must evaluate both the short-term and long-term response of an individual plant to defoliation.

Basically, the short-term or immediate responses of an individual plant to any defoliation event may be limited to three. First, it may flourish which conceptually may be perceived as an increase in size or number of plants. Secondly, it may die or at least decline in vigor. Thirdly, it may not respond in either a positive or negative manner.

As a result of these basic short-term responses, the competitive abilities of individual plants are altered. For example, a major difference in competitive abilities may result if one plant species is grazed and another is not grazed. These relative changes in the ability of plants to compete for a given resource results in a change in their relative abundance. One goal of any grazing management scheme is to prevent this shift in species composition toward less desirable species.

The major factor controlling frequency and severity of defoliation regardless of type of grazing system is grazing pressure. Grazing pressure is defined as the animal unit to forage unit ratio (Soc. Range Manage. 1974). Severity and frequency of defoliation will always increase as grazing pressure increases. But the relationship between grazing pressure and frequency and severity of defoliation is extremely complex in any rangeland because: livestock are selective grazers and forage preference and availability vary between the growing season and the dormant season. Basically, these factors create a situation whereby grazing pressure varies between plant species. Thus, the most preferred plants will generally be defoliated more frequently and severely than the less preferred plants. This is true regardless of type of grazing system.

Role of Grazing Systems

How is the frequency and severity of defoliation controlled in various types of grazing systems? Again for the sake of simplicity, let us limit our discussion of grazing systems to three basic types: continuous (1-herd, 1-pasture); deferred rotation (multi-herd, multi-pasture); and short duration (1-herd, multi-pasture).

Under continous grazing schemes stocked with a single class of livestock, rate of stocking is the principal factor

Authors are associate professor and research associate, Texas Agr. Exp. Sta., P.O. Box 1658, Vernon, 76384. The article is the text of a talk given at the annual meeting, Society Range Management, Albuquerque, NM, Feb., 1983.

The Savory Method of short duration grazing can be successful on any given ranch.

TEXAS A&M AGRILIFE RESEARCH

This is a paper that I co-wrote with my mentor Rod Heitschmidt in 1983 almost 40 years ago and not much that has happened in the intervening years has changed my mind. Furthermore, my colleague Poncho Ortega at Texas A&M Kingsville still uses this paper to teach his grazing management class.

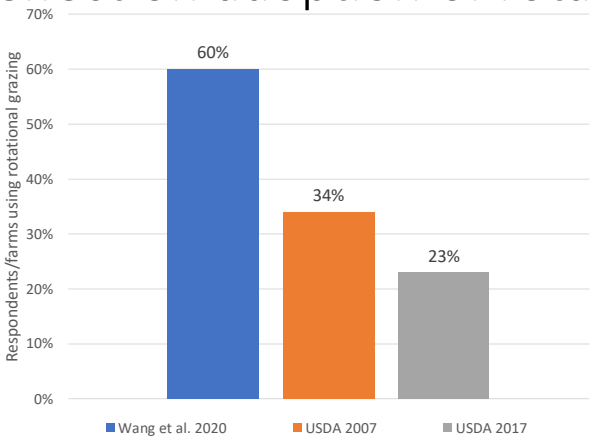
Two reasons to rotationally graze

- If your ranch has multiple pastures, grouping all animals that can be managed as a group into 1 pasture makes routine checking more efficient.

- Over time, rest especially long rest will improve the ecological health of rangelands and result in greater primary production and animal carrying capacity.

TEXAS A&M AGRILIFE RESEARCH

Science and strong arguments will have little effect on adoption of rotational grazing



Ranchers are a lot like scientists!

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it.

— Max Planck, Scientific autobiography, 1950, p. 33

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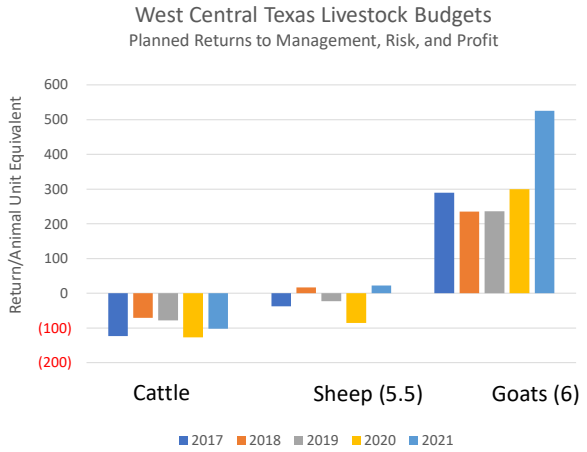
The USDA data percentage of farms that use rotational grazing was calculated by dividing the number of farms that use that practice by the number of Permanent pasture and rangeland, other than cropland and woodland pastured farms, which may overestimate the percentage of farms that use rotational grazing because rotational grazing is probably more common on cropland pastures. The difference between Wang et al. 2020 and USDA can also likely be attributed to the fact that Wang only surveyed operations with 100 hd or more non-feedlot cattle and in the USDA Census of AG less than 10% of the farms have 100 hd of cattle and calves.

Max Planck received the Nobel Prize in Physics in 1918 for his development of the quantum theory, which revolutionized human understanding of atomic and subatomic processes

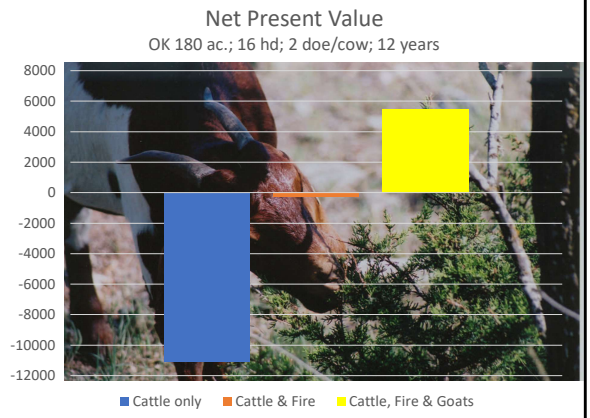
Livestock species

TEXAS A&M AGRILIFE RESEARCH

Goats have consistently been most profitable



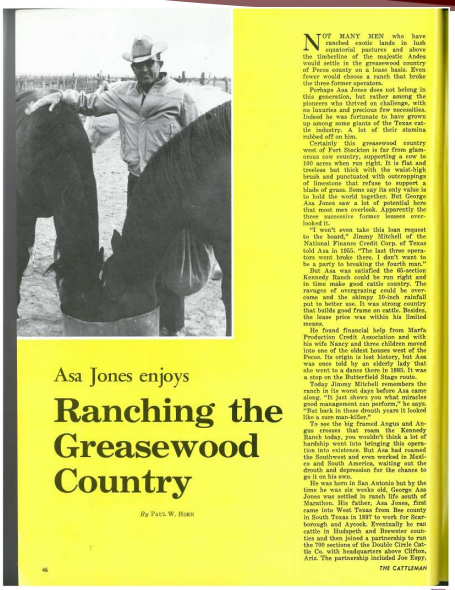
Source: https://agecoext.tamu.edu/resources/crop-livestock-budgets/budgets-by-extension-district/district-7-west-central/



Source: Hintze, K., Bir, C. & Peel, D. 2021. Economic Feasibility of Mixed-Species Grazing to Improve Rangeland Productivity. Animals, 11, 1226.

TEXAS A&M AGRILIFE RESEARCH

Ranching is not a business it's a <u>disease</u>!



Asa Jones enjoys

Ranching the Greasewood Country

By PAUL W. HORN

NOT MANY MEN who have ranched exotic lands in lush equatorial pastures and above the timberline of the majestic Andes would settle in the greasewood country of Pecos county on a lease basis. Even fewer would choose a ranch that broke the three former operators.

Perhaps Asa Jones does not belong in the first category, but neither among the pioneers who thrived on challenge, with no luxuries and precious few necessities. Indeed he was fortunate to have grown up among some giants of the Texas cattle industry. A lot of their stamina rubbed off on him.

Certainly this greasewood country west of Fort Stockton is far from glamorous cow country, supporting a cow to 100 acres when run right. It is flat and treeless but thick with the waist-high brush and punctuated with outcroppings of limestone that refuse to support a blade of grass. Some say its only value is to hold the world together. But George Asa Jones saw a lot of potential here that most men overlook. Apparently the three successive former lessees overlooked it.

"I'll bet even take this loan request to the board," Jimmy Mitchell of the National Finance Credit Corp. of Texas told Asa in 1955. "The last three operators went broke there. I don't want to be a party to breaking the fourth man."

But Asa was satisfied the 65-section Kennedy Ranch could be run right and in time make good cattle country. The ravages of overgrazing could be overcome and the skimpy 10-inch rainfall put to better use. It was strong country that builds good frame on cattle. Besides, the lease price was within his limited means.

He found financial help from Marfa Production Credit Association and with his wife Nancy and three children moved into one of the oldest houses west of the Pecos. Its origin is lost history, but Asa was once told by an elderly lady that she went to a dance there in 1885. It was a stop on the Butterfield Stage route.

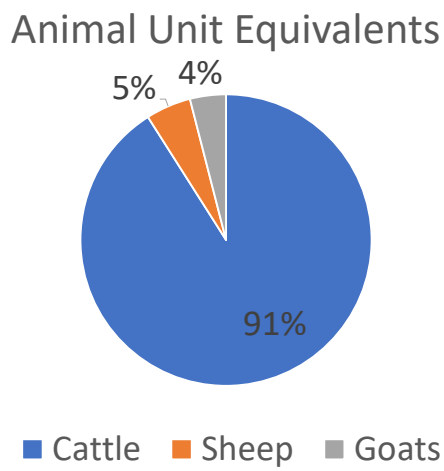
Today Jimmy Mitchell visits the ranch frequently and knows before Asa says anything, "I'll just show you what miracles good management can perform," he says. "But back in those drouth years it looked like a sure man-killer."

To see the big framed Angus and Angus crosses that roam the Kennedy Ranch today, you wouldn't think a lot of hardship went into bringing this operation into existence. But Asa had roamed the Southwest and even worked in Mexico and South America, waiting out the drouth and depression for the chance to go it on his own.

He was born in San Antonio but by the time he was six weeks old, George Asa Jones was settled in ranch life south of Marathon. His father, Asa Jones, first came into West Texas from Bee county in South Texas in 1897 to work for Scarborough and Aycock. Eventually he ran cattle in Hudspeth and Brewster counties and then Jeff Davis county. He was one of the founders of the Double Circle Cattle Co. with headquarters above Clifton, Ariz. The partnership included Joe Espy,

TEXAS A&M AGRILIFE RESEARCH

West Central Texas livestock composition



TEXAS A&M AGRILIFE RESEARCH

These statistics are for Texas the largest sheep and goat producing state in the U.S. Not only that they are for the heart of the sheep and goat producing region of Texas. What does that mean? There are many reasons for not integrating small ruminants into a ranching operation. For me the number one would be not getting phone calls at all hours of the day and night that your goats were on the County road or had their head caught in the fence.

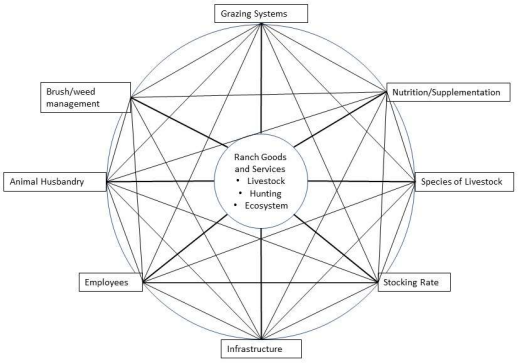
Still, a man hears what he wants to hear

And disregards the rest

TEXAS A&M AGRILIFE RESEARCH

This is the long and the short of 2 out of 3 of the principles of grazing management.

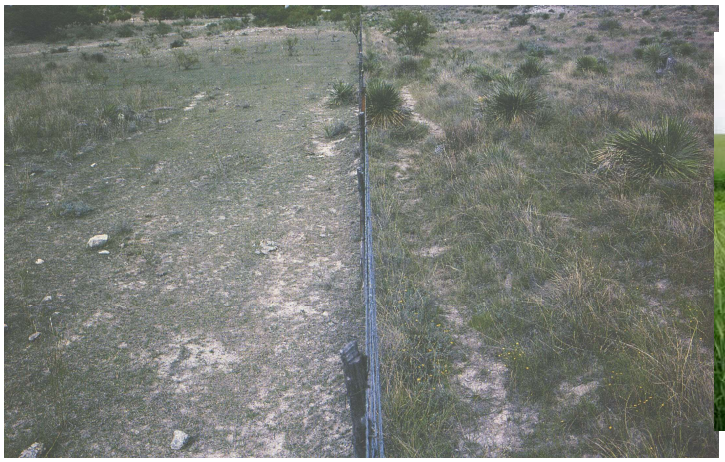
If Management is limiting
Mange what is most important



- ~~Distribution (rotational grazing)~~
- ~~Species of Livestock~~
- Stocking Rate

TEXAS A&M AGRILIFE RESEARCH

Stocking Rate
Nothing else matters until this is right!



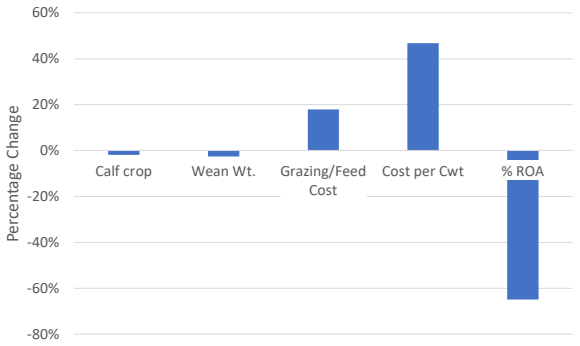
TEXAS A&M AGRILIFE RESEARCH

Proper stocking rate drives profitable livestock production

Principles of profitable livestock production

- Low production cost
- High reproductive efficiency

- Effect of 10% increase in Stocking Rate

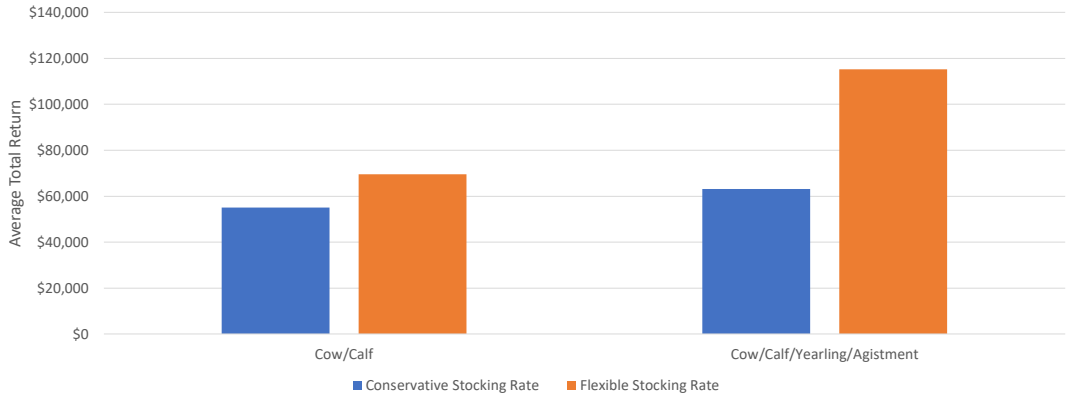


Source: Standardized performance analysis data – 475 Herds, TX, NM, OK 1991 – 2004 Herd Sizes 10 - 13,884

TEXAS A&M AGRILIFE RESEARCH

Analysis of 185 Cow-Calf Operations in the Northern Great Plains by Barry Dunn
Grazing management is the key to Low production cost and High reproductive efficiency. Purchased feed was 30% less for High compared to Medium and Low ROA operations were stocked 10% heavier the High or Medium ROA operations.
Of the 23 SPA production measurements used to describe the cow-calf enterprise that were compared for Low, Medium, and High Profit, the only measurement for which High Profit enterprises were higher ($P < 0.10$) than Medium and Low Profit enterprises was weaning percentage. On a per 100 lb. of weaned calf basis, High Profit enterprises had fewer total dollars invested than did Medium Profit ($P < 0.05$). They also had lower depreciation expenses ($P < 0.10$) and lower total expenditures ($P < 0.05$) than both Medium and Low Profit enterprises. High Profit enterprises had higher revenue ($P < 0.05$), lower breakevens ($P < 0.05$), and higher net income and ROA ($P < 0.01$) (Table 2) than Medium and Low profit enterprises. production systems in the three designated regions within this analysis vary, region was not a factor affecting profitability. This would indicate that the opportunity for profit was not determined by geographical region, but management's response to opportunities and challenges within regions. Purchased feed was 30% less for High compared to Medium and Low ROA operations were stocked 10% heavier the High or Medium ROA operations.

Flexible stocking rates can double net ranch return



Torell, L. A., S. Murugan, and O. A. Ramirez. 2010. Economics of Flexible Versus Conservative Stocking Strategies to Manage Climate Variability Risk. Rangeland Ecology & Management 63(4):415-425. doi: 10.2111/rem-d-09-00131.1

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28,000 acre; 575 Animal Unit ranch. 40 year planning horizon. Conservative stocking was flexible but could not

Management options for annual variation in forage availability

Good year

Bad year

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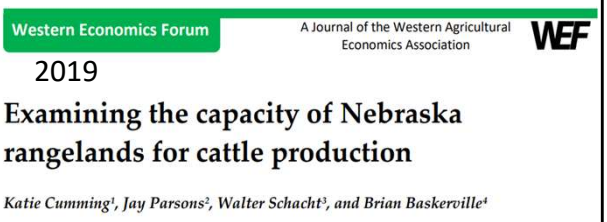
Is your stocking rate about equal to the carrying capacity of your grazing land?

- Conclusion
  - These results indicate that, as a whole, the state of Nebraska was operating at 100% of carrying capacity.
- Simplifying assumptions.
  - Cattle production is the sole user of the perennial grazing resources.
  - The potential perennial forage production in each county was based on the most productive plant community best adapted to each ecological site.



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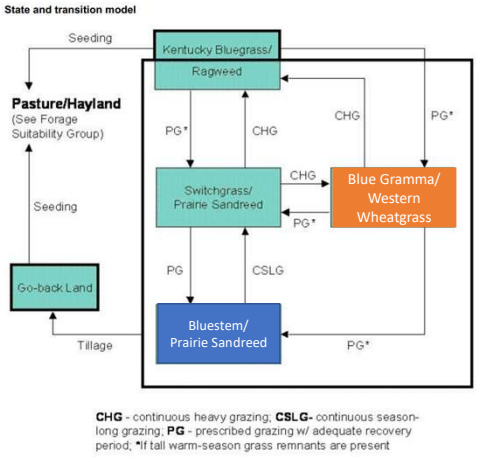
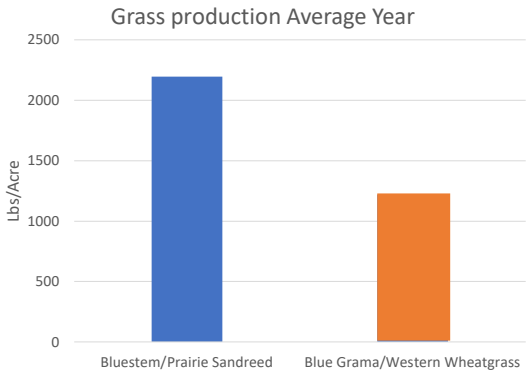
Ignoring other grazers, i.e., bison, sheep & goat not a big problem they would increase forage demand by only about 2%.

using the most productive plant community would cause the actual forage production to be lower than what we estimate for this analysis. This may impact the results significantly; for example, in Eastern Nebraska, where a majority of pasture acres are predominantly smooth brome grass and Kentucky bluegrass, the actual plant production is less than the most productive plant community for most Eastern Nebraska soil map units.

Ecological condition affects forage production

Sandy Medium Ecological Site





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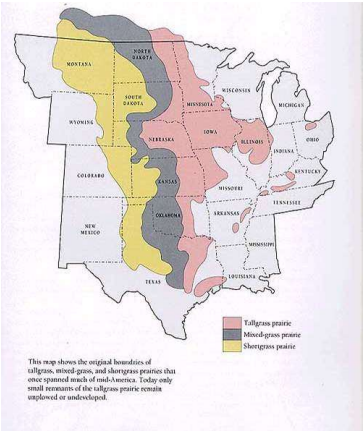
Proper stocking rate should be based on residual forage prior to the next growing season.

Table 1. Suggested forage residue levels for maintaining soil stability and plant vigor.			
Vegetation type	Precipitation (in)	Lbs/ac	Stubble height (in)
Tallgrass	30	1200 – 1500	10 – 15
Midgrass	20	750 – 1100	6 – 8
Shortgrass	15	300 – 500	2 – 3



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Monitoring end of grazing season forage production

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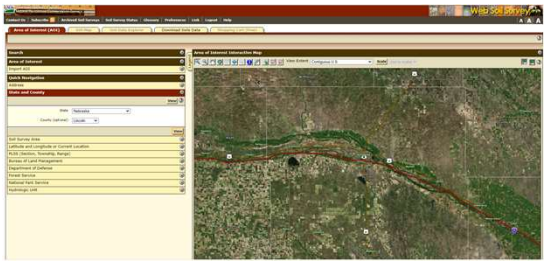
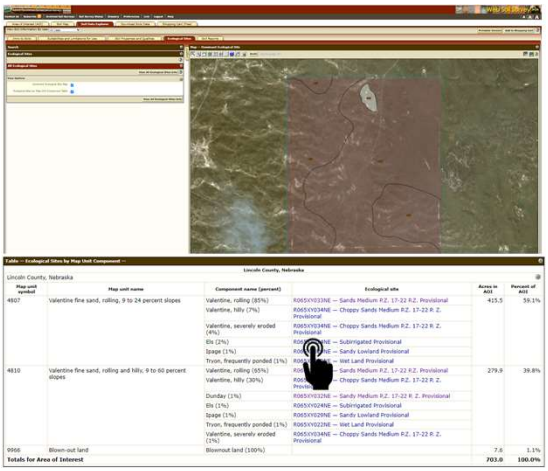
Determining carrying capacity

https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx





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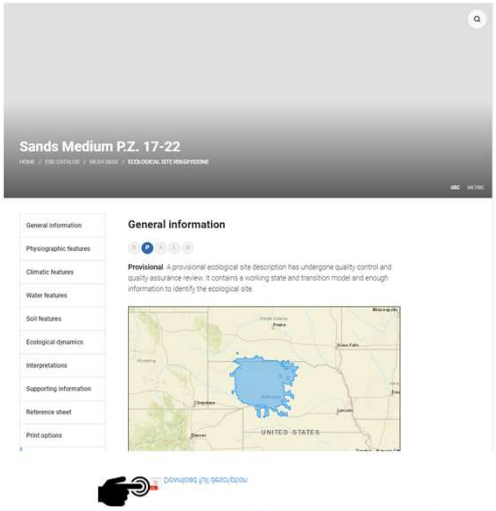
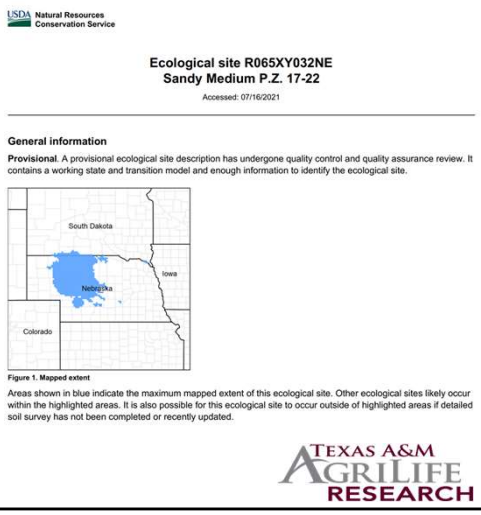
I suspect that many of the people that are overgrazing do not know the true carrying capacity of their ranch. The next few slides demonstrate a method that I have used successfully to estimate carrying capacity.

Ecological site descriptions





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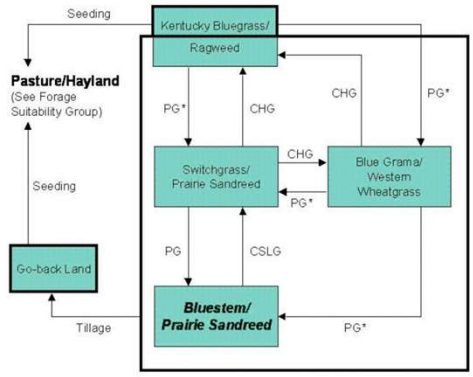
Acre/AU = ($26_{\text{lbs forage/AUD}}$ x days grazed) / (Lbs/Acre x 0.25)

Forage demand

State and transition model



CHG - continuous heavy grazing; **CSLG-** continuous season-long grazing; **PG** - prescribed grazing w/ adequate recovery period; *If tall warm-season grass remnants are present

Forage available

Bluestem / Prairie Sandreed

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1760	2196	2625
Forb	20	132	250
Shrub/Vine	20	72	125
Total	**1800**	**2400**	**3000**

(26 x 365) / (2196 x 0.25) = 17 ac/AU

Blue Grama / Western Weatgrass

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1025	1218	1410
Shrub/Vine	10	77	145
Forb	65	105	145
Total	**1100**	**1400**	**1700**

(26 x 365) / (1218 x 0.25) = 31 ac/AU

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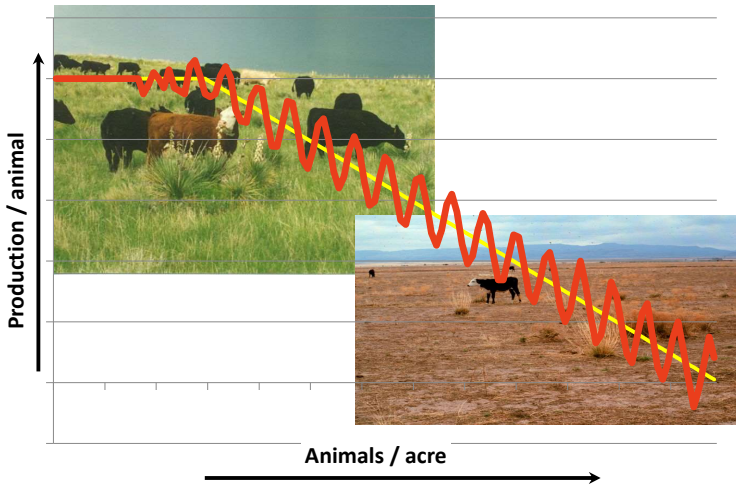
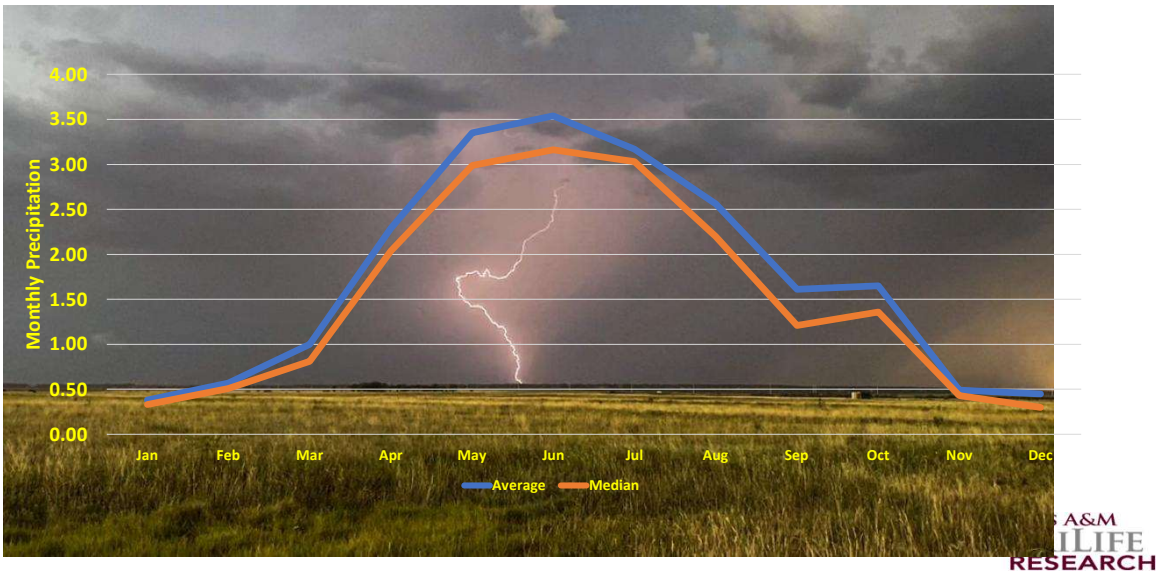
26 lbs of feed a day is the forage intake on a yearlong basis for a 1,000 lb cow raising a calf. If your cow herd averages 1,200 lb then use 31 lb/day.

Planning for forage variability



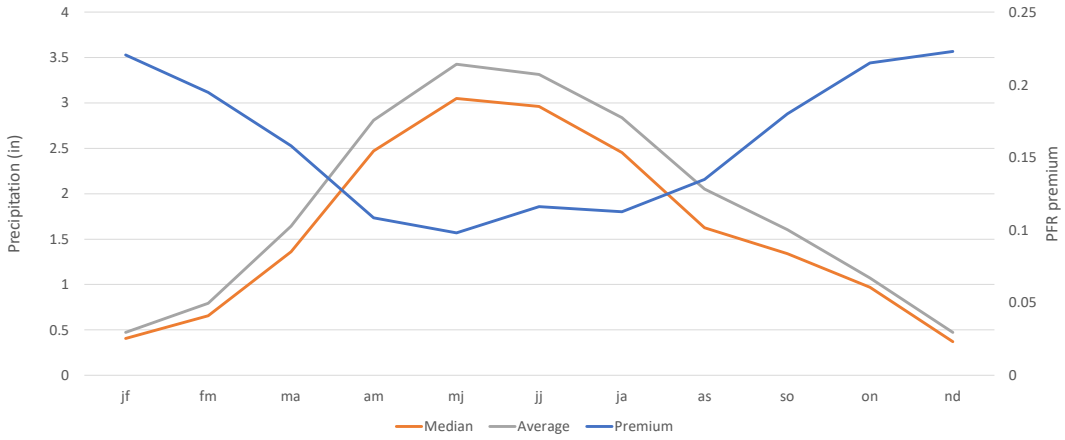
TEXAS A&M AGRILIFE RESEARCH

North Platte Precipitation



Nebraska precipitation is more normally distributed than in the areas that I have spent most of my time. The median, that number for which half of the events are above and half of the events are below is about 10% less than the average. In many place the difference is 20%. That means that you should not count on getting average precipitation because you will be overestimating your expected precipitation. Rather you should plan for the median year.

North Platte precipitation and PRF premium



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This slide is a bonus and not related to this talk, but of economic importance. When the median growing season precipitation diverges most from the average precipitation is also when the premium for PRF insurance is lowest. Take home message is don't divide your acreage evenly across all intervals but put more acres in the growing season intervals.

Use long-term forecasting to plan for Stocking Rate adjustments

- International Research Institute for Climate and Society
  - https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/
- National Weather Service – Climate Prediction Center
  - https://www.cpc.ncep.noaa.gov/products/predictions/long_range/
- Harris-Mann Climatology
  - http://www.longrangeweather.com/
- Weather Trends 360
  - https://www.weathertrends360.com/

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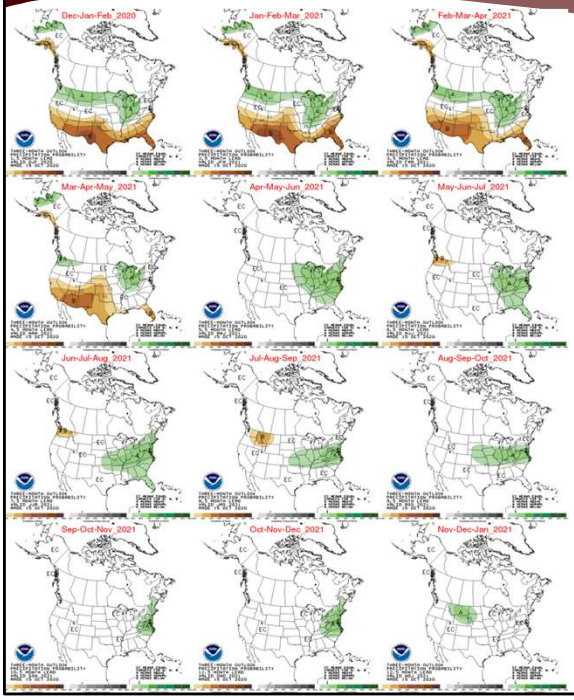

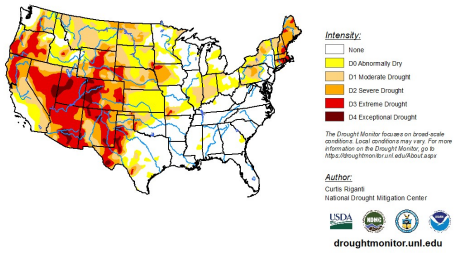

Long range precipitation forecast October 15, 2020

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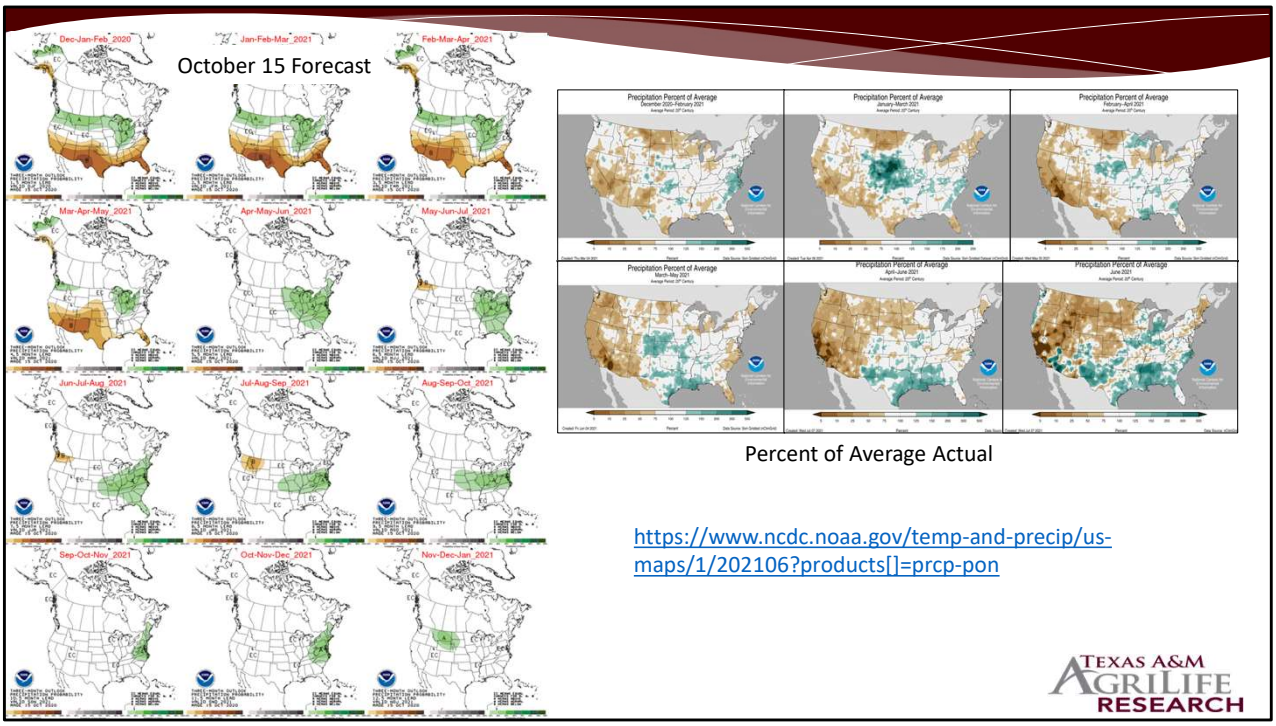
October 15 Forecast
Dec-Jan-Feb_2020
Jan-Feb-Mar_2021
Feb-Mar-Apr_2021
Mar-Apr-May_2021
Apr-May-Jun_2021
May-Jun-Jul_2021
Jun-Jul-Aug_2021
Jul-Aug-Sep_2021
Aug-Sep-Oct_2021
Sep-Oct-Nov_2021
Oct-Nov-Dec_2021
Nov-Dec-Jan_2021
Precipitation Percent of Average
Percent of Average Actual
https://www.ncdc.noaa.gov/temp-and-precip/us-maps/1/202106?products[]=prcp-pon
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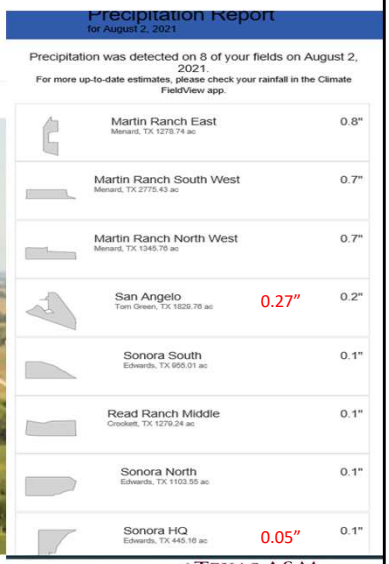
Free rainfall data for your pastures

https://climate.com/



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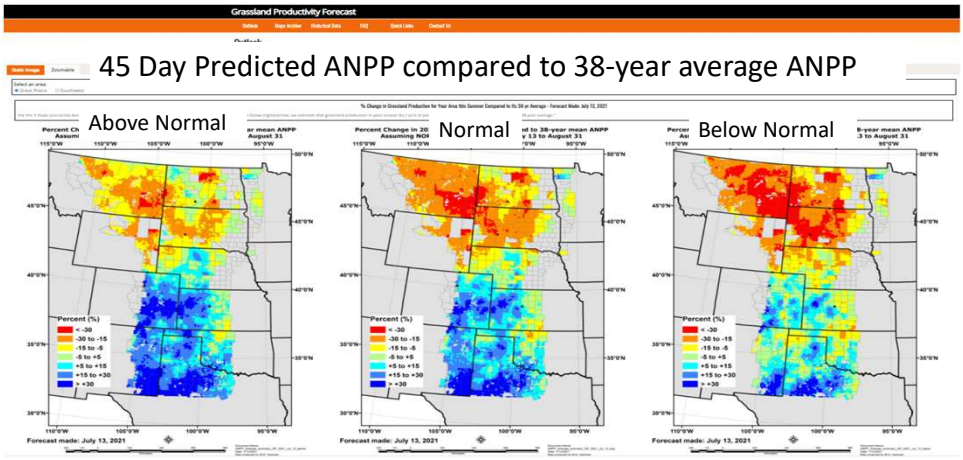
Grass-Cast https://grasscast.unl.edu/



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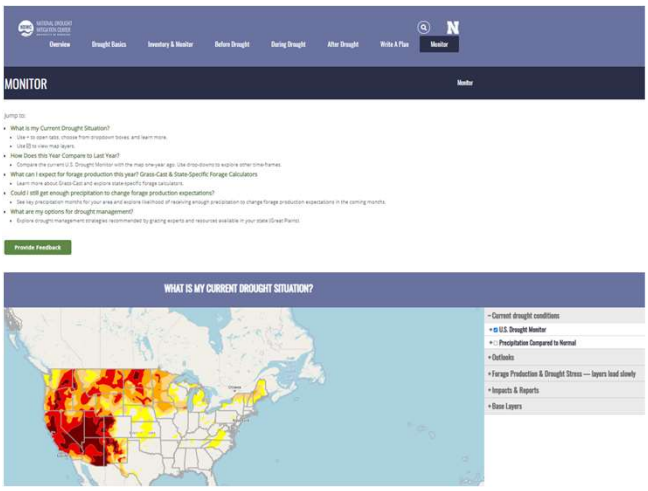
Ranch drought monitoring dashboard https://drought.unl.edu/ranchplan/monitor.aspx



- What is my Current Drought Situation?
- How Does this Year Compare to Last Year?
- What can I expect for forage production in the next 30 days?
- Could I still get enough precipitation to change forage production?
- What are my options for drought management?

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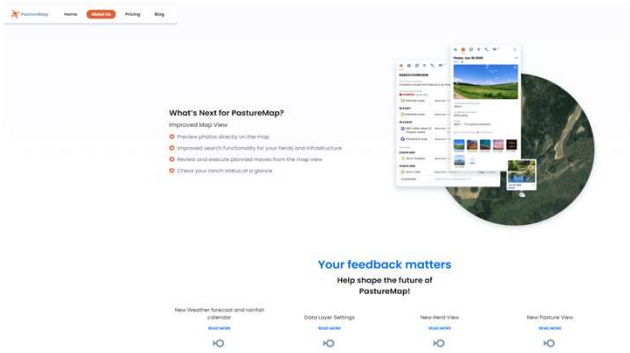
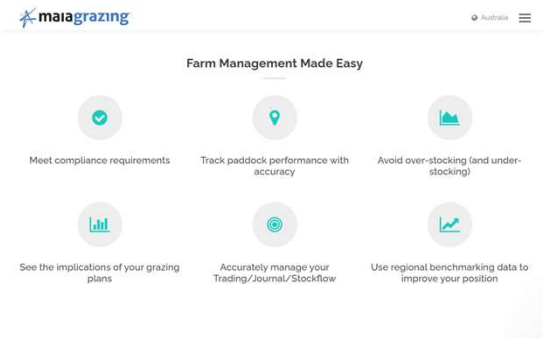
Best monitoring tool:
Look, Think, Record

Grazing management apps

PastureMap
U.S. $750, $500, $200



Maiagrazing
Australia $2,300; $1,150



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That's My Story