Paradise Found Ranch

Somewhere in the Rockies

Consulting visit May 24, 2016

1) Estimated carrying capacity
2) Recommendations on infrastructure development
3) Pasture improvement strategies

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Goals, Opportunities, and Challenges

The overarching goal at Paradise Found Ranch (PFR), like so many other ranches, it to provide a profitable living for owners. In this case, there are three families directly involved in operating the ranch who must derive all or part of their living from the ranch.

Ironically, given the name of the ranch, one of the operational goals is reducing the amount of hay being harvested and fed. Assessment has already been made of the hay production costs on the ranch and it has been determined that it may not be profitable to feed as much hay to the cow herd as has been done in the past. With declining cattle prices expected over the next few years, production costs will need to be reduced and the hay enterprise is an area where reductions could be made.

Increasing carrying capacity on the deeded range unit is another objective. Because the owner of the leased upland ranch has primary wildlife habitat goals, he is less concerned with the cattle component of his ranch. This places a distinct challenge for the PFR operations. Stock water distribution on both units is the primary challenge for improving grazing distribution and carrying capacity.

Timber encroachment on the upper range unit is another concern for PFR. While the landowner may be happy with more timber for more elk cover, it is not conducive to growing any more grass for the cattle operation.

Whenever we talk about challenges or opportunities for farming or ranching, weather always has to come into play. We will talk about the role of precipitation in determining the potential forage production in any environment a little later on in this report. Although winter weather can be severe at times, overall the climate is actually fairly moderate with expected daily highs exceeding freezing most days of the year. Total snowfall is fairly high at 53" annually, but Chinook weather patterns can cause snow to rapidly disappear. The historical weather records suggest strong potential for greatly extending the grazing season beyond what is typical for this region.

Table 1. Historical weather record for Somewhere in the Rockies.

	Mean		Record				*Mean*	
Month	Low	High	Low	Year	High	Year	Precip	Snow
			(°F)				(in.)	
Jan	16	35	-32	1997	67	1981	0.64	10.3
Feb	20	41	-33	2006	70	1995	0.48	7.5
Mar	25	47	-21	1965	75	2004	0.85	10.5
Apr	31	55	-2	1983	86	1962	1.58	0.8
May	38	65	11	2002	93	1954	2.83	1.9
Jun	46	75	27	1998	99	1990	2.46	
Jul	50	85	35	1972	104	2000	1.54	
Aug	48	85	28	1992	105	1961	1.37	0.2
Sep	40	73	10	1985	99	1998	1.48	1.6
Oct	33	60	-11	1991	88	1996	1.20	3.9
Nov	24	44	-31	1959	77	1999	0.74	7.7
Dec	18	36	-41	1983	62	1995	0.56	8.8
Means	**32.4**	**58.4**	**-5.0**	**1986**	**85.4**	**1986**	**15.73**	**53.2**

Estimated carrying capacity of the ranch

Operating a farm or ranch at the appropriate stocking rate is critically important to both your profitability objective and any land improvement objective. Stocking rate is one of the two main determinants of revenue flow for the farm. Product development and marketing is the other component of revenue. Carrying capacity is the appropriate stocking rate for a farm or ranch that allows you to achieve a target level of livestock or financial performance while maintaining or enhancing the health and quality of the natural resources of the operation.

We are going to look at three different means of estimating the overall productivity of a farm or ranch. Each has its own limitations, but the three together give us some boundaries of expectations for what we might be able to do on this property. Within the process of each of these estimates, we must also realize that carrying capacity is the product of both climatic environment and the management regime imposed. The climate dictates the upper limits of carrying capacity while our management determines how much of that potential we are actually able to capture. It is not uncommon to see a four-fold difference in 'carrying capacity' of individual farms or ranches within the same township or county. Those differences are almost always entirely due to management choices.

In these estimates, we will first come up with an expected pasture yield expressed as standard animal unit-days/acre or AUD/acre. There is a lot of confusion as to what constitutes a standard animal unit. The only thing that is really important to understand is it is nothing more than a harvested yield of 26 lbs of dry matter forage. We can then convert that usage to any class of livestock we choose. From the initial AUD/acre yield, we can then calculate how many head of any particular class of livestock the farm or ranch should be able to support. An AUM is one month's worth of AUDs and is equivalent to 780 lbs of harvested forage.

These three estimates project the 'potential' carrying capacity based on environmental factors of precipitation, length of the growing season, and soil type. From the grazing perspective, actual carrying capacity is the product of four factors managed in the context of the particular environment. These are: 1) Forage productivity, 2) Seasonal utilization rate, 3) Target intake level, and 4) Length of the grazing season.

While forage production is often thought of as being primarily determined by the environment, it is in fact just as much the product of our grazing management choices. The simple decision of whether to leave 4-5" of post-grazing residual rather than just 1-2" can double the productivity of a pasture. Relatively speaking, our day-to-day grazing management decisions have as much impact on carrying capacity as our growing environment.

Seasonal utilization rate and daily forage intake by the grazing animals are completely under our control and we can choose to be efficient or inefficient in our use of available forage. These two factors are tied very tightly to the length of grazing period we choose to utilize. In general, the shorter the length of the grazing period, the better we optimize these two parameters.

The length of the grazing season is the product of the interaction of these first three factors. There will be tradeoffs along the way as you seek to optimize your production system to meet specific goals.

Soil Survey estimate

The USDA-NRCS Soil Survey system offers a reasonable baseline for estimating carrying capacity of farms and ranches across the US. Over the past 40-50 years, soil scientists from SCS / NRCS have walked or driven over almost all the agricultural soils of the US and described those soils based on a number of characteristics including expected forage production. In my experience, the estimates are usually on the conservative side and are typically exceeded by good graziers after a few years of improved management.

Unfortunately, the data set for estimated pasture and hay yields on the irrigated part of the ranch was incomplete. There were alfalfa yields given for about half the soil types and pasture yields for only a couple. For the yields that were given, the average was about 2-3/4 tons/acre. The best soil type was given at 3.8 T/A and the lowest was 1.4 T/A. The corresponding grazing yield on the best soil was 6.8 AUM. We will use a different method to estimate carrying capacity on the irrigated.

Fortunately, the soil data set for the range units was much more complete in terms of yield information for all soil types in the unit. Unfortunately, there were a couple thousand acres that were blacked out. Did you used to have missile silos or something top secret on the ranch?

Table 2. Rangeland yield estimates for the deeded home range unit based on NRCS Soil Survey & projected harvested yield as AUD.

Soil Name	Slope	Acres	Pasture Yield (AUM/acre)	Total pasture yield as AUM	Seasonal Utilization target	Harvested forage (lbs/acre)	Total yield as AUD
Savage-Work clay loams	0-8	20.3	2000	40600	30%	12180	468
Soapcreek silty clay loam	0-2	60.6	4855	294213	50%	147107	5658
Cabba-Bacbuster-Doney complex	2-15	93.0	1623	150939	25%	37735	1451
Meadowcreek-Nesda complex rarely flood	0-2	0.6	3705	2223	25%	556	21
Tamaneen cobbly clay loam	15-35	6.0	1687	10122	25%	2531	97
Farirfield-Tamaneen complex	0-4	27.5	2249	61848	25%	15462	595
Cabba-rock outcrop	15-45	118.8	1031	122483	35%	42869	1649
Soapcreek-Clunton complex	0-4	321.6	4920	1582272	60%	949363	36514
Cabba-Bacbuster-Gnojek complex	2-15	2304.2	1567	3610681	45%	1624807	62493
Meadowcreek-Clunton rarely flooded compl	0-4	10.9	3970	43273	25%	10818	416
Bacbuster-Whitlash-Vershal complex	8-35	784.8	1490	1169352	40%	467741	17990
Cabbart-Tanna-Reedpoint complex	2-15	53.8	908	48850	40%	19540	752
Bacbuster-Bigbear-Vershal very channery	4-15	110.3	1745	192474	45%	86613	3331
Bacbuster-Bigbear-Vershal complex	4-35	360.2	1581	569476	45%	256264	9856
Rentsac-Tanna-Cabbart complex	4-35	53.0	805	42665	40%	17066	656
Cabba-Doney-Rock outcrop complex	15-60	139.8	1255	175449	30%	52635	2024
Bigbear-Bacbuster-Vershal complex	4-45	10.8	1835	19818	25%	4955	191
Denied access		2839.9	1818	5162938	35%	1807028	69501
Paradise Found Ranch rangeland pastures		7316	1818	13299676	42%	3748240	144163

By multiplying the number of acres for each soil type times the expected productivity for that soil type, we get an estimated total yield for this unit. The overall estimated mean rangeland yield for the deeded rangeland is about 1820 lbs/acre. Based on a mean seasonal utilization rate target of 42%, the projected harvested yield would be about 28 AUD/acre.

For the 'Denied Access' area (2800+ acres), I used the range yield mean from the other 4500 acres. If the southern third of that unit is markedly different soil from the northern 2/3rds. Then the estimate will either be too high or too low. Right now, this is the best we have.

The next block of calculations allows you to enter a specific class of livestock and a projected length of grazing season to see how many head of that class of livestock you might be able to run on the property. I have set the example for cow-calf pairs with cows weighing about 1400 lbs for a 120-day grazing season.

This example illustrates how this part of the process works. I have done a similar analysis for the Leased Ranch as well. In the overall summary of carrying capacity you will be able to look at what the ranch could support with or without certain land resources.

Table 3. Estimated carrying capacity of the deeded rangeland at the Home Ranch

PFR rangeland on the lower unit	7316	*acres*
Mean standing dry matter yield per acre	1818	*lbs/acre*
Target seasonal utilization rate	42%	
Mean dry matter yield /acre available for harvest	764	*lbs/acre*
Mean potentially harvestable AUD/acre	29	*AUD/acre*
% grazable land area	80%	
Grazable acres	5853	*acres*
Total animal unit days produced on grazable acres	171873	*AUD*
Drought reserve buffer	20%	
AUDs available for grazing with primary herd	137498	*AUD*
Expected harvested AUD/acre with drought buffer	23	*AUD/acre*
Projected grazing season	120	*days*
Potential carrying capacity	1140	*AU*
Animal weight for your stock	1400	*lbs/hd*
Animal unit equivalent	1.4	AU/hd
Number of animals of this class	814	*hd*

As we go through this process one of the important considerations is how much of the land area is actually open, growing grass, and is available for grazing. For the deeded lower range, I have used 80% as the grazable acres. For the upland Leased Ranch, I have used 60% for the grazable acres. While the upper part of that ranch looks pretty wooly, there is really a lot of open country on the lower reach. While there aren't large trees on that lower reach, there is an abundance of sagebrush cover.

We will discuss options for improved range production and utilization later int his report. This first section is strictly an assessment of what might be potentially available

Estimation based on historic hay yield

In the absence of good Soil Survey yield predictions based on the soil characteristics, we need an alternative method for estimating the potential carrying capacity for the irrigated land. A simple method of estimating potential grazing capacity is to base it on typical hay yields around your neighborhood. With good grazing management, we should be able to harvest just as much dry matter yield per acre as can be done through mechanical hay harvest, assuming daily rotation of the pastures.

For example, if you typically expect a 3.3 ton/acre hay yield with two cuttings, we can make the conversion to grazing capacity simply by using the SAU equivalent of 26 lbs/AU/day. We also need to adjust the hay yield to dry matter yield on which all grazing estimates are based. I generally use 88% dry matter content of hay as the standard conversion.

Table 4. Estimated carrying capacity from PFR irrigated acres based on a typical hay yield of 3.3 tons/acre

PFR irrigated land	1100	*acres*	carried forward from Soil Survey calculator
% grazable land area	95%		estimated open ground available for grazing
Grazable acres	1045	*acres*	Total acres X % grazable land area
Average yield/acre as hay	6600	*lbs/acre*	Best estimate of local hay yield from similar land
Target seasonal utilization rate	80%		Adjust for length of grazing period
Harvested dry matter yield / acre	4646	*lbs / acre*	Hay yield X utilization rate X % dry matter of hay
Expected AUD/acre	179	*AUD/acre*	Harvested DMY/acre ÷ 26 lbs DM/AUD
Total available animal unit days	186750	*AUD*	Grazable acres X Expected AUD/acre
Projected grazing season	185	*days*	How many days of the year will stock be on this unit
Potential carrying capacity	1009	*AU*	Total available AUD ÷ projected grazing season
Average weight for your stock	1400	*lbs/head*	Average weight of stock you will be grazing
Animal unit equivalent	1.4	*weight / 1*	Average weight ÷ 1000 lbs standard AU
Number of animals of this class	721	*head*	Potential carrying capacity ÷ AU equivalent

Using the criteria described above, the irrigated acres have the potential for carrying about 720 cows weighing roughly 1400 lbs for about 185 days or about half the year. If we shorten that period to just 145 days or about 4 ½ months, then the potential capacity goes up to about 920 head.

Another consideration when comparing hay as a harvested crop to grazing pasture is resulting animal performance. Hay is almost always harvested as Phase 3 growth and the expected digestible energy and protein levels are in decline. Effectively managed pasture will have most of the forage grazed as higher value Phase 2 forage. Individual performance on pasture is almost always greater than the performance had the forage been harvested as hay.

More effective nutrient return to the pasture through dung and urine also tends to keep grazed forage higher in mineral content than each successive hay crop. This does not mean that a pasture never needs to receive additional soil amendments or that grazing animals never require mineral supplementation. Those needs are determined on a case-by-case basis and will need to be monitored through time.

Precipitation-based pasture yield projection

To a large extent forage production and livestock carrying capacity are determined by the amount of precipitation received or irrigation applied and the effectiveness of the water cycle on your segment of the landscape. How effectively we manage the pasture to capture solar energy and then harvest it with livestock is the second component of carrying capacity.

The final method we will use is based on the expected dry matter yield per inch of water received based on overall precipitation regime. We start from a standard table of pasture yield based on amount of water available as shown in Table 5. As the amount of water available in the environment increases, each additional inch of water provides the potential for increased pasture yield, up to a point. Yield per inch of water declines rapidly above 40" of total effective water.

Table 5. Standard table for estimating pasture dry matter yield and animal unit day carrying capacity based on effective precipitation.

Precipitation range (inches/year)	Expected growth (lb/inch-H_2O)	Potential yield range (lb/acre/year)		Appropriate utilization for this moisture regime	Grazable forage at specified utilization (lb/acre)	**Expected AUD/A**	**Expected AUD/inch precip**
< 10"	50 - 100	200	1000	40%	240	9	0.92
10 - 15	100 - 150	1000	2250	45%	731	28	2.25
15 - 20	150 - 200	2250	4000	50%	1563	60	3.43
20 - 25	200 - 250	4000	6250	60%	3075	118	6.76
25 - 30	250 - 325	6250	9750	70%	5600	215	7.83
30 - 35	325 - 375	9750	13125	85%	9722	374	11.51
35 - 40	375 - 400	13125	16000	85%	12378	476	12.70
> 40"	Dry matter yield / inch of water begin to rapidly decline						

The historic record for precipitation for Somewhere in the Rockies was given in the introductory section of this report. We will do a calculation for the rangeland piece based on natural precipitation and an estimate for the irrigated fields based on an additional 20" of water applied.

An important thing to remember when looking at precipitation records is average precipitation is not normal precipitation. The typical precipitation pattern is 7 out of 10 years are below average and just a few are above average. It does not take very many excessive rainfall years to skew the average upward. Normal or median precipitation is generally 10-15% below the average. For your area, the normal precipitation is more likely to be in the 12"-14" range rather than the reported average of 15.3". This is why is doesn't seem that you receive the 'average' amount of rainfall because you don't!

Another consideration is not all winter snow turns into usable moisture for the growing season. Finally, heavy rainfall events can generate runoff beyond the soil's infiltration capacity and small summer rainfall events can vanish rapidly through evaporation. The result of all these parameters gives us what we call effective precipitation.

With all of this in mind, we can probably consider your effective growing season natural precipitation to be only about 10"-12" annually.

Table 6 shows the potential carrying capacity of the total of 27,000 acres of deeded and leased rangeland based on 12" of effective precipitation and an expected yield per inch of water set at 120 lbs/acre-inch. I have assumed 65% grazable acres across the total area.

Table 6. Carrying capacity estimate based on 12" effective natural precipitation.			
Effective water received per acre	12.0	inches	Effective natural precip + irrigation
Expected DMY per inch precip	120	(lbs/acre)	From the standard table or reasonable estimate
Projected dry matter yield	1440	lb/acre	Water received X DMY/inch
Seasonal Utilization target	42%	%	From the standard table or reasonable expectation
Grazed forage per acre	605	lb/acre	Projected DMY X Utilization rate
Daily AU forage requirement	26	lb/AU	Forage consumed daily by standard animal unit
AUD/A	23		Grazed forage / acre ÷ AUD
Target length of grazing season	365		How many days this unit is expected to provide feed
Forage requirement for specified season	9490	lb/AU for	AUD equirement X Length of grazing season
Required pasture / AU for specified season	15.69	acres/AU	Forage required for season ÷ Grazed forage / acre
Property size	27000	acres	Enter number of acres in the grazing unit
% grazable land	67%		How much of this land can actually be grazed
grazable acres	18090		Property size X AUD/acre
Total SAUD of this property	420801	AU annuc	Grazable acres X AUD/acre
AU Carrying Capacity for specified season	1153	Total AU	Total SAUD from ranch ÷ calendar days of grazing
Your average livestock wt	1400	lb/hd	Enter the average weight of your livestock
Your AU equivalency	1.40	Your wt /	Average weight of your livestock ÷ 1000 lb/SAU
Projected grazing season for your stock	180	days	How long will you have stock on this farm
Carrying capacity as your stock	1670	Stock unit	AU carrying capacity ÷ Your AU equivalency

The projected carrying capacity for 180 days is 1670 cows at 1400 lbs/head. This is considerably higher than anything you have done in the past and may seem totally impossible for you to accomplish.

Here are some considerations.

If the effective precipitation is really only 8-10", that would reduce the projected cow number by 20-40%. By the same token, if you were able to increase effective precipitation by 2-4" through better landscape management, that 20-40% becomes your potential increase in carrying capacity above the current situation.

If grazing distribution and harvest efficiency across the landscape is presently being limited by lack of stock water availability then there is also a clear potential to increase carrying capacity through additional stock water development. We will need to look at opportunities we have with water sources and landscape gradients to see what might be cost effective. I have encountered very few properties where we could not accomplish cost-effective infrastructure upgrades. We will pursue this topic later in the report.

Reducing tree and sagebrush encroachment would create more grazable acres that should translate to greater grazing capacity. Here is where the balance between the land owner's goal and your ranching goals need to be kept in balance. I don't believe there would be a shortage of elk cover even if you reduced the timber cover by up to 50%. You may want to bring in a professional wildlife manager to address that particular issue.

Table 7 shows the precipitation plus irrigation projection based on the same forage yield per inch of water concept. Remember yield per inch of water can increase up to about 40" of total available water.

Table 7. Carrying capacity estimate based on 12" effective natural precipitation plus 24" of irrigation water.

Effective water received per acre	36.0	inches	*Effective natural precip + irrigation*
Expected DMY per inch precip	380	(lbs/acre)	*From the standard table or reasonable estimate*
Projected dry matter yield	13680	lb/acre	*Water received X DMY/inch*
Seasonal Utilization target	80%	%	*From the standard table or reasonable expectation*
Grazed forage per acre	10944	lb/acre	*Projected DMY X Utilization rate*
Daily AU forage requirement	26	lb/AU	*Forage consumed daily by standard animal unit*
AUD/A	421		*Grazed forage / acre ÷ AUD*
Target length of grazing season	365		*How many days this unit is expected to provide feed*
Forage requirement for specified season	9490	lb/AU for	*AUD equirement X Length of grazing season*
Required pasture / AU for specified season	0.87	acres/AU	*Forage required for season ÷ Grazed forage / acre*
Property size	1100	acres	*Enter number of acres in the grazing unit*
% grazable land	95%		*How much of this land can actually be grazed*
grazable acres	1045		*Property size X AUD/acre*
Total SAUD of this property	439865	AU annuc	*Grazable acres X AUD/acre*
AU Carrying Capacity for specified season	1205	Total AU	*Total SAUD from ranch ÷ calendar days of grazing*
Your average livestock wt	1400	lb/hd	*Enter the average weight of your livestock*
Your AU equivalency	1.40	Your wt /	*Average weight of your livestock ÷ 1000 lb/SAU*
Projected grazing season for your stock	185	days	*How long will you have stock on this farm*
Carrying capacity as your stock	1698	Stock unit	*AU carrying capacity ÷ Your AU equivalency*

These precipitation-based models show a potential year-around capacity of about 1600 cows on the place. That does not take into account the land requirements for replacement heifers or bulls no any other cattle you might decide to keep or bring in as outside cattle. This model for the irrigated land is suggesting an annual harvested dry matter yield potential of over 5 tons/acre. I think that would be a real challenge in your environment, but it is not impossible.

We all understand you need to harvest the first four tons before you will ever get that 5th ton.

The projection based on what you have historically accomplished with hay yields suggests you might be able to carry about 700 cows on the irrigated land for six months. I based that on a seasonal utilization target that is only 80% of the hay yield. That could be accomplished with twice-a-week rotation if you were paying attention to the details. With daily rotation, you should be able to equal or exceed the hay yield from the same acres.

The soil survey estimate for the rangeland suggests a carrying capacity of about 1000 cows for six months based on allowing 40% drought reserve on the Leased Ranch and 20% drought buffer on your deeded rangeland.

I think you could reasonably plan for a carrying capacity of about 1200 animal units on the ranch based on year-around stocking. How you choose to allocate your forage resources to accommodate that stocking level is what we call stock policy.

Stock Policy for the next few years

Stock policy defines what types of livestock we have on the ranch, how many of each class, and the time period they are present on the ranch. We have the opportunity to have a single livestock enterprise or multiple livestock enterprises. We should base our allocation of forage resources on relative profitability of these enterprise options rather than relying on tradition to dictate our enterprise choices.

Within the beef cattle business at the ranch level, we may have cow-calf, growing (stockers), and finishing (finishers) phases. The product of the cow-calf phase is steer and heifer calves that can either flow into the growing enterprise after weaning or calves can be sold. Stockers grow into replacement heifers or finishers and can be finished on the same ranch or they can be sold as feeders. Each enterprise must purchase livestock from the prior stage. This approach gives us a point of weight and price where we have the opportunity to sell our product.

We may also be growing our own replacement heifers if we are in the cow-calf business. Heifers are a separate enterprise from the cow-calf phase because you always have the choice of either raising your own heifers or buying replacements. Depending on where we are in the cattle cycle, a replacement heifer may have more, the same, or less value than a stocker heifer destined for the feedlot. You may also choose to grow replacements for sale to other ranchers as a value added enterprise.

The ranch has the capacity to produce forage. It basically costs us the same to grow a ton of forage regardless of which animal type we have harvest that forage. For this reason, I bring each grazing enterprise back to a comparison based on standard animal units. Our bottom line becomes gross margin per AUD harvested. If profitability is our objective, we want to put as much of our limited supply of forage into animals that maximize return per AUD harvested.

We begin with a simple series of gross margin calculators with one for each stage of the cattle production cycle. Gross margin is the difference between the value of your product and the operating costs required to produce that product. Gross margin is what is left to pay all of your overhead costs, including your salary, and the residual remaining after paying overheads is your true profit.

Table 8 shows the gross margin calculator for the cow-calf phase with a brief explanation of the parameters. The production parameters are all typical of better run cow-calf outfits. We have been using a target cow size of 1400 lbs for all the carrying capacity estimates, so we will continue to use that animal. Adjust the % calf:dam weaning weight ratio to obtain the correct weaning weight for your calf crop. You can override the % ratio if you know you average weaning weights, but it takes away the informational value of knowing the weaning weight ratio of your herd.

The cattle prices in the calculator were taken from the 2016 annual budgeting program put together each year by Dr. Harlan Hughes in Laramie WY. The cost to keep a cow is based on the current nationwide average for custom grazing cow-calf pairs which is around $45/month. This may be higher or lower than your actual costs. Obviously, the better set of records you have for your own operation, the more valuable this tool becomes.

Table 8. Gross margin calculation for cow-calf enterprise.				
Average cow weight	1400	lbs	Daily cost to keep a cow	$ 1.50
Weaning weight %	45%	calf:dam	# of days cow is on ranch	365
Expected calf weight	630	lbs/calf	Annual cost to keep a cow	$ 548
Expected calf price / lb	$ 1.68		Annual Cow replacement cost	$ 334
Value per calf	$ 1,058	$/calf sold		
			Gross margin	$ 213
% weaned for cows exposed	88%			
lbs of calf per cow exposed	554	calf lbs/cow exposed	Gross margin ratio	19%
Calf sale value per cow exposed	$ 931	$ calf income / cow	GMR w/o cow replacement	50%
Cow cull rate	18%		Daily intake target for cow	2.8%
Cull cow price / lb	$ 0.65			
Value of cull cow	$ 910	$/hd		
Annual cull value allotment	$ 164	$ / cow exposed		
Gross income per cow exposed	$ 1,095	calf + cull income		

As a general business principle, profit is more rapidly advanced through cost reduction rather than increased output as long as the gross margin ratio (GMR) is less than 50%. With the GMR at 19%, the outfit in this example could clearly benefit from substantial cost reduction. If we look at the GMR without including cow replacement cost, the ratio looks much more favorable. Many economists do not include cow replacement in the gross margin calculation. Because cow replacement is an ongoing process and costs are incurred every year, I include cow replacement as an operating cost. I think if it is not included and a manager were to look at the 50% GMR instead of the 19%, they become lackadaisical about cost management to the detriment of the business. In this particular example, the cost area that most needs to be addressed is cow replacement.

Weaned calves from the cow-calf enterprise are moved into the growing phase of the business where they would remain through the winter. This phase runs for 180 days and gives us the starting weight and value of the cattle going into either the replacement heifer or finishing phase.

Cost for keeping the stocker is based on current custom grazing rates. Wintering costs may run higher depending on location. Performance may be higher or lower. In the current market situation, this is the least profitable part of the entire cattle complex.

Table 9. Growing stocker enterprise gross margin calculator			
Stocker beginning weight	630	Daily cost to keep a stocker	$ 1.00
Days on farm	180	# of days stocker on farm	180
Expected ADG	1.5	Cost to keep a stocker	$ 180
Ending stocker weight	900		
Expected value / lb at this weight	$ 1.32	Gross margin per head	$35
Value of stocker at end of growing	$ 1,188		

There are other enterprise calculators on the first worksheet page on the Excel file 'PFR Grazing Resources & Stock Policy.xlss 'which you have received via email. All of the calculators feed into the second worksheet page where you can see the comparison of all enterprises with the bottom line of gross margin/AUD.

Here is the first comparison of gross margin per AUD.

Table 10. Comparison of six different beef cattle enterprises on basis of gross margin return per AUD.

	Cow-calf Pair	Growing Stocker	Finishing Yearling	Replacement Heifers	Custom Stockers	Burger-Cow	
Animal live weight	1400	765	1050	1040	770	1088	*lb/hd*
Animal unit equivalency	1.4	0.77	1.05	1.04	0.77	1.09	*live wt/1000 lbs*
# of calendar days stock are on the ranch	365	180	150	285	120	90	*calendar days*
Target intake rate	2.8%	2.6%	2.8%	2.6%	3.0%	3.0%	*as % of weight*
Daily forage consumption	39.2	19.6	29.1	27.0	23.1	32.6	*lb/hd/day*
Forage consumption for time on ranch	14308	3521	4359	7703	2772	2936	*lb/hd/year*
Seasonal equivalent AUD consumption	**550**	**135**	**168**	**296**	**107**	**113**	*AUD/year*
Gross return per animal	$ 1,095	$ 1,188	$ 2,700	$ 1,500	$ 132	900	*$ /animal /year*
Operating cost per animal	$ 863	$ 1,238	$ 1,488	$ 1,448	$ 96	$ 704	*$ /animal /year*
Gross margin / animal	**$ 232**	**$ (50)**	**$ 1,212**	**$ 52**	**$ 36**	**$ 196.50**	*$ /animal /year*
Gross margin value / AUD	**$ 0.45**	**$ (0.37)**	**$ 7.70**	**$ 0.17**	**$ 0.39**	**$ 1.74**	*$/AUD*

Two numbers from the bottom line that will likely jump out at you are the very high GMV/AUD for the 'Finishing Yearlings' and 'Burger-Cow' enterprises. These are both enterprises built around the concept of buying on the commodity market and selling on the grass-fed premium market. We use the same calculator for seedstock operations selling bulls or heifers at a premium price based on individual value rather than priced by the pound.

If we look strictly at the commodity side of the market, the scary number is the negative margin for the growing phase. This is telling us that calves are overvalued relative to yearling prices. Conventionally fed cattle are expected to lose money again in first two quarters of 2016, but may improve as the ripple effect of lower fed cattle prices finally reaches back to the calf sector. What this really tells us from a stock policy standpoint is you either want to sell calves at weaning time for the next couple of years or carry them all the way through to a grass-fed market. There is very little margin in the in-between game right now.

Raising replacement heifers still has a decent margin to it, but that will likely shrink as cow prices begin to substantially soften in response to the falling calf market. Cow prices usually lag 12-18 months behind the fed cattle market in terms of adjusting to changing market conditions.

Custom grazing outside yearlings is expected to have a positive margin this year and ahead, but it is a smaller margin that what cow ownership can provide on a GMV/AUD basis. Low risk is the greatest selling point for custom grazing. It is a way to ramp up your stocking numbers to meet the productive capacity of the ranch, but it is not the most direct route to improving net worth in the cattle business.

As I indicated above, I used typical custom grazing numbers for the cost of operation. The gross margin will shrink or expand depending on whether your own costs are above or below those levels. The performance number I used are typical of above average cattle operations. The gross margin will also shrink depending on the performance of your own cattle. This Excel file is a very powerful tool for assessing the relative profitability potential of different enterprises on the ranch, but it is only as good as the input data.

Recommendations for infrastructure development

It is important to remember that the goal of developing a grazing cell is not just to have more fence and water infrastructure than anyone else in the neighborhood. The goal is to make your land healthier and more productive so that your livestock are healthier, more productive, and that you can raise more of them. Managing the duration of time any piece of pasture or soil is exposed to livestock is the key to making the land healthier and more productive. Fence and stock water developments are simply the tools we use to facilitate the management of time and space.

The fence and stock water requirements are driven by the level of management intensity you want to impose. Shortening the grazing period has several benefits for the pasture including reducing opportunity for overgrazing, increasing recovery times, promoting biodiversity, among many others. The duration of time for the grazing period to accomplish these benefits depends on the growth rate of the pasture or range. In a high natural rainfall or irrigated pasture environment, my preference is daily pasture allocation with a maximum of 3-4 day occupancy on any area. On rangeland I generally think in terms of maximum occupancy of 10-14 days, with less than 7 days being preferred.

From the grazing animal's perspective, longer grazing periods tend to reduce individual animal performance unless the stocking rate is very low. Since increasing stocking rate is one of the critical components of creating a profitable ranching business, low stocking rates are not at all desirable. My preference is still to move stock every day but we can get by allowing animals up to 3-4 days pass over the previously grazed areas without doing harm. Your irrigated grazing cell is designed so that 'back-grazing' should be kept to no more than four days.

Shorter time periods on smaller areas translate to higher stock density grazing which results in more even nutrient redistribution. On the negative side, excessive animal traffic can lead to soil compaction. Contrary to what many ranchers think, spreading cattle out over larger areas actually dramatically increases their daily travel mileage resulting in more hooves hitting the ground every day and delivering more physical impact on the soil. Shorter grazing periods at higher stock densities reduce daily travel distance and reduces animal impact on the soil.

Because of the much higher production potential of the irrigated land, there is greater opportunity for higher return on investment in fence and stock water infrastructure on the irrigated land compared to your rangeland. This makes improvements on the irrigated land a much higher priority than on the rangeland. Increased returns from the irrigated land can be used to finance future improvements on the rangeland.

Increased livestock output is the only way to pay for infrastructure development, in the absence of participating in cost share programs. We can assess the cost:benefit relationship by projecting what we expect the increase in carrying capacity to be as a result of some change in management or some additional input, in this case, stock water and fence infrastructure. If we can project additional AUD/acre as a response to our improvement, we can then use the gross margin/AUD calculated in the previous section to project the potential added GM/acre. This process helps us make an informed decision rather than simply gambling on the outcome.

The proposed infrastructure improvements for both the irrigated land and rangeland are shown on the map figures on the following pages. Laying out fences is generally fairly simple. Stock water development tends to be more complicated and generally much more expensive than fencing.

On rangeland we generally start our planning process by looking at the current stock water distribution in the grazing unit. Research has shown the travel distance from water at which an economically meaningful reduction in utilization to occur to vary from roughly a half-mile to three-quarters of a mile, depending on topography and climate. If we locate all the available water on the landscape and then draw circles of ½ to 3/4 of a mile, we identify those areas inadequately served with available stock water.

Here is what the lower unit of the home ranch looks like without including any possible live water from flowing streams.

Figure 1 shows both the ½ & 3/4 mile zones around the two existing stock tanks on this unit. If there is live water in any of the green stream channels shown on the map, then the situation is much more favorable than it appears. Without live water in those streams, over 60% of this unit is under-served with stock water which means there is great opportunity for improving carrying capacity through additional stock water development. Where live water is reliably available, we can draw lines at the appropriate distances from the stream corridors to identify those areas that are adequately served with stream water. If the two major water courses have year around reliable water, then the under-served area drops to about 20%.

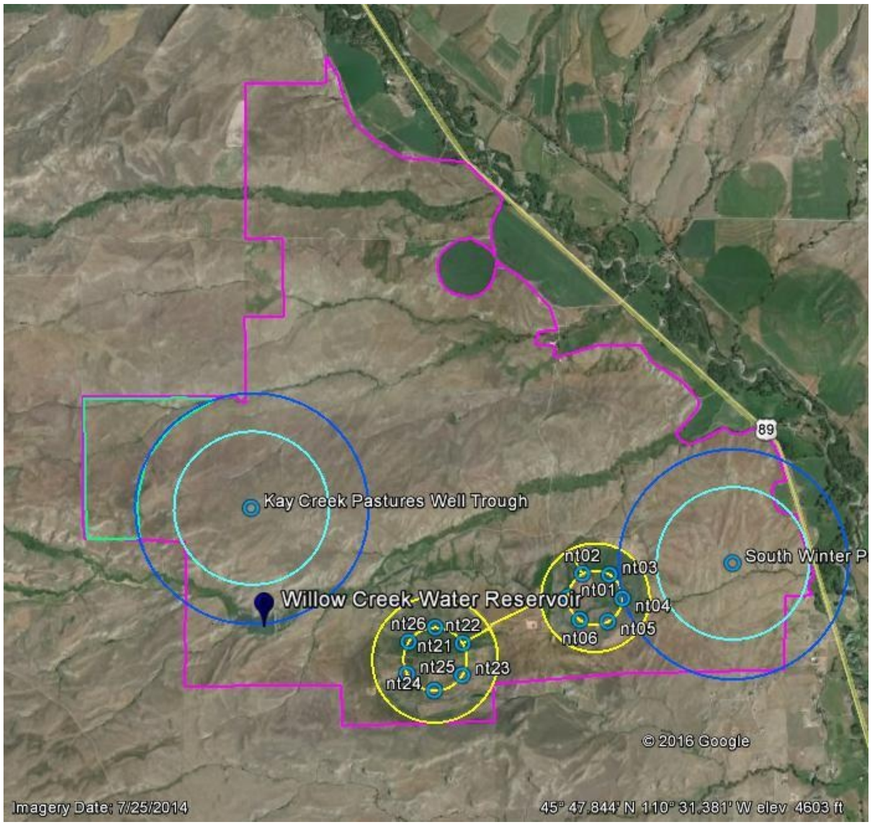


Figure 1. PFR deeded rangeland with 1/2-mile and 3/4 mile water circles showing potential areas of underutilization.

Based on the reported flow rate of 32 GPM from the Kay Creek well and the land gradient from this point, you do have the potential of installing a pipeline system that would deliver adequate water supply across the entire area east and north east of the Kay Creek pastures. With up to 300 ft elevation drop from the well site to the lowest elevation trough, the head pressure generated would be approximately 130 psi. Using 2" pipe through the entire system, you should be able to comfortably water a herd of 800-1000 cow-calf pairs. If you proceed with mostly fall-winter use on this unit, daily water demand would be substantially lower than the 35 gallons/pair maximum consumption that I used in the calculation.

The following diagram shows the location for the proposed pipeline, tanks, and permanent 2-wire HT subdivision fences. This grazing cell development will allow you to move away from the current monthly lengths of stay to weekly grazing increments. In a growing season grazing scenario, this would allow you to allow much increased recovery periods which should result in improved range vigor and productivity. In a dormant season grazing scenario, it will allow you to budget out the standing forage and ration the available protein.

Based on similar projects we have done, I expect at least 40% increase in carrying capacity from this unit as a result of this infrastructure investment and implementing appropriate grazing management to capitalize on the investment. I think you understand I have drawn the lines the best I could from a few hundred miles away relying on the contours shown on Google Earth. You will definitely need to do some ground-truthing and will likely need to make some adjustments in the exact routing of pipelines and fences. You may also decide to install some additional tanks along the way. Once a pipeline is in place, adding tanks is simple.

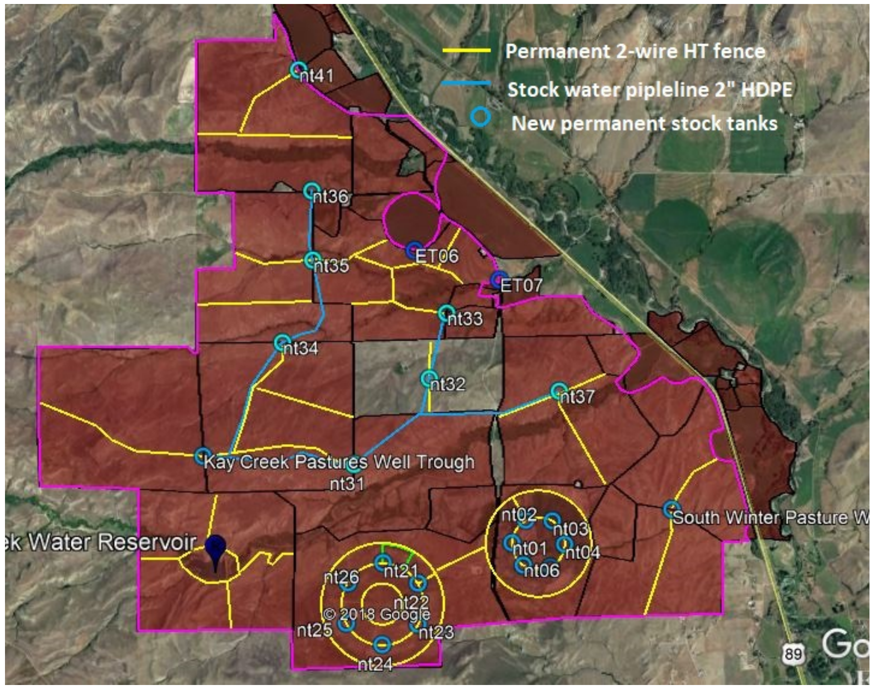


Figure 1c. Proposed grazing cell for the home rangeland unit and the two large pivots on Willow Creek.

Here is the cost estimate for this phase of the project.

Project information: Home Rangeland						
Acres in project	7100	acres		Capital recovery period		5
Expected carrying capacity	1000	animal units		Annual interest rate		4.75%
Fence Project component	Material Cost	Material Cost/acre	Labor Factor	Labor Cost	Installed Cost	Installed Cost/acre
Energizers	$ 2,305	$ 0.32	15%	$346	$2,651	$ 0.37
Range fence 2-wire HT electrified	$ 22,117	$ 3.12	100%	$22,117	$44,233	$ 6.23
Offset wires to connect power fences	$ 1,951	$ 0.27	100%	$1,951	$3,903	$ 0.55
Fence subtotal cost	$ 26,373	$ 3.71		$ 24,414	$ 50,787	$ 7.15
Water Project component	Installed Cost	Installed Cost/Acre	Comments			
Pipeline & tank system	$ 111,623	$ 15.72	*Assumes tapping the mainline*			
Total project cost	$ 162,410	$ 22.87	*Installed fence & stock water cost*			
Annualized project cost	$ 37,254	$ 5.25	*Amortized based on criteria in G2-G3*			

Labor cost for the fence is estimated to be equal to the material cost for the components giving us an installed cost for the 14 miles of 2-strand electrified hi-tensile fence to be just over $7/acre. The pipeline and tanks are calculated based on common contractor charges in the Northern Plains & Rockies. The install cost of the stockwater system is about $16/acre. This gives us a total infrastructure cost on this range unit of about $23/acre.

What else could you do for $23/acre on rangeland that will likely yield a 40% increase in carrying capacity?

This next figure shows our basic approach to developing center pivots as flexible grazing cells with minimal interference with ongoing farming activities such as making hay or pasture reseeding.

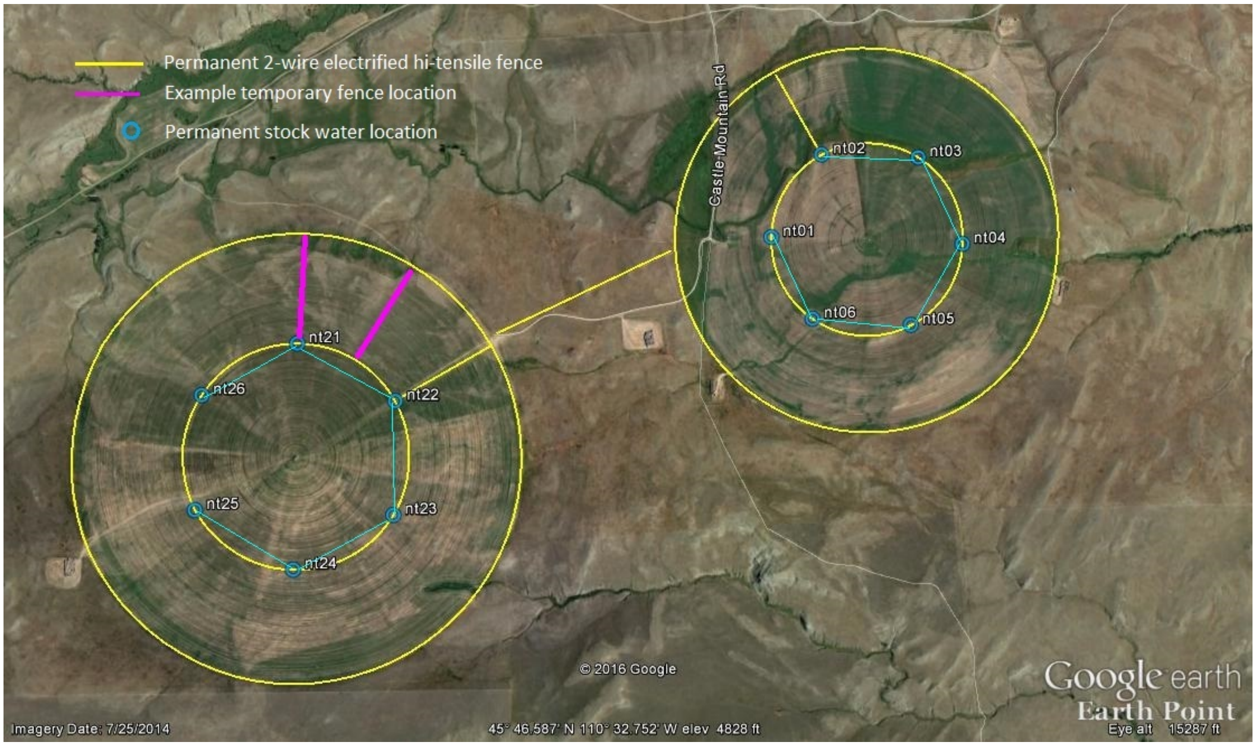


Figure 1. Proposed grazing cell layout for the two larger pivots.

The flexible grazing cell allows the manager to create as many or as few paddocks as needed for the particular situation. The basic framework is created by the inner and outer circle fences and all the interior subdivisions are created using movable polywire fencing and step-in posts. I often get asked how many paddocks do we have on our pivots. My reply is as many as I want or as few as I want. On each pivot there is a single wire fence to connect the inner and outer circles so that a single energizer can run both fences. In your situation, I have also run a fence between the two pivots to provide electrical connection so one energizer runs both pivots.

The two pink lines just illustrate possible location for temporary fences to create a daily or multi-day grazing increment. From a labor standpoint, on our 300-acre pivot, my temporary fence runs are just over 1000 ft. It typically takes me 25-30 minutes to take down one fence and set it up again for the next day's move for anywhere from 350 to 550 pairs. It is really no big deal to move several hundred cows on a daily basis if you have the proper infrastructure in place and use the right portable fence components. When no temporary fences are in place, you still have open space for efficiently operating any kind of farming equipment.

Table 11 shows the cost estimate for developing the stock water and fences for the two pivots shown in Figure 1. The material fence costs are current retail prices from AGLS. We generally estimate labor costs as a percentage of the material costs. Most simple hi-tensile fences are generally figured at a 1:1 material:labor ratio. The stock water is presented as installed costs typical of other projects we have done.

Table 11. Estimated costs for developing flexible grazing cells on the 320 A & 250 A pivots at Paradise Found Ranch

Acres in project	570	acres		Capital recovery period		5
Expected carrying capacity	500	animal units		Annual interest rate		4.75%
Fence Project component	Material Cost	Material Cost/acre	Labor Factor	Labor Cost	Installed Cost	Installed Cost/acre
Energizers	$ 946	$ 1.89	15%	$142	$1,088	$ 2.18
Inner circle & connector fences	$ 4,664	$ 9.33	100%	$4,664	$9,328	$ 18.66
Outer circle & link fence	$ 4,859	$ 9.72	100%	$4,859	$9,718	$ 19.44
Fence subtotal cost	$ 10,469	$ 18.37		$ 9,665	$ 20,134	$ 35.32
Water Project component	Installed Cost	Installed Cost/Acre	Comments			
Both pivots	$ 44,180	$ 77.51	*Assumes tapping the mainline*			
Total project cost	$ 64,314	$ 112.83	*Installed fence & stock water cost*			
Annualized project cost	$ 14,752	$ 25.88	*Amortized based on criteria in G2-G3*			
Temporary fence	$ -	$ -	*FYI - more of an operational expense*			

What should you expect if you invest in stock water and fence development on irrigated pasture or hay ground? From a conservative standpoint, I generally tell clients they should expect a 20-40% increase in carrying capacity with an infrastructure project like this one. We have, however, seen many projects with 50-100% increases in carrying capacity. Our best outcome has been a 400% over a four year period.

While the up-front cost of the project might seem a little daunting at first glance, I think it is important to look at it on a per acre basis and think in terms of what are you buying with this investment. If you increase carrying capacity by 33%, you are essentially buying another acre of productive, irrigated land for about $340/acre. Developing the tools and improving grazing management is the most cost-effective way of buying another ranch.

An additional development and expense that may be necessary to allow this cell to work in the winter would be a dedicated livestock well with solar pumping system located between the two pivots. There would also be another 4000 ft of pipeline to link the pipeline running around the inner circles of both pivots.

One way to use these two pivots in the overall scheme of management is still take the first crop as hay and then stockpile all of the growth for the remainder of season for fall and winter grazing. With the proper fence & water in place, the standing (or swathed) feed could be rationed out on a daily basis for very efficient use. If you are currently willing to feed hay on a daily basis, you should also be willing to strip graze pasture on a daily basis and feed your cows at a substantially lower daily cost.

Over time I would expect you to become more comfortable with minimal hay feeding and the summer growth on the pivots might be used for grazing as well. We can develop plans for any of the other irrigated fields as well upon your request.

Pasture & Range improvement recommendations

We generally approach pasture and range improvement in from four broad concepts. Soil health & fertility, desirable species diversification, invasive species suppression, and general grazing practices. Some of what follows are generic sections and some are specific to Paradise Found Ranch.

Soil testing and nutrient management

Whether you ever plan to use fertilizer or not, it pays to have a good soil testing program in place on all of your irrigated land. I generally advise my clients to get on a regular soil sampling schedule with a 3 or 4-year cycle. In the first year, I like to see samples from the entire pasture area to establish a baseline of information from which to work. We generally divide the pastures into sampling units based on soil type and management areas. Twenty acres is often considered the optimal sampling unit size and is a good upper limit to consider. If there are fields with distinctively different past cropping history, you will want to sample in smaller units than the 20-acre increments. If you have areas that are similar soil type and have a shared past management history, you may want to sample in somewhat larger areas. In the layout shown, the sampling units will be in the 20-40 acre size based on past use and differences in soil type.

Here is an example of how the upper and middle areas of irrigated pastures might be split up for sampling based on the grazing units of the farm. In the first year, I suggest taking samples from each of the designated field areas. This should be a minimum of 20-30 soil cores taken to 6- inch depth from across the entire sample area. Thoroughly mix the 20-30 cores from one sample area and fill the sample box or bag provided by the soil testing lab. The bag will probably only hold about a third of what you have collected, so pour the soil in a back and forth motion over the container so about 1/3 goes in the container and 2/3rds spills over. This gives the best representation of the sampled area going into the container.

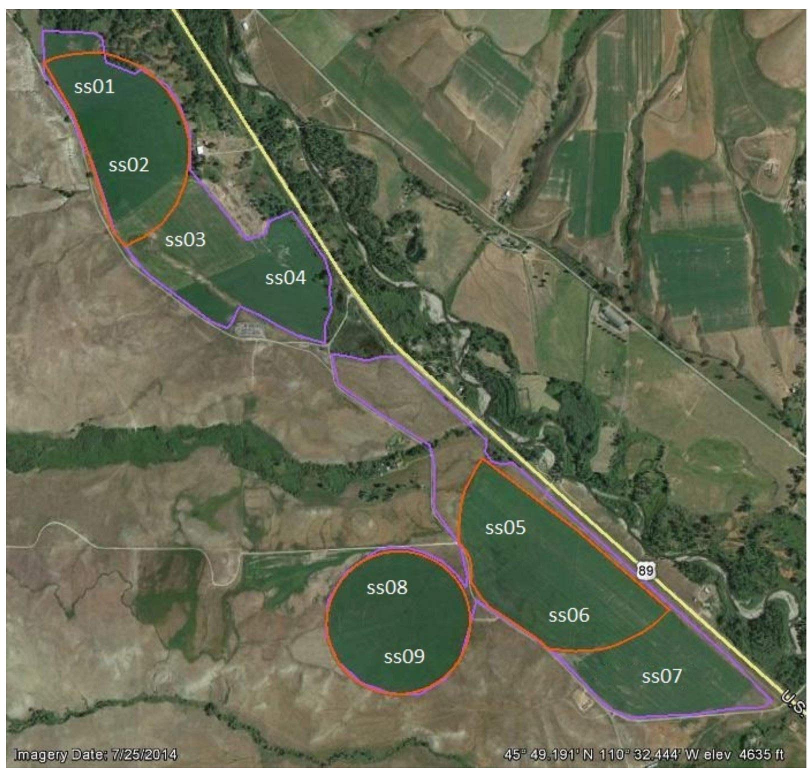


Figure 2. Suggested soil sampling distribution for upper and middle irrigated sections

Depending on how many other fields you sample, you will likely end up with 40 or more total samples. For the following example, we will use 40 samples.

In this first set of baseline samples, I recommend getting the basic nutrient analyses as well as any micronutrients that may be of questionable content in your soil. Basic soil analysis should include pH, organic matter, P, K, and Ca. You will also want Mg, S, Cu, B, and Zn on all of the samples. These tests provide the foundation for future management decisions. Part of the reason for the micronutrient analysis is also to help plan the livestock mineral supplementation program.

If the lab analysis says everything is more than adequate, we won't do any more sampling for four years. However, I have rarely seen a situation where this was the case. Generally we see some areas with adequate fertility and others with some deficiencies.

From the 40 soil samples, we identify the ten with the most serious nutrient limitations. Within the context of economic nutrient management strategies, we make amendments to those pastures. Those amendments may include commercial fertilizer, manure or litter from some other location, or simply feeding hay there this winter. The following year we sample those ten pastures again to determine the effect of our soil amendments.

In year two, we take the next ten most deficient pastures and deal with them in the same manner. We do this for each set of ten until we have cycled through them all with a few pastures being sampled each year and fertilized accordingly. Then it is time to sample the first set again. I recommend this approach because it puts you into the habit of sampling something every year and also budgeting something each year for soil amendments. If we get to the point of not requiring any soil amendments on an ongoing basis, we can stretch the sampling cycle out to something longer than four years.

In my experience, the alternative strategy of sampling everything every four years frequently stretches out to every five, six, or never years. When you're not in the habit of doing a job on an annual basis it becomes very easy to let it slide until next year and then it doesn't get done. If it does get done and the fertilizer recommendation comes back as a really big expense, the farmer very often decides he can't afford to do all that and so he does nothing.

While the cost of this initial base line sampling is likely to be of concern to you, I believe soil testing almost always pays, as long as it is done properly. A well-designed soil testing program done on a field by field basis can save you a lot of money. Even if you do not plan to use any fertilizer, this information helps us select which forage species and varieties may work the best on your land and it also serves as a guide as to where hay feeding could be used to enrich the soil.

With every year that goes by I am less and less interested in using manufactured fertilizers. While I don't believe that commercial fertilizer kills everything in the soil as some hardcore organic advocates claim, it is increasingly clear that many fertilizer products are not beneficial to regenerating biologically active soils. In the long term, managing to create biologically active soils will drastically reduce the need for external inputs.

Manures from beef feedlots, dairy farms, or poultry facilities are my preferred source of fertility amendments because they tend to provide a full nutrient package including Ca, Mg, and micro-minerals. Composted manures are even better because the N within the manure has been stabilized and composts are far less likely to cause urea scorch or any other negative effects sometimes associated with spreading raw manure.

Legume interseeding:

In most grassland systems, N is the first limiting nutrient for plant growth. I am not a fan of commercial N fertilizers because of its environmental transience and relatively high cost. Instead of relying on fertilizer as our primary N source, I always encourage the use of legumes in the pasture and putting our reliance on the natural N-fixation process.

In light of the above soil nutrient discussion, I should emphasize the need for maintaining base levels of nutrients required for legume establishment and persistence. Having a strong legume component in all of your pastures is the key to having productive, low-cost pastures. We should see 40-50% of the annual forage growth coming from the legume component to ensure enough N is available for companion grasses and forbs. As you make the soil environment increasingly more favorable, you will want to introduce additional legumes into your pastures.

For your pastures that are predominantly cool-season grasses, use red, alsike, and white clover seeded at 4,2, and 1 lb/acre respectively. I usually recommend locally produced common red clover in lieu of the higher priced improved varieties. If there is no red clover seed production within 100 miles of your ranch, then use one of the improved varieties available from your local seed house. I also like birdsfoot trefoil in the mixture and it should be seeded at 3 lbs/acre.

For all legumes to have effective N fixation, they must be infected with the appropriate strain of Rhizobium bacteria. All of the clovers I have recommended use the same inoculant, however there is a special inoculant required for the trefoil.

My experience with interseeding legumes on irrigated land has been using a no-till drill just ahead of starting the irrigation works best. Broadcasting seed early for the 'frost seeding' effect, which worked very well in the Midwest, has been largely a failure here in the West. What happens is seed broadcast early may germinate on early natural moisture and then dries out and shrivels before the irrigation is started. Seed depth is key for successful no-till seeding. No more than ½" depth for these legumes.

Once a viable stand of legumes has been established, for the most part you can rely on natural reseeding to improve legume composition of the pastures. Stockpiling pasture with existing legume components and allowing natural seed set to occur is a low-cost means of maintaining long term legume stands.

If you want to rely on natural reseeding to maintain legume stands, a minimum 60 to 75-day rest period is required by most species to have enough mature seed to ensure stand survival. Letting a pasture produce mature seed, grazing it for 24 to 28 hours and then moving the stock to another pasture where you would like to establish legumes is a good way of spreading legumes around the farm. Using a harrow to disperse the manure piles containing the seed usually results in a more uniform stand compared to leaving piles intact. The higher the stock density on the pasture, usually the better this system works.

To get optimal performance out of both your pasture and your livestock, you need to make an investment in the pasture to move from where you are now to where you want to be.

As you transition more of the irrigated land away from alfalfa for hay into permanent pasture, this is the mixture we have been recommending for full-season irrigated pasture in the Intermountain Region. It should work well at you location.

Table 4. Recommended mixture for highly productive irrigated pastures using MiG.

Species	Varieties	Seeding rate
Meadow Bromegrass	Cache, MacBeth, Fleet, Paddock, Regar	6-8
Orchardgrass	Tekapo, Cambria, Niva, Baridana, Icon	4-6
Tall fescue	Bariane, Barolex, HiMag, and others	4-6
Timothy	Climax, Barpenta	2-4
Perennial ryegrass	BG34, Calibra, Garibaldi, and others	4-6
Meadow fescue	Preval, Pradel	4-6
Red Clover	Marathon, Starfire, Persist, and others	3-4
Alsike Clover	common	2
White Clover	Alice, Durana, Will	1
Birdsfoot Trefoil	Norcen, Bull, Tretana	2-4

We have found this mixture to yield comparably to alfalfa hay when it is managed effectively. That means daily feed allocations with appropriate recovery periods. On irrigated pasture we are generally grazing about 60% and leaving a 40% residual. This will generally be about 4-6" residual if the cattle enter the pasture at 10-15" sward height. This should correspond with 4-1/2 to 5 leaf stage for most grasses.

This mixture can be seeded together in the spring without a nurse crop. I generally like to see the first harvest taken as hay in mid to late July. I am not a fan of the idea that a new seeding should not be harvested the first year.

Alternatively, the grass components can be seeded in mid to late August and the legume components added in the Spring of the second year. This approach often gives a better grass stand.

Suppression of invasive species

I used to call this section 'weed control'. Over the last several years I have come to realize weed 'control' may not really be cost-effective, but we can generally suppress weeds without the expensive outside purchases that characterizes conventional weed control. Some of the plants we may want to suppress are hard to actually describe as weeds such as pine trees and sagebrush. Those are native plants and play important roles in the overall ecosystem. We just might have more of them than we want.

The main invasive plant concerns we discussed when I was at the ranch were in fact those latter two species: conifers and sagebrush. The most cost effective way of dealing with these species is controlled burning. Trees are more of a problem on the Leased Ranch than on your deeded land. Given the landowner's primary objectives for land use, you will probably just have to live with most of those trees up there. Sagebrush covers a fairly significant acreage on both the Leased Ranch and your deeded property.

You may need to demonstrate the usefulness of fire on your property to encourage Mr. Leased to allow some burning on his unit. If you want to start a burn program for sagebrush suppression on your lower deeded range unit, I would recommend a 10-year cycle starting in the heaviest infested areas. After the burn cycle is complete, evaluate the relative cover of sagebrush vs. open grass communities. If additional treatment is needed to reduce sagebrush even more, repeat the cycle. If the balance is at an acceptable level, do nothing other than maintaining a well-planned grazing use. Remember it was likely overgrazing of the bunch grasses that brought on the sagebrush dominance in the first place. Repeating the same grazing management will bring on the same flood of sagebrush.

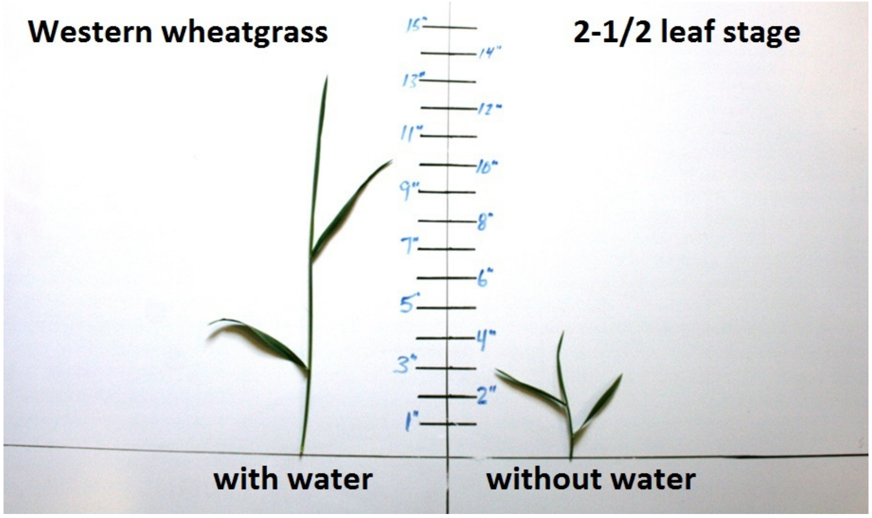
I do not think elimination of sagebrush should your objective, but bringing the sage cover down to less than 20% is reasonable. That will increase grazable acres while still maintaining the necessary level of sage for quality wildlife habitat.

Most of the herbaceous weeds present on your range can likely be suppressed just through continuation of your planned grazing approach. Anything that you can do to shorten the period of stay on any one pasture should help improve the vigor of the desirable species. This does, of course, mean increasing the availability of stock water points across the landscape.

A few comments on grazing objectives: (This is a generic section I include in most reports)

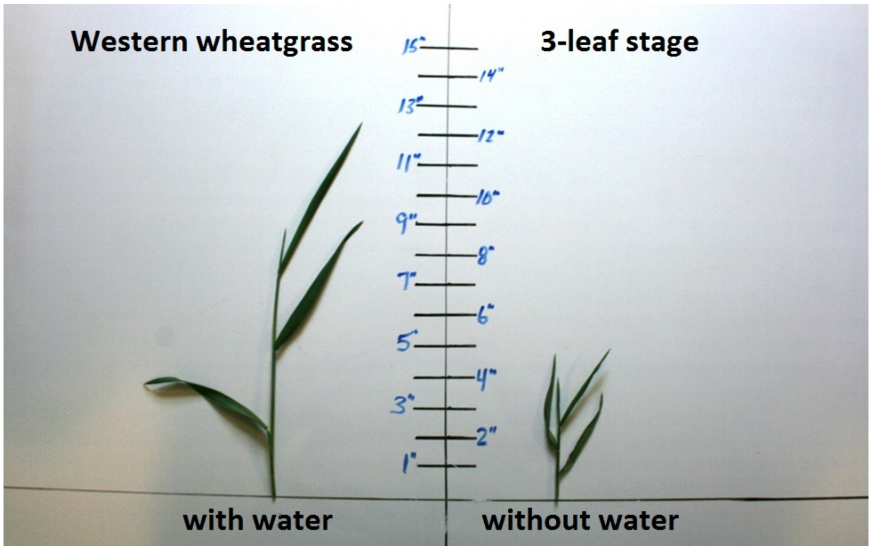
We often start with the question of when is a pasture ready to be grazed. Understanding leaf stage is an important part of answering this question. Basically leaf stage is simply a numeric accounting of how many fully emerged leaves are present on each individual tiller of grass. Remember, overgrazing happens one plant at a time, not as the entire pasture.

The illustration to the right shows western wheatgrass at the 2 ½ - leaf stage. A leaf is considered fully developed when the collar has formed. The collar is the 'hinge' where the leaf blade joins to the sheath, the part that wraps around the stem. Leaf stage is an indication of the energy flow in the plant. Until there are about three fully formed leaves on the plant, more energy is flowing from the base to top than top to base.



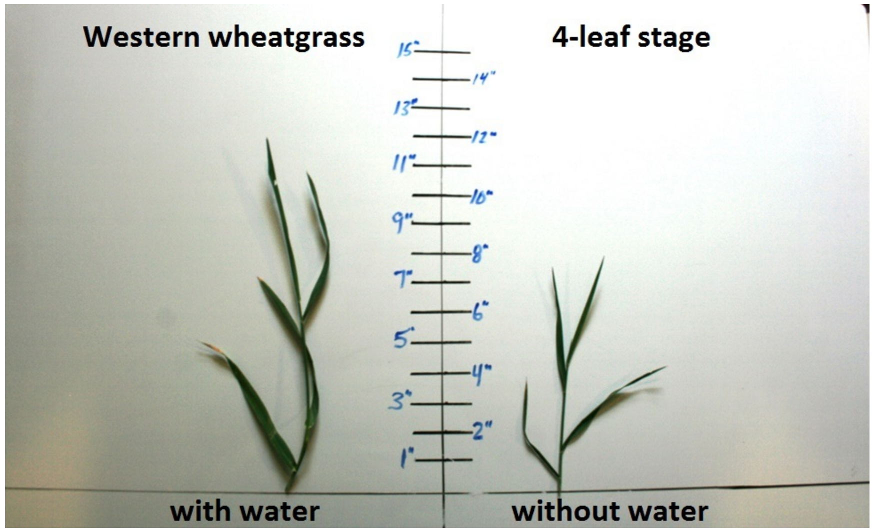
In this illustration, the two plants are actually nearly identical in terms of CHO balance and their grazing readiness status. While the one that has been watered is 12-13" tall, it is no further developed than the non-watered plant that is only 3-4" tall. This is why we can't base grazing readiness strictly on plant height!

When the plant reaches the 3-leaf stage, the energy balance in the plant shifts towards sending more energy flow to the roots or other storage organs rather than drawing from reserves. In the case of most bunch grasses, the energy storage is in the stem bases just above and just below ground level. For rhizomatous grasses like western wheatgrass and smooth brome, the storage is in the rhizomes or root system.

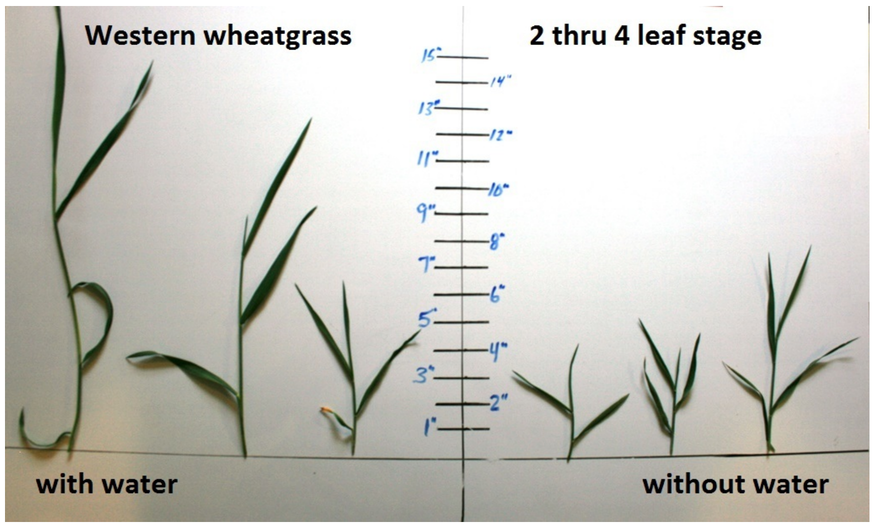


Three-leaf stage is the earliest growth stage at which a grass should be grazed! Later is better!

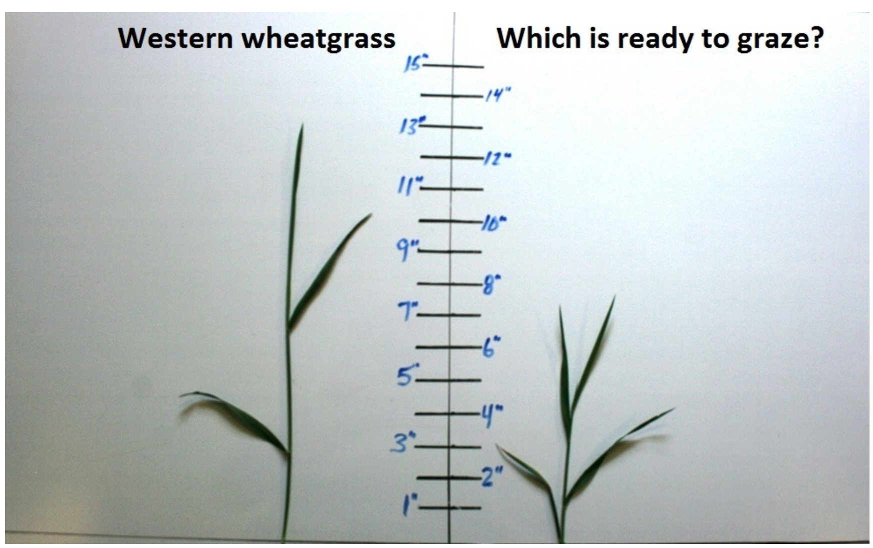
These plants both have four fully emerged leaves and the fifth leaf is beginning to form. My preference is to graze pastures at 4 ½ to 5 ½ leaf stage. Delaying grazing to this growth stage has allowed the pasture to develop into a very efficient solar panel and capture a relatively high percentage of available solar energy. Delaying beyond this point leaves are starting to die off the bottom of the plant and net photosynthesis declines.



This photo shows tillers at 2 -3 - 4 leaf stages both with or without irrigation. In your case the comparison may be did it rain or not! The irrigated pasture at 4-leaf stage is already up above 15" height while the non-irrigated tiller is only about 7" tall. Very often I get asked what the height of the pasture should be when grazing is initiated. This illustration shows why the answer to that question must be 'It depends!'

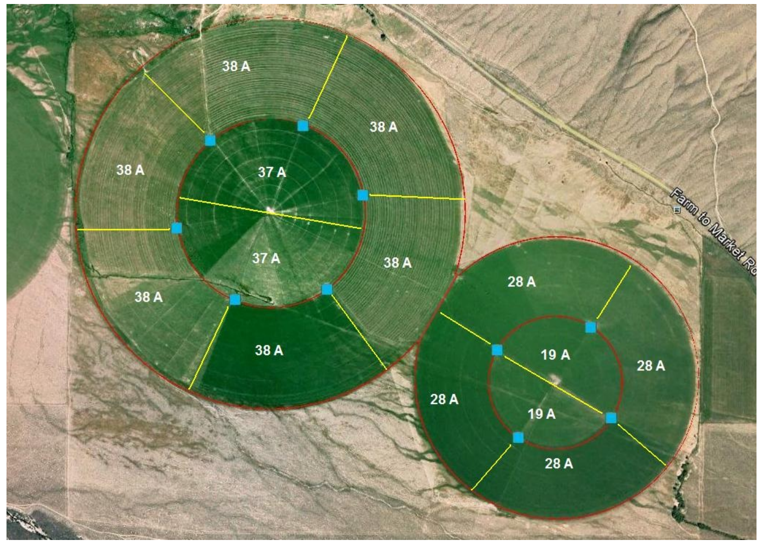


In this photo we have the irrigated tiller at 2 ½ -leaf stage standing 13" tall and the dry land tiller with 4+ leaves at 7" height. So which is ready to graze? Strictly from a physiological basis, the 7" pasture is more ready to be grazed than is the 13" pasture. This is why I spent so much time with you on understanding leaf stage, because it is more important than height!

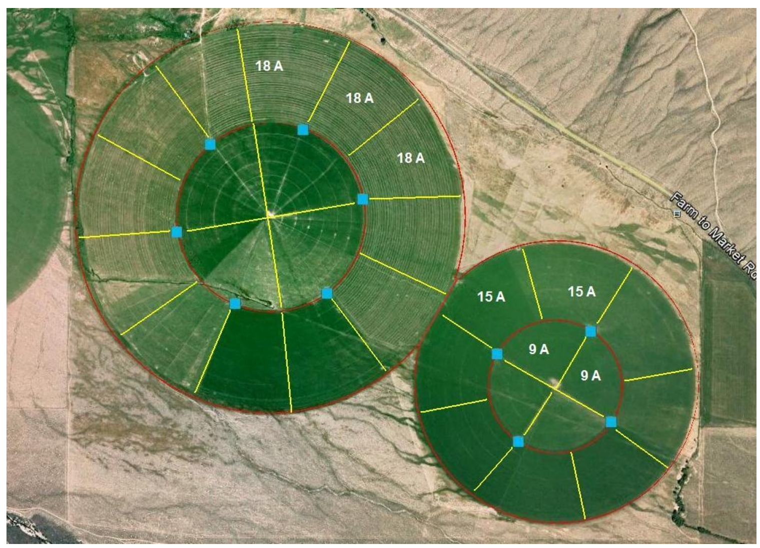


This series of figures shows how I approach the grazing season on our pivots using daily moves.

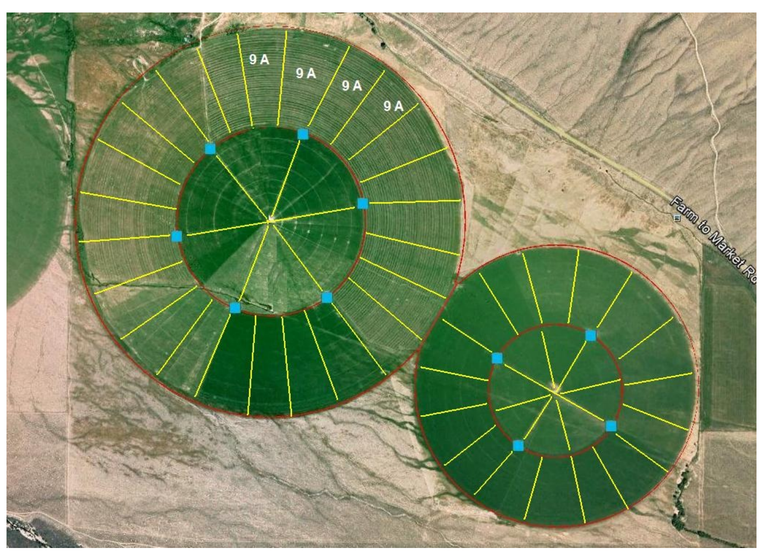
I will begin the first cycle when tillers reach the 2 ½ to 3 ½ leaf stage. From a pasture inventory standpoint, this is generally about 30 available stock-days/acre. My objective on this cycle is to get across the entire pasture area to try to get a small bite off everything. This illustration is with 500 pairs on 450 pivot acres. I don't worry about getting a high stock density on this first rotation. I don't worry about trying to take 50% utilization. It is take a bite and move along. This cycle usually takes 2-3 weeks.



On the second cycle I slow the rotation down a little bit. Note the allocated paddock areas are only half the size they were in the first rotation. Stock density is going to be twice as high and utilization rate should be somewhat higher, though it may still not be 50%. It just depends on growing conditions through this period. It is during this grazing cycle that we will begin to graze out seed heads while they are starting to elongate but before they ever emerge from the boot. This cycle will usually take about 4 weeks.



By this point just 6-7 weeks into the grazing season, I have been across everything twice and have staggered growth occurring across the pastures Some seed heads have already been removed. Now we slow the rotation down to 5 to 7 weeks depending on water availability and growth rate. We do this by allocating smaller daily paddocks and allowing utilization rate to increase to the 50-60% range. From this point on we are trying to leave appropriate residual and provide appropriate recovery periods.



When you start into daily rotation of pastures as a core part of your management, it is critically important to be able to accurately estimate the amount of feed you need to allocate to the herd on a daily basis. This is remarkably easy to do once you are set up for daily strip grazing. While you may not need to commit to doing daily strips on pasture or rangeland for the rest of your life, doing it for a period of time is the easiest way to train your eye. Do 30 moves and your eye is trained.

Here is the basic process for calibrating your eye. Look at the pasture and look at your herd.

Set up a strip that you think will feed that herd for one day. Measure the area. With smart phone technology it is easy to just drive or walk around the strip and get the area using any one of the several available mapping apps. Come back tomorrow and see how they did. If they grazed it too short, you guessed wrong so give them a bigger area for today. If they didn't eat nearly as much as what you thought they should have but they are content, give them a smaller area for today.

If it turned out just the way you expected, then you are well on your way to being a master grazier!

Do this for 4 - 6 weeks and you will be able to look at just about any growing or stockpiled pasture and know how to allocate the feed to optimize both animal performance and post-grazing residual for improving soil health and water cycle.

With the grazing corridor system, you can install the permanent line posts at a measured spacing based on the corridor width to make the area between any pair of posts a known acreage. This makes feed allocation and record keeping very easy.

If you are not using a back fence because you need to allow the stock to return to a fixed watering point by walking across previously grazed areas, you will need to monitor animal behavior to make sure they are not returning to graze new growth on previously grazed areas. That is what we commonly refer to as 'back-grazing'. On high natural rainfall or irrigated pasture you can usually allow 3-4 days for animals to cross over the previously grazed strips before back-grazing becomes a problem.

If you move stock in the morning, look at the herd in the late afternoon or early evening. If over 75% of the herd is grazing on the strip you gave them that morning, they are telling you that is still the best bite of feed in the pasture. That is what you want them to be doing. If more than 30-40% are out picking around where they have already been, then they are telling you the allocated strip was not enough so give them a bigger strip tomorrow. The cattle will tell you most things you need to know about the effectiveness of your grazing management.

Failure to properly execute the first several weeks of the grazing season generally leads to one of two possible outcomes. If the cattle go out too early, graze pasture too short, and come back to it to soon, you will quickly be out of pasture resulting in poor animal performance and potentially financial loss. If cattle go out too late and pasture is allowed to mature ahead of the cattle, individual animal performance typically is poor as is pasture regrowth potential for the remainder of the season.

Once pasture reaches this growth stage, your best option is to rotate the stockers quickly across all the paddocks allowing them to remove the top 20-25% of the plants which may still have enough energy to support acceptable stocker gains. After that clean up the remaining forage with cow-calf pairs or dry cows in the fall or winter. Forcing growing cattle to consume all of the forage at this growth stage will reduce individual performance substantially.

Good luck & Good grazing!

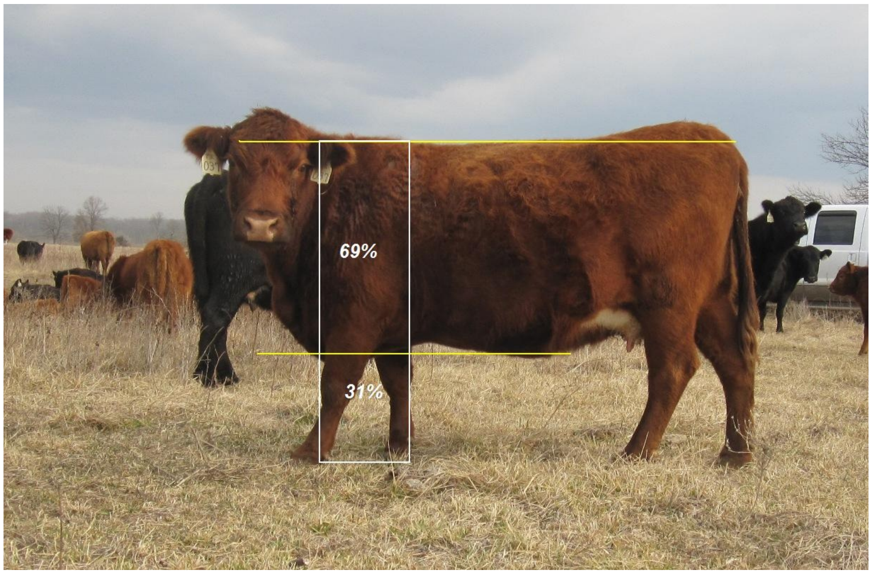
Cattle selection for pasture performance (I included this generic piece for cow size!)

Perhaps the most unpleasant part of my job is having to tell clients they have less than optimal cattle. This is particularly true for people just getting started in the cow business when they think they have a really nice set of cows. In my view, the most important genetic trait for cow selection is adaptation to your resource environment. This includes the natural resources, the human resources, and capital resources. Every other performance trait becomes moot if you have to modify the environment just so your choice of cattle can just function there.

As you know, we generally speak of such things as moderate framed, thick, deep bodied, easy fleshing, and so forth when we try to describe good, functional cattle that will perform well on pasture and range with little or no external supplemental feed. While the words are easy to say, sometimes we have different interpretations of what those things mean. I like to try to visually depict these things using the client's own cattle as illustrations. Since I have no pictures of the cows your cattle came out of, we will just use other examples.

I want to start with a photo of what I view as being an optimal cow (Ideal is too strong a word!). This cow is from Ozark Hills Genetics in Missouri and I consider this herd to have some of the very best grass-based genetics in the country. This is an 11 year old fall-calving cow with calf at side in February. She has seen no hay for the last seven winters and the only supplement has been salt and minerals. OHG has a whole herd of cows like this. They are the epitome of functional cattle.

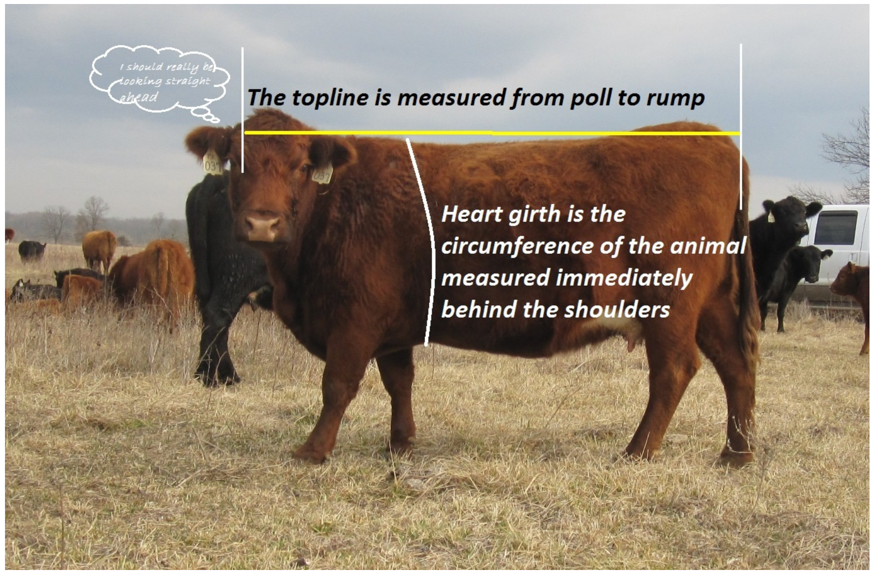
Functional cattle tend to have a few phenological traits in common within and across cattle breeds. One of those traits is how their total height is distributed. In general we are looking for cattle with greater than 2/3rds of their total height made up by body depth. Less than 1/3rd of total height should be in the legs. In the past we measured this in the chute, but I find you can get a pretty good assessment with a field photo and then just measuring the proportions on the photo.



These type of cattle can be found in any beef breed, but it is much easier to find them in the British breeds and in herds that have avoided the push towards 'bigger is better'. To me it is far more important to get the right type of cattle than it is to have a particular breed just because that is what is popular in the neighborhood.

Cow type is more important than cow breed!

Another physical trait we look at is the ratio of heart girth to top line on an animal. As a general guideline we want the heart girth to be at least equal to the top line when the cow is at BCS of 5. When we start increasing heart girth to exceed top line, good things start happening. From the meat producer's viewpoint, the good thing is a 3-4% increase in cut-out meat yield per 1" of increased heart girth above top line length. That is substantial.

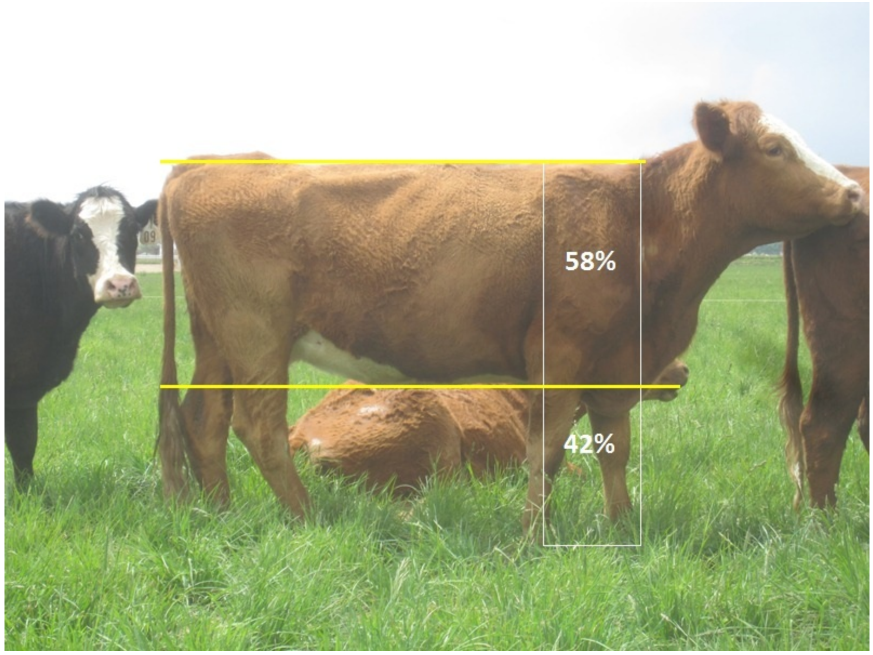


Unfortunately we still have to put the animals in the chute to take these two measurements.

Here is a typical southern type cow. I commented on this tiger stripe as looking to be a fairly functional cow. She stacks up fairly well with a 63:37 body depth ratio. She is suckling a calf and is in pretty good body condition for the early Spring transition period. Some grass-fed producers might want to shy away from her because of the Brahman influence and the perception of poor carcass traits. Breed her to a good Red Angus, South Poll, or Polled Hereford and the carcass would be just fine.

If you put together a herd of cows like this old girl, they would cost you less than Black Angus or Brangus cows, probably perform better on the farm, and produce carcasses that would grade and yield right where you need them to be. As I recall, I thought this cow was a little on the big side with a weight between 1300-1400 lbs, so you would want just a smaller version of her weighing in the 1100-1200 lb range. She has just enough Brahman to really help her heat tolerance, but not enough to limit carcass potential.

This photo illustrates what you do not want in your cow herd. This 4-year old cow is an ugly rip with less than 60% of her height in her body. She is narrow through the heart girth and flat sided. This is a hard keeping cow with very little socially redeeming value. Her mature herd mates weigh 1500-1700 lbs. She happens to be a Simmental but the Angus cross standing behind her wasn't much better, This was one of those places where I did have to tell the owner, who was very proud of his cows, that he had really lousy cattle.



Here is a data set from research done at North Dakota State U by Dr. Kris Ringwall and it is very telling when it comes to the detriment of owning big cows. The sad thing is they didn't have any cows down in the 1100-1200 lb range to extend the comparison.

Contrary to what people seem to think, big cows do not automatically wean bigger calves. The opposite is often the case especially when forage resources are limiting. This particular study was done under drought conditions when big cows with big maintenance requirements can't cover enough ground in a day to meet their needs.

Cow size (lbs)	annual forage intake (lbs/cow)	calf weaning weight (lbs)	lb forage /lb calf	calf gain/acre
<1300	11196	617	18.1	31.2
1301 - 1400	11964	611	19.6	28.9
1401 - 1500	12612	589	21.4	26.2
1501 - 1600	13212	598	22.1	25.5
>1600	14256	572	24.9	22.4

With the majority of costs of being in the cow-calf business being land-based costs, upping the conversion efficiency of forage to salable product is a critical step towards building a consistently profitable business.

When you're buying calves for your finishing program, look for steers or heifers coming out of herds with mature cow weight at BCS 5 generally in the 1000-1200 lb range. These will typically be cows in the frame score range of 2 to 5. If bred to bulls of comparable frame score, the steer progeny of a cow should reach Low Choice grade at about 95% of the dam's weight. Most of our pasture-finishing clients are aiming for the High Select-Low Choice quality grade. This will have steers weighing 90-95% of the dam and heifers weighing 83-87%.

Knowing your target endpoint for finishing makes animal selection criteria much simpler.