LAYOUT & DESIGN OF GRAZING SYSTEMS

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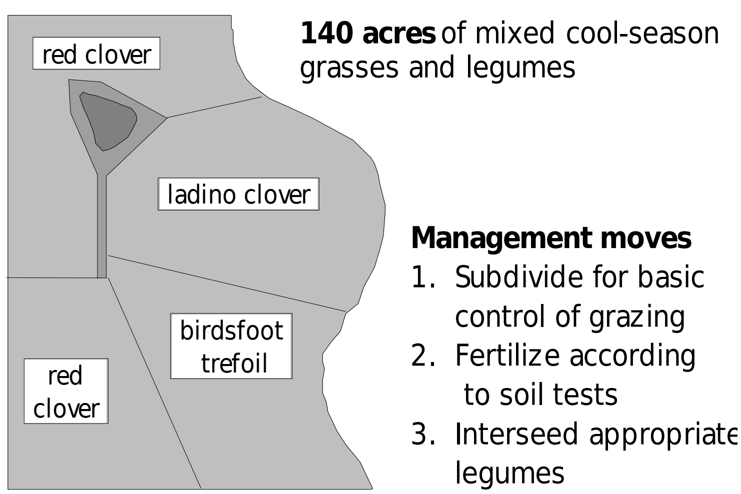
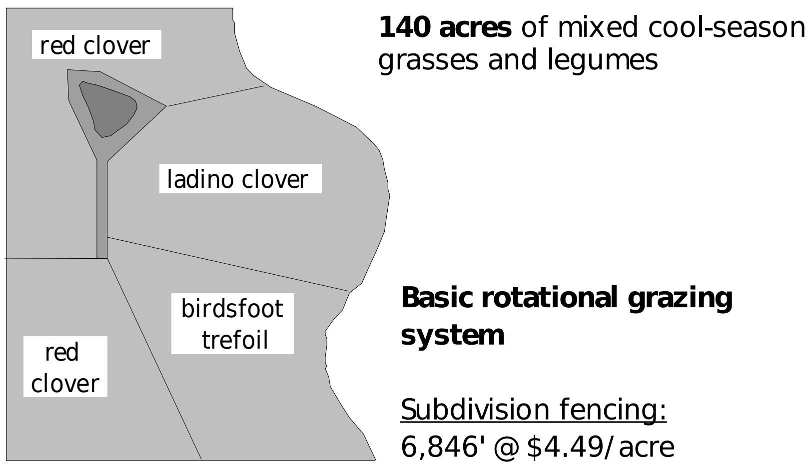
The first step in designing a planned grazing system is evaluating the resource base available to the manager as discussed in Chapter 2 of this manual. The soil, plant, water, and physical facility resources should be carefully inventoried before a management plan is developed (Figure 12.1). It is essential to know what limitations are imposed upon the system by the natural resource base as well as limitations of capital, labor, and management expertise. Production and economic goals should be set within the context of the resource base. In developing the system, both short term and long term goals should be identified.

Once the resource base has been defined and goals have been set, the first management step should be to get in basic control of grazing distribution. In continuous grazing situations on a rolling landscape, the grazing animals will quickly develop preferred grazing areas and tend to virtually ignore other large areas. Lowlands tend not to be grazed early in the season while slope areas, particularly south and southwest facing slopes, are often overgrazed. Use soil survey maps, aerial photographs, and topographic maps as aids in planning where subdivision fencing or water developments will be made. Clear acetate sheets and erasable color markers are essential tools in this planning stage. Trying many subdivision plans on paper before erecting the first fence will save money and headaches in the long run.



Primary subdivision fencing to divide the landscape into management units based on soil productivity and landscape features or plant community is a good starting point (Figure 12.2.). Other management actions such as fertilization or interseeding are made much more effective if basic grazing control is implemented first. These first subdivisions should be made in such a way that they are easily subdivided into smaller grazing units at a later date. In some situations, these primary subdivisions may separate pasture from cropland. If this is the case, a multiwire, electrified hi-tensile fence would be advisable (Figure 12.3).

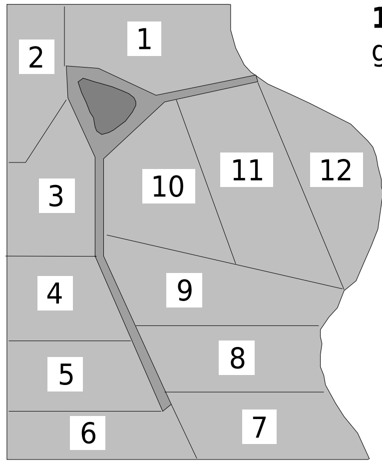
When the landscape has been divided, each unit can be managed according to its own fertility and plant community requirements. Limited fertilizer dollars can be applied to the unit where it will return the most benefit. Interseedings can be made on defined



management areas where grazing can be managed to favor successful establishment.

While many producers make the initial subdivisions without making additional water source development, they often find that later steps in subdividing would have been easier if water supply improvement had been done in the first stages of development. Improving water distribution greatly increases the flexibility the manager has in fence placement and keeping paddocks similar shape and sizes.

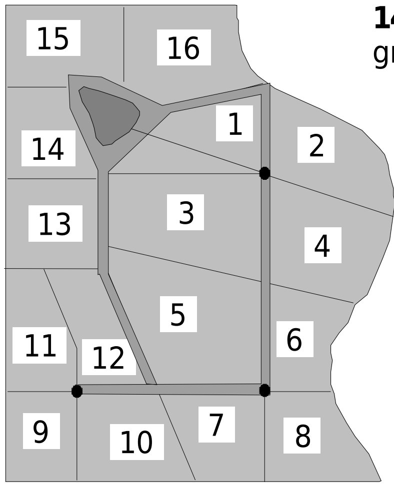
The cost of the initial subdivision fences may be quite low, depending upon the size of the grazing unit and whether single strand or multistrand fences are installed (Tables 12.1 & 12.1a). The single strand fence is appropriate if the subdivision fencing is being strictly used to separate pasture units for any class of cattle. The three wire fence would be used for paddock fencing for sheep or goats, or if pasture is being separated from cropland.



Further subdivision to make the shift from rotational grazing to intensive grazing can be made with or without additional water development. The first example shown uses no additional water development, but simply uses alleyways to bring the livestock to water (Figure 12.4). Costs for development of the 12 paddock grazing cell are given in tables 12.2 and 12.2a. These costs include the original paddock subdivision fences as well as the additional fences. Pond and alleyway fences are also included in this cost estimate.

Whenever the decision is made to use alleyways, certain effects must be accepted. Alleyways are a likely spot for erosion to occur and for weeds such as thistles or nettles to take hold. Both of these are the results of bare ground resulting from continual animal traffic. To minimize erosion, alleyways should be laid on a contour line. A certain amount of productive area is sacrificed in an alleyway. The actual amount may not be much different than the area that will inevitably be trampled around a watering site in individually watered paddocks. With an alleyway, only a limited number of subdivisions can be made without paddocks becoming very long and narrow. A second alleyway can be added to keep pastures nearer to square, but that effectively doubles the area where the negative effects of alleyways can occur.

Livestock will deposit manure in an alleyway when they travel to water rather than depositing it on the productive part of the pastures. Based on manure distribution measurements at the Forage Systems Research Center approximately 15 percent of the manure produced is deposited in the alleyway. Beef cows grazing in a paddock system that had water available in every paddock drank 15 to 20 percent more water on a daily basis compared to cows grazing in similar grazing cells except that water access was by means of an alleyway.



140 acres of mixed cool-season grasses and legumes

Grazing system with additional water development

Subdivision fencing:
18,744' @ $14.46/acre

Water development:

power	$ 700
pump system	1,200
water lines	800
	$2,700
	$19.29/acre

The second example illustrates several advantages to installing a water distribution system providing water access in each individual paddock (Figure 12.5). One of the easily observable differences between the two systems is that where water development was carried out, there are 16 paddocks compared to only 12 in the alleyway system.

Another significant difference is that the paddocks are more nearly square in the 16-paddock system. The total linear footage of fence required for the 16 paddock system is actually less than for the 12 paddock system. This is because a square area always has less perimeter than a rectangle of comparable area. A square pasture will be grazed more uniformly than will a rectangular paddock, which will result in more uniform manure distribution. The grazing animals will always be closer to the water source in a square paddock configuration compared to rectangular paddocks of comparable acreage.A major limitation in the design of the 16 paddock cell is that it is very difficult to shift cattle from paddock 16 to paddock 8, for example. Alleyways are viewed in a negative sense only if they are used everyday for water access. If alleyways are only used to move stock from one paddock to another, then they are a very positive component of the total grazing system. Without the alleyway, the manager will be tempted to fall into a routine series of moves based on ease of shifting cattle from one paddock to an adjacent paddock. The flexibility of the management system is thereby limited and animal and pasture performance will likely suffer. For minimal additional cost an alleyway could be installed as shown in Figure 12.6 to tie all the paddocks together to allow for simple, straightforward stock movements. Based on the cost figures in tables 3 and 3a, the alleyway cost would be about $150 total or a little more than $1 per acre.

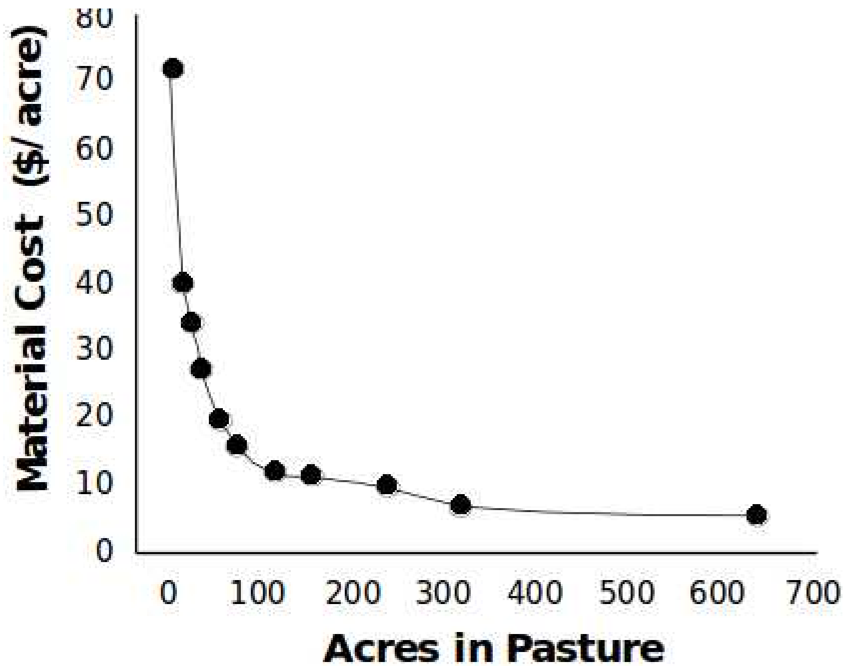
The actual cost per acre for subdividing pastures not only depends upon the number of subdivisions being made, but how large the entire grazing unit is. The larger the unit, the lower the cost per acre for both water development and subdivision fencing will be (Figure 12.7). The simple reason is that as size of an area increases, the ratio of perimeter length to enclosed area, decreases. The following sections summarize the general guidelines regarding size, shape, and number of paddocks required.

Paddock Shape

Paddock boundaries which follow approximate contours and changes in soil type allow the producer to better select forage species adapted to a specific site. For example, orchardgrass-alfalfa might be sown on good upland soils, fescue-trefoil on eroded slopes, and canarygrass in a bottom and each area fenced as separate pastures or sets of multiple paddocks. On more evenly laying land it may be desirable to harvest hay or silage or even crop some paddocks from time to time. In this case, sharply angled fences and tight corners are undesirable.

Where land allows, uniform sized paddocks with parallel sides are most desirable. Observation around the world and at the Forage Systems Research Center indicates that shape of the paddock will influence grazing behavior. Paddocks with low length:width ratios tend to be grazed more uniformly than long, narrow paddocks. Long narrow paddocks are frequently grazed much more heavily in the front portion of the paddock compared to the back part of the paddock. As distance from water increases, this becomes more and more significant. On small grazing units where livestock are never more than several hundred feet from the water source, shape is less critical. The shorter the grazing period the less critical shape becomes. Cattle take about three days to establish a strong grazing pattern within an individual paddock. As cattle are allowed to remain on a paddock beyond three days spot grazing and pronounced cattle trails will begin to develop. When the cattle return to this paddock in future grazing cycles, the pattern is already established and they will begin to follow those patterns on the first and second day of grazing

The amount of fencing required to subdivide a large tract into paddocks can vary greatly depending upon the shape and layout of paddocks. Frequently, fencing needs can be cut 10 - 30 percent by considering different layout options. In most situations we find that a subdivision based on uniform paddocks of low length:width ratio with water in every paddock or a central alleyway to water to be the most efficient fencing layout. On many farms with rough terrain and cut up by timber and creeks, this will be impossible and numerous trial and error measurements are the only way to find the best design. Working with detailed aerial photos and soil maps will allow the producer to overlay many system designs on the landscape before the first fence is ever built.



based on single strand 12.5 guage hi-tensile fence

<u>Paddock Size</u>

The size of paddock needed for a particular herd is obviously dependent upon forage availability per acre. A more productive crop will support a higher stock density calculated by the following equation:

$$\textbf{stock density} = \frac{\textbf{(available forage * utilization rate)}}{\textbf{(daily intake * length of grazing period)}}$$

The amount of forage standing in the pasture can be measured by cutting and weighing and other complex methods but out on the farm this part of the operation becomes largely an eyeballing art. With a little experience it isn't too difficult to judge the amount of forage present. Most good stockmen can look at a pasture and say, "That will feed 20 cows for three days." Judging approximate forage availability on a per acre basis can be learned with a little practice. Availability should be expressed as lb forage/ acre.

Utilization is going to be largely controlled by the length of the grazing period but must also be adjusted to reflect the desired performance goal for the livestock involved. Forcing the animals to over utilize the pasture is the quickest path to having a performance wreck. Utilization is expressed as the percentage of the original available forage that the livestock will actually consume.

Daily intake requirements can be determined approximately from NRC tables. These tables are available from your local extension office and give the daily feed requirements for most classes of livestock. These are average figures calculated under controlled conditions, so always err on the side of being conservative. If the table says an 1100 lb lactating cow will eat 21.6 lbs of dry matter a day, figure that she will eat 27. To use the equation, the intake must be expressed as lb of forage per lb of animal liveweight. As a rule of thumb, figure 2.5 to 3 percent of bodyweight for breeding animals and 3 to 3.5 percent for growing stock. You might find you're wasting some feed, but that beats running out!

To decide what size paddocks should be, add up the total liveweight of your herd that will run as a single grazing unit, divide that total weight by the desired stock density calculated with the equation above and the answer will be the approximate number of acres that each paddock should be for a single grazing day. If you want a three day grazing period in each paddock, then multiply your answer by 3.

Number of Paddocks

The optimum number of paddocks will vary with both pasture species and animal type due to desired utilization and performance goals, resistance to grazing, regrowth habit, and economic potential. The ideal system is to have grazing animals move daily to a fresh paddock. The advantages of such a system include minimal feed wastage, consistent forage quality each day, reduction of parasite infestations, rapid uniform grazing, and many more. To begin to realize these advantages, grazing periods should be less than four days. To achieve this grazing period a system should have a minimum of 812 pastures to allow the appropriate rest period. Most producers quickly see the advantage of more paddocks and move in that direction.

Resistance to grazing damage affects the necessary number of paddocks. For species which elevate their growing point quickly, a short grazing period is critical to prevent damage to regrowth potential. The grazing duration should be long enough and the stock density adjusted such that a flush of growth will be grazed off before new shoots or leaves elevate to grazing height, usually a maximum of 37 days depending upon species and weather. Another point to remember is that with a shorter grazing period, the fluctuation in forage quality from the first grazing day to the last grazing day in each paddock is minimized.

The actual number of paddocks required for a particular grazing cycle is determined by the necessary rest interval required for that particular pasture mix under the current environmental conditions and by the maximum number of days that animals should be left on a paddock. Typically the CHO replenishment cycle in forage plants takes 2040 days, therefore, this is the range in rest interval we should be generally considering. Under good growing conditions, a 20 day rest may be plenty whereas in midsummer a cool season forage may require 40+ days to reach a state of positive CHO balance due to high respiration rates. The implication is that fewer paddocks or more livestock are needed at certain times of the year. The paddocks not needed for grazing can be harvested as hay or haylage. The greater the number of paddocks, the more fine tuned the proportion of grazed acres to hayed acres can become. One aspect to bear in mind though, is that one 20 acre tract can be harvested more efficiently than can five 4 acre tracts. The use of temporary fencing can facilitate both goals. Remove the first harvest of the 20 acres as hay in a single block and then erect temporary fence for controlling grazing on the regrowth.

SUMMARY

Grazing cells should be constructed with ready access to water, preferably with the livestock always being within 600' to 800' of the water source. Paddocks should be laid out as near to square as possible following landscape changes such that each paddock has as little soil variation within it as possible. Permanent paddocks should be sized to meet the average forage allotment expected to be needed and seasonal adjustments made by changing length of grazing period or further subdividing the primary paddock with temporary fencing.