MANAGING GRAZING IN STREAM CORRIDORS

PATTERSON CREEK PHOTOS

MINNESOTA DEPARTMENT OF AGRICULTURE

MANAGING GRAZING IN STREAM CORRIDORS

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About the author:

Howard Moechnig graduated from North Dakota State University in 1974 with a degree in Agriculture, majoring in Soil Science. He worked for the Natural Resources Conservation Service from 1972 through 2006. For the last ten years of his career he was a Grazing Specialist with NRCS, and was the State Grazing Specialist from 2001 through 2006.

After his retirement on Jan 3, 2007, Howard organized a consulting business, Midwest Grasslands. His business specializes in consulting with those who desire to manage their pastureland, rangelands, and grasslands in a manner that will sustain the soil, water, and plant resources. His work includes pasture and rangeland evaluation, and planning managed rotational grazing systems on pastures, rangelands, and land for wildlife habitat.

Howard has a small farm southeast of Cannon Falls where he raises sheep and markets grassfed lamb. His pasture contains a stream corridor nearly a half mile long and is used for grazing the flock.

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www.mda.state.mn.us

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Introduction

Intent of the Publication

Stream corridors are an integral part of many grazing systems in southeastern Minnesota. Commonly, those areas within stream corridors are used for pasture because of the high risk for crop damage due to flooding and because there is a steady supply of water for livestock.

The information in this publication is presented primarily for the region of southeast Minnesota, but it could easily apply to the entire region known as the Driftless Area, Major Land Resource Area 105. In addition to southeast Minnesota this area includes southwest Wisconsin and northeast Iowa. This area has many cold water streams, those that are fed by groundwater springs. Some of the concepts presented in this publication apply to other parts of the country, but you must make adjustments when applying them in areas that differ geologically.

Major Land Resource Area 105 - Northern Mississippi Valley Loess Hills

NRCS

The results of a recently completed EPA Section 319 project indicate that there are significant positive environmental changes in streams when livestock grazing in the riparian corridor is converted from a continuous grazing form of management to that of managed rotational grazing. The most beneficial changes include the change in the composition, health and vigor of the plant community on the streambanks and adjacent area, as well as the stabilization of the streambanks and subsequent improvement in the physical structure of the stream channel itself.

PATTERSON CREEK PHOTOS

Cattle doing final fall grazing on well managed streamside paddock.

This publication is intended to provide practical information for farmers who manage livestock in pastures that contain flowing water riparian areas. The information will help with planning a successful shift from continuous

grazing to one of managed rotational grazing. It includes planning criteria, options, and situations to avoid. Much of this information is based upon the experience of the author in planning grazing systems in riparian areas in southeast Minnesota.

What are the Issues?

DAVE ANDERSON, ON THE FLY GUIDE SERVICE

Trout fishing is a significant part of the tourist industry in Southeast Minnesota.

Considerable effort has been expended in recent years to improve treatment of stream riparian corridors to reduce erosion of the streambanks, to reduce introduction of pollutants into streams, and to improve streams as resources for fish production and reproduction. Many reaches of streams in southeast Minnesota have been monitored and the results indicate loadings of sediment, nutrients, and bacteria in excess of state standards for water quality. Efforts to remediate pollutant loading include improving the management of the land in the watersheds of the impacted streams.

Because the pastures in riparian areas make up a small percentage of the land use in most watersheds, the impact on overall water quality for the stream may not be significant when accounted for on its own. However, significant improvements in grazing management on individual reaches of streams can have a positive impact on the health of the environment by reducing the erosion of the streambanks and by reducing the time that livestock actually spend in the water. The benefits to the livestock producer include better forage production, improved livestock health, and improved stream condition.

In addition to reducing pollutant loading, there is considerable interest in improving the streams for fisheries, especially for trout. Southeast Minnesota contains many miles of cold water trout streams. Trout fishing and related recreational activities such as camping are important to the economy of the region.

Livestock grazing in stream corridors is a definite asset to riparian management, when properly managed. Removing livestock from a stream corridor may be detrimental to the overall health of the riparian system. The emphasis is, of course, on properly managing the grazing activity of the livestock in time with the stage of growth of the plants in the riparian zone.

Permits

Prior to doing any construction activity in a stream that will alter the course, current, or cross section of the channel, it is advisable to notify the Minnesota Department of Natural Resources (DNR) to verify whether or not a permit for the work is required.

Continuous Grazing Systems

Common grazing management of pastures, including those that contain streams, has been to allow livestock to graze the entire pasture from the beginning of the grazing season to the end of it. This is continuous grazing. The effects of this type of management are detrimental to the health of the stream and its adjacent riparian area. These effects include:

- poor health and vigor of the plant community on the streambanks;
- erosion of the streambanks resulting from livestock grazing and watering actions on the streambanks;
- very little diversity of the plant community;
- short vegetation provides no cover and shade for the stream itself;
- increased water temperature because of lack of shade;
- direct deposition of manure and urine in the stream by the livestock as they gather, rest, and ruminate while standing in the stream;
- loss of beneficial physical structure of the streambanks that provides cover for fish; and
- low overall yield of the forages in the pasture, reducing livestock performance.

NRCS

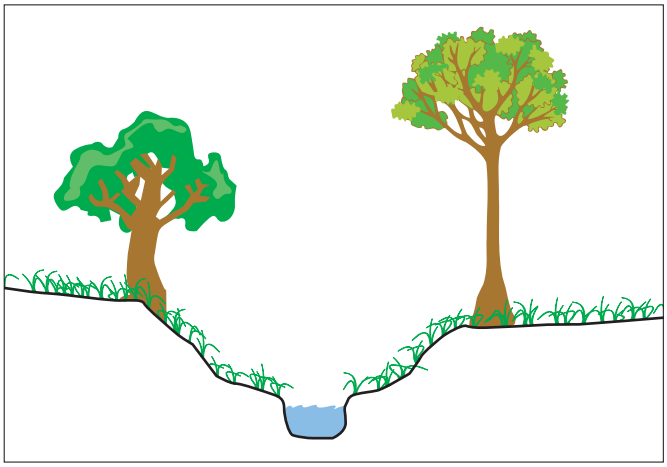
Cattle grazing a stream corridor in a continuous grazing system. The livestock have access to any part of this stream through the entire grazing season.

Managed Rotational Grazing Systems

Managed rotational grazing is becoming more accepted as an improved method of managing pastures, including those that contain stream corridors. In this type of management, livestock are placed in one portion (a paddock) of the pasture (divided into several paddocks) when the forages are ready for grazing. The livestock are systematically moved from one paddock to another based on the stage of growth of the forages and on the objectives for the grazing system as well as for each paddock. With this system of management the forages have an opportunity to rest and recover. This maintains them in a healthy and vigorous condition. The amount of time that livestock have access to any segment of the stream is significantly reduced with managed rotational grazing.

The effects of this method of managing streamside pastures include:

- streambanks become covered with growing vegetation;
- a more healthy, vigorous, and diverse plant community;
- reduced erosion of streambanks;
- reduced warming effect on the water because of shading by healthier and taller plants;
- reduced amounts of manure and urine deposited directly into the water because livestock spend less time in the water;
- improved structure of the stream that provides concealment for fish; and
- improved productivity of the forages in the pasture, providing improved livestock performance.



Stream cross section with managed rotational grazing.

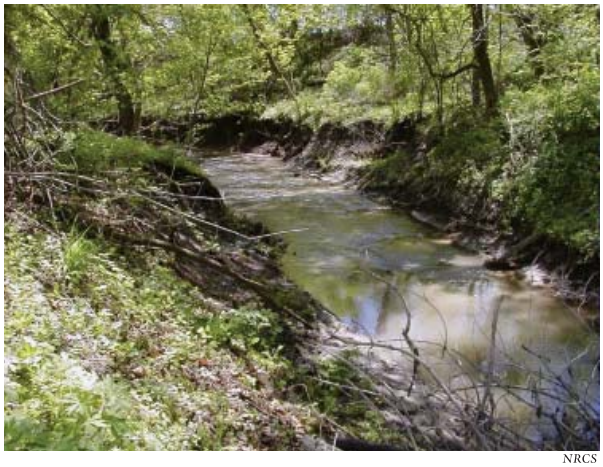
NRCS

Cattle grazing a streamside paddock. They have access for a short period of time and are not allowed to return until the plants recover from the grazing, normally 30 days.

Abandonment of Grazing in Stream Corridors

NRCS

Abandoned pasture growing to weeds soon to be dominated by trees and brush.



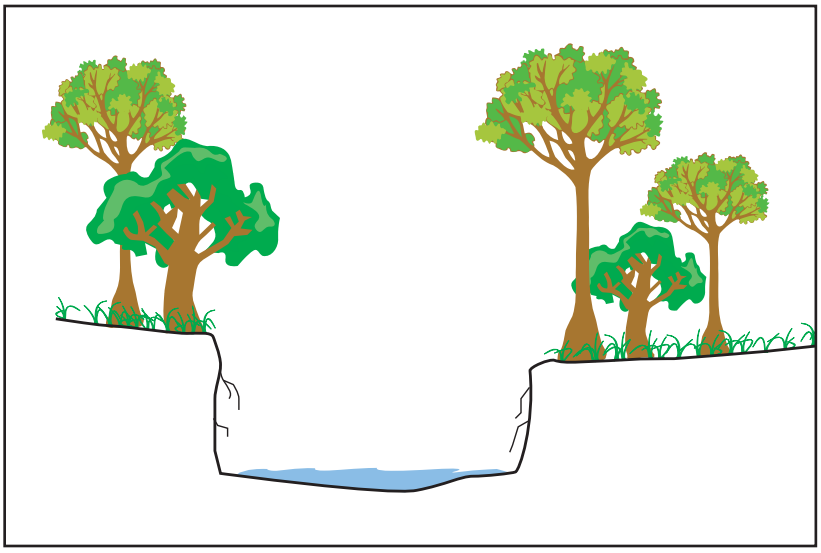
NRCS

Streams grown up to trees display wide, shallow cross sections and eroding verticle banks.

Removal of livestock grazing from stream corridors is commonly recommended but not necessarily a good option for management of the stream corridor. When grazing is terminated, the stream is subjected to changes because of the shift in the composition of the plant community.

- Early in this progression, the grasses become much more healthy and vigorous because of the lack of animals removing plant top growth. This is especially true in situations where the grazing management was "continuous grazing" prior to abandonment of grazing.
- Over a period of a few years, the plant community will shift to more tall, broadleaf herbaceous plants, such as wild parsnip, burdock, and stinging nettle. In addition, early successional woody species, primarily boxelder and willow, will become established. Under a grazing regime these would be consumed by the livestock, or the plants would not have been able to withstand the livestock traffic and compaction.
- As the boxelder become more numerous, increase in size, and provide a major portion of the canopy that shades the ground, the grasses diminish and eventually disappear. This leaves the woody species and some shade tolerant, broadleaf herbaceous plants on the streambanks and in the riparian corridor.
- During this process of the elimination of the grasses, the stream channel itself changes. The grasses that occupied sloping streambanks had an extensive and fine root system that could, in most cases, effectively prevent erosion. The herbaceous broadleaf plants and woody species that replace the grasses do not have root systems that are effective for protecting the streambanks. Erosion of the banks occurs; the banks become vertical and unprotected by vegetative cover and the stream channel becomes wider and shallower. The stream channel also is impacted by sediments so the value for fisheries is significantly reduced.

Exclusion of livestock from streams in the area of southeast Minnesota, and in many other settings, does not always result in better stream conditions for fisheries and wildlife, nor does it always prevent negative impacts to the environment. Livestock grazing and animal impact are tools to be used as needed to maintain healthy streams and riparian corridors. Without these tools, management options for stream corridor maintenance are seriously restricted.



Sketch of stream cross section wooded corridor.

Using Livestock to Improve Physical Characteristics of Streams

When livestock graze adjacent to streams and on streambanks their hoof action causes displacement of the soil in a way that reduces the slope of the banks. This allows vegetation to establish, it reduces the width of the stream, increases the depth and velocity of stream base flows.

Streams that have been damaged from overgrazing can be rejuvenated by implementation of a managed rotational grazing system for the entire pasture, and by implementing a system of controlled grazing on the streamside paddocks. This stream grazing system will initially call for high density grazing of livestock (many animals on a small area) on small sections of the stream. Even vertical stream banks can be "gentled down" by the livestock. In the initial stages of the stream rejuvenation the stream paddocks may need fairly long rest periods to allow for establishment of new plants and recovery of existing vegetation after the grazing event. As the stream shows improvement, rotational grazing may be done on a more regular basis. You need to realize that monitoring the streamside paddocks is very important so that proper grazing decisions can be made.

Streams that are degraded from overgrowth by trees and brush can be rejuvenated in a similar way. However, some trees may need to be removed mechanically to allow sunlight to reach the soil surface to promote the growth of grasses. In some cases it is wise to spread some seed on the area so that ground cover is established quickly.

Factors to Consider in Plan Development

Installation of a managed rotational grazing system in stream corridors will provide considerably more forage than a continuous grazing system, while protecting the stream channel and adjacent riparian areas from detrimental impacts of grazing livestock. This conversion requires a significant change in management of the pastures. Plans for the managed rotational grazing system must include:

- well thought out objectives, especially related to what the stream will look like when the plan is fully implemented;
- management strategies for the forages;
- a system of fencing;
- stream crossings;
- a system of providing water for the livestock;
- provisions for easy movement of livestock; and
- access requirements for machinery.

Stream Characteristics that Affect Plan Development

The Size of the Stream

Large streams are much more difficult to deal with in grazing systems than smaller streams. Fences are more difficult to install. Livestock crossings are more difficult. Crossing large streams with pipelines for water is more difficult. It is generally easier to have a beneficial impact on streams that are smaller in size.

Soils on the Streambank

Streambanks with soils that are finer textured are generally easier to stabilize with grazing than those composed of sand and gravel. Finer textured soils will endure livestock traffic quite well. They are more fertile and generally have a more viable seed bank from which new plants will emerge.

Several factors related to the stream itself, the soils, and the vegetative resources in the adjacent riparian area must be considered in order to design a grazing system that will meet the objectives of the landowner while keeping the stream corridor in a healthy condition.

MDA

Small streams are generally easier to manage for grazing.

MDA

Large streams present greater challenges for grazing management than smaller streams.

Sandy and gravelly soils will not stand up well to livestock traffic. Livestock traffic will displace and damage plants. The droughty nature and low inherent fertility levels of these soils hinder the growth of new vegetation. These soils are easily eroded from the banks of streams, making the banks very difficult to stabilize.

Flooding

Flooding is one of the most significant factors affecting grazing plans and designs. Flooding can easily take out fences and livestock watering system components. In addition, the quality of the floodwaters may be detrimental to livestock as a water source. Sediment deposition and excess wetness can delay re-entry to streamside paddocks by livestock.

NRCS

Flooding presents issues with fence and water pipeline crossings.

Flooding is more difficult to deal with the more frequent the flooding is, the deeper and wider the floodwaters are, the faster they flow, and the longer the area stays flooded.

Depth of the Stream Channel

Streams that are deeply incised into the surrounding landscape are more difficult for livestock to traverse. This makes it difficult to provide the kind of impact necessary to reduce the slope of the banks to a point where vegetation can get established. In addition, livestock may have difficulty in getting to the water if the stream is used as the primary water source.

Some streams are so deeply incised that it is not feasible for livestock to have access to the banks. Heavy equipment is sometimes used to reduce the slope of the banks prior to seeding the banks to establish vegetation before the introduction of livestock.

Water Quality

The quality of the water in the stream will determine how much access is provided to livestock, or if the stream is even a satisfactory source of water. Excess levels of sediment, pathogens, nutrients, or pesticides will adversely affect livestock performance and herd health. Streams with good quality water are normally economical sources of livestock water.

During times of flooding, or even during runoff events, water can carry high concentrations of pollutants. In many of the streams in southeast Minnesota, these runoff events are short term and the water clears up rather quickly. During periods of runoff it may be best to not use the stream as a source of drinking water.

Vegetative Management in Stream Corridors

The primary purposes for preparing a managed rotational grazing plan for pastures containing stream corridors are to manage the plant community for optimum health and vigor, to develop an erosion resistant root system, to provide shade for the water for temperature control, to provide habitat for fish and wildlife, to control livestock use of the stream, and to provide forage for grazing livestock.

A healthy stream corridor will contain a plant community composed of diverse species, mostly grasses, but with some trees and patches of brush scattered throughout. The plants will be used for grazing but will recover quickly because they will not suffer from overuse.

The most useful method of determining when livestock should be moved from the corridor is to measure the residual stubble height. In general, when livestock have grazed the plants to a residual stubble height of four inches, it is time to move them to another paddock.

This can vary, however, by what is desired for vegetation. For example, if you want livestock to suppress the growth of brush, you may have to keep them in the paddock for a longer time and the decision to move them will be based upon the effects they have had on the brush. In this case, if they are kept in a paddock longer than normal and they have grazed the grass much more than desired in order to impact the brush, then this paddock would receive a longer than normal rest period so that the herbaceous vegetation can recover from the livestock impact.

Each situation needs to be based upon the desired effect on the vegetation in the paddock. By noting the effects grazing has on the vegetation, you can learn what the impacts of the livestock are and be better able to predict those effects in various situations. Monitoring is the essence of good vegetation management.

Winter use of Stream Corridors

Stream corridors should not be used as outwintering sites, where livestock are kept and fed throughout the winter months. When used as such there is a substantial threat to water quality in the stream from the deposition of manure and urine on the frozen ground in the stream corridor. When the weather warms and melting takes place, the runoff will carry significant amounts of nutrients into the water of the stream.

This does not mean that the stream cannot be used as a source of drinking water for livestock that are outwintered in paddocks situated a distance from the stream. It is feasible and practical to have livestock travel in a lane to the stream for water. If a permanently placed lane is not available to provide a path for the livestock, then a lane constructed of temporary fencing materials should be used to guide the movement of the livestock. The watering site at the stream should be a constructed access point. In this type of situation, livestock will travel to the stream for water and then back to the outwintering site for feed. They do not loiter in the stream, so deposition of manure and urine in the stream corridor is dramatically reduced as opposed to situations where livestock are wintered in the stream corridor itself.

Design and Layout of a Riparian Grazing System

Paddock Design and Layout

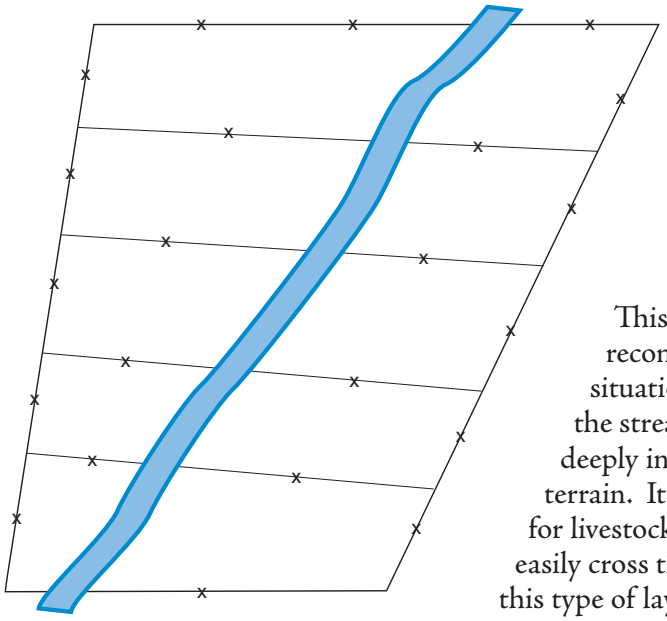
Three options are commonly used to manage the impact of livestock on stream corridors. Each option is based on stream characteristics and on the characteristics of the adjacent pasture. Within each of these options there can be some variation. Each site needs to be evaluated on the basis on its specific characteristics.

FENCE TO INCLUDE THE STREAM IN ADJACENT PADDOCKS

With this option the stream is included in the paddocks that it flows through. Livestock have full access to the stream for the grazing period for that paddock. In these systems, the stream normally serves as a source of drinking water for the livestock. Constructed access points are a good option in this system as a way of reducing livestock impact on streambanks.

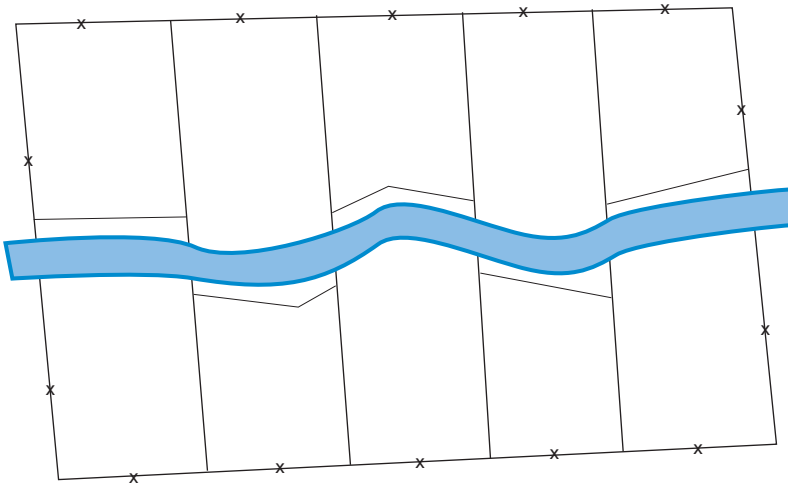
It can be seen from the accompanying sketch that this option calls for the fences to cross the stream in several places, which can be problematic during flood events. For this reason, this type of layout should be considered for small order streams, on streams where flooding rarely occurs, or on streams where flood waters are at slow velocities and do not disrupt the integrity of the fences.

Sketch of plan with stream included in paddocks.



This layout is recommended in situations where the stream is not deeply incised into the terrain. It is important for livestock to be able to easily cross the stream in this type of layout.

Alternative method of laying out paddocks when including stream in adjacent paddocks.

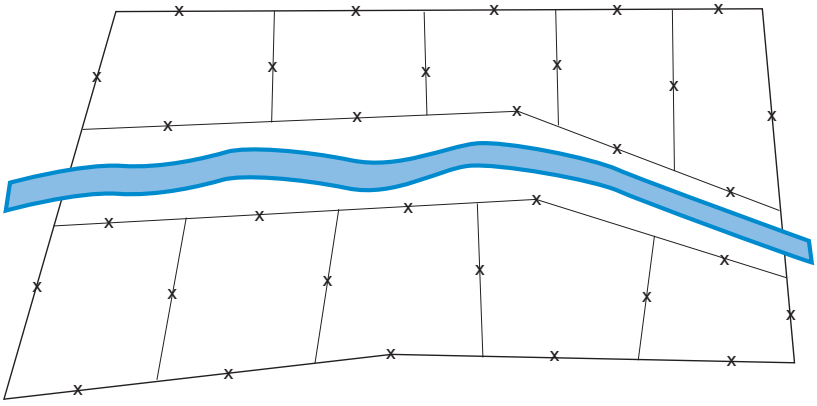


An option to having significant portions of the paddock on both sides of the stream is to fence in a manner that includes the stream on one end of the paddock. Livestock are unlikely to cross the stream for a small sliver of pasture on the opposite bank, allowing the vegetation to grow with little grazing pressure. This can provide low livestock impact to areas of streambanks that need additional rest or time to recover from livestock impact.

As you monitor the streambank it will become apparent where livestock impact should be increased or decreased to benefit the stream and the plant community. It is desirable to install the fences in a way that allows easy management of livestock movement to areas that need increased livestock impact, or to keep livestock away from areas that need additional rest. This can be accomplished by installing easily moved temporary fences or constructing gates at strategic points in the fences to allow easy livestock movement.

FENCE TO MAKE THE STREAM CORRIDOR A SEPARATE PADDOCK

A second option is to fence the stream corridor in a manner that makes the corridor a paddock apart from the other paddocks in the pasture. This is a very good option when the stream is a larger order stream than those discussed above. In cases where flooding frequency, duration, and intensity are such that fences would be very difficult to maintain, this is a reasonable approach. Only two permanent fences that cross the stream are necessary: one at the upstream end of the corridor and one at the downstream end of the corridor. This reduces the maintenance workload for fences.



Sketch of a plan with stream fenced as a separate corridor.

This is also a good option when the stream corridor needs to be managed closely to obtain the desired effect. Examples of this type of situation include streams that are important fisheries and corridors that contain features that are quite sensitive, such as significant streamside wetlands or streambanks with soils that are easily damaged by grazing.

These stream corridor paddocks can be, and in most cases need to be, split into several smaller paddocks (depending upon the size of the corridor paddock and the livestock density) to adequately apply proper grazing pressure and to obtain the desired effect on the vegetation and stream itself. Temporary fences made from polytape or polywire and using step-in posts are commonly used in these situations so they can be rolled up when not in use. The only fences that are exposed to the effects of floods are the fences at each end of the stream corridor paddock.

Stream crossings are necessary where the substrate in the stream bottom is not solid enough to support livestock traffic or where the stream is incised deeply into the landscape and the livestock have difficulty traversing the stream. These crossings may also serve as access points from which the livestock can drink water.

With this option there needs to be some type of livestock watering system installed to provide water to the paddocks that are outside of this fenced off corridor. Refer to the section on livestock watering systems for guidance.

A stream corridor paddock can serve as a "manifold" through which livestock may be moved from one paddock to another, minimizing or eliminating the need for travel lanes.

FENCE TO EXCLUDE THE STREAM CORRIDOR

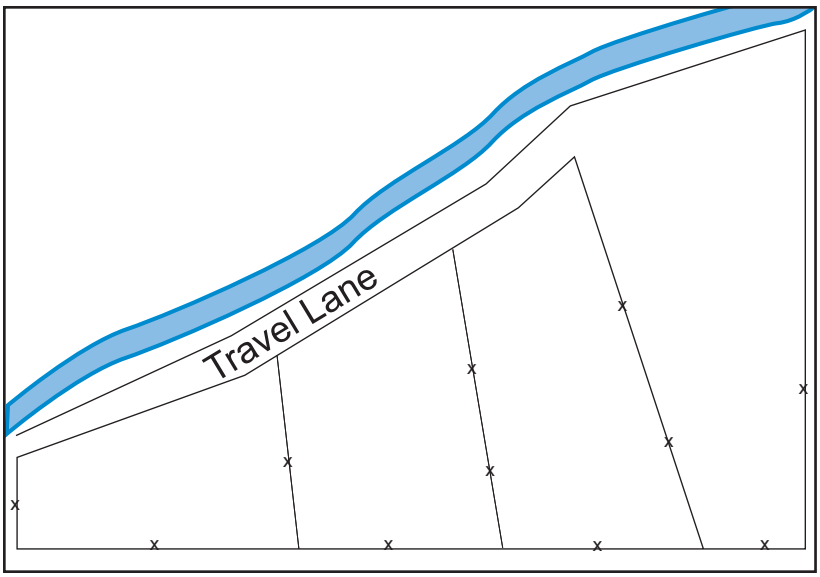
In some cases it is in the best interest of the stream to totally exclude livestock. This is pertinent in the following situations:

- The stream is so deeply incised into the landscape that livestock grazing on the stream banks or watering from the stream cause serious trailing and erosion issues.
- The soils of the streambanks are sand and gravel, and any livestock traffic will damage the soils and vegetation. In these soil conditions the vegetation easily suffers serious damage and cannot recover adequately enough or quickly enough to stabilize the streambanks to protect them from erosion.
- In the case of pastures adjacent to very large streams or rivers, it is sometimes best to exclude the livestock. This is especially true if the stream floods often or if the banks of the stream are seriously eroding. High vertical banks along major streams are difficult to positively impact with livestock grazing.

SITUATIONS TO AVOID

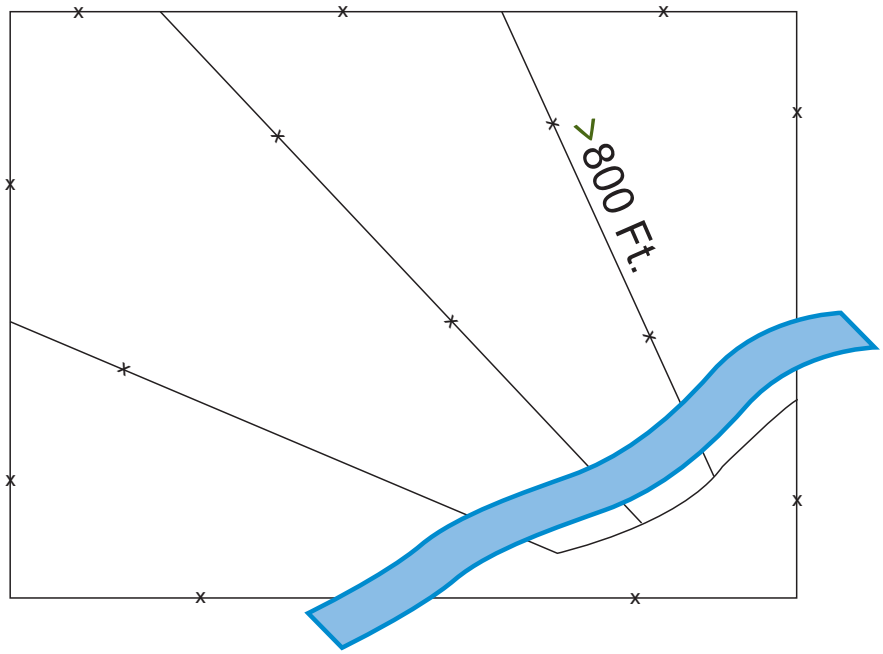
There are some situations that should be avoided when setting up paddocks in pastures with streams. These situations can cause livestock trailing which leads to erosion, and zone grazing. Zone grazing is overutilization of forages in portions of the pasture closest to water and underutilization of forages that are farther from the drinking water.

The first of these situations is installing travel lanes close to and parallel to streams. Due to livestock traffic the vegetation in the lane is damaged and significant bare soil areas exist. In addition, significant amounts of feces and urine are normally deposited in lanes. The result is degradation of the water quality from erosion of the soil and movement of nutrients and pathogens to the stream.



Sketch of situation to avoid - lane constructed adjacent to stream.

A second situation is pastures with a stream in one corner, along one side, or only in a small portion of the overall pasture. It is tempting to fence portions of the stream into each paddock, having the paddock stretch out into the pasture for long distances. Livestock tend to ruminate and rest in areas near the water and do not travel long distances from it. It is generally accepted that cattle will do uniform grazing up to a distance of 800 feet. Beyond that distance forage utilization diminishes and "zone grazing" is evident. To overcome this, paddocks should be sized to match the production of the forages, the desired grazing period, and the projected forage requirement of the herd. Paddocks should be planned and installed to use the stream for water to the extent possible, with the above distance criteria in mind. Those paddocks that do not have access to the stream should be set up with a functional livestock watering system, as explained in the section "Livestock Watering System."



Sketch of situation to avoid - paddocks with too much travel distance to water.

Livestock Watering System

The goals for a well planned livestock watering system include the following:

- To provide water to the area where livestock are located. This prevents their trailing to a watering point or facility and reduces the erosion from trailing.
- To be able to closely manage livestock impact on vegetation and physical structure of streambanks and channel.
- To reduce the deposition of feces and urine directly into the water, thus improving water quality.

One of the benefits of having a stream in a pasture is that it provides a convenient and economical source of water for livestock. On the other hand, streams can carry pollutants that will adversely affect livestock performance and may even lead to herd health problems.

You must consider the land use and treatment in the watershed that provides runoff to the stream and be able to plan around runoff events. The more common pollutants of concern are sediment, nutrients, pesticides, and pathogens. With most cold water streams in southeast Minnesota, the runoff from storms passes through very quickly, usually within two days. After that, the water quality returns to the same conditions that were present prior to the runoff event. Streams with serious and continuous water quality issues should be avoided as a source of water for livestock.

Even a stream that appears to be clean may have issues related to pathogens. It is important to monitor the health of the herd so that changes to management can be made before serious damage occurs to the livestock.

Providing water from a stagnant source (dugouts or constructed earthen dams) is a relatively poor method of watering livestock. These are unreliable sources of water during periods of drought. In addition, the quality of the water is usually much poorer than that from flowing streams.

Many times a stream is no longer directly available for water for livestock when a pasture is subdivided into paddocks to control grazing in the riparian areas. This requires installation of a watering system so that livestock have access to water in all of the paddocks without having to travel long distances to a central watering point.

Source of Water

The source of water provided to paddocks can be either the stream itself or water brought to paddocks from another source, generally through pipelines. Which source to use depends upon the distances to convey the water, the terrain (especially elevation differences), and the quality of the water in the stream. Cost of installation, flow characteristics of the stream (especially flooding issues), and maintenance requirements of the equipment are additional factors.

Wells at farmsteads generally provide the best quality drinking water. A livestock watering system connected to a farmstead water system is normally the most dependable method of providing good quality water to livestock on pastures. Water can be piped for long distances unless it needs to be pumped up significant elevations.

Livestock Watering System Options

STREAM ACCESS POINTS

The easiest and most economical method of providing water to livestock in pastures adjacent to or including streams is to provide stream access points for the livestock. The locations of these should coincide with areas that are currently being used by the livestock. This does not disrupt their established habits, and they are usually using those places that are easiest to develop. In most cases, the access points that livestock are already using need to be upgraded with shaping and placement of a stable surface for livestock to stand on.

MIDWEST GRASSLANDS

Stream access points are relatively easy to construct and maintain. They can serve as stream crossings.

Improved stream crossings can serve as access points for watering, but a barrier, such as a strand of electric fence, may be required to keep livestock on the side of the stream that you want them on.

LIVESTOCK OPERATED PUMPS

Livestock operated pumps are many times referred to as "pasture pumps" or "nose pumps." These pumps are actuated by the livestock pushing the pump arm with their noses to pump the water from the source. The typical source is a pool of water in the stream. The inlet to the pump is suspended in the water to prevent it from sucking in mud. A one-way check valve is installed at the inlet so that the water in the pipeline feeding the pump does not have a way to return to the stream, thus keeping the pump primed.

MIDWEST GRASSLANDS

Livestock operated pump. This one was set up for demonstration. In reality they need to be anchored to the ground so livestock do not push them around.

These pumps work quite well, but keep the following in mind:

- They can handle approximately 30 cows per pump, so you may need more than one available to each paddock if your herd is larger than that.
- They are portable. It is a good idea to leave the inlets in place and move the pump to other established inlets to save time in setting them up.
- You must prime the pump initially for the livestock.
- Small animals, such as calves or sheep, will not be able to operate the pump. In cow/calf operations, a small pan is sometimes installed under the pump to catch overflow for the calves.
- The pump is limited to a distance of 150 feet from the water source. It will lift water about 26 feet, but only if placed close to the source of water. It is more difficult to operate as it has to lift water higher.
- It requires no electricity to operate.

SLING PUMPS

Sling pumps float in a stream and the movement of the current on the blades causes the blades to spin. The pump picks up water from the stream and moves it through internal tubes to the pump outlet through a hose to a watering facility. These pumps come in various sizes. The smallest one can pump 550 to 830 gallons per day depending upon the velocity of the stream.

NRCS

Sling pump operating in stream.

Keep the following items in mind if considering this pump:

- The pump takes a fair-sized stream to operate in. If the pump touches the side or bottom of the channel it will quit pumping. The smallest pump on the market takes a stream that is at least one foot deep with adequate velocity.
- The pump must be anchored well to keep it in place.
- These pumps are subject to curious passers-by if located on a stream used for fishing or canoeing.
- They can be easily disrupted and damaged by high water flows.
- The water tank that it pumps to must have an overflow so excess water can be removed from the area to prevent formation of mudholes. There is no way to put a system on the pump to stop flows when the tank is full.

SOLAR PUMPS

Solar pumps come in a variety of configurations. One common type is directly connected to a solar panel. It operates all the time when the sun is shining. Another type is actually a battery operated pump connected so that the solar panels charge the batteries. This type can be easily regulated to turn on and off as water use dictates.

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One type of solar pumping system. This one pumps whenever the sun shines on the solar panel. It is set up in a paddock adjacent to the one with the livestock to avoid livestock damage to the solar panel. It pumps to a tank in the paddock with the livestock.

Important considerations for solar pumps include:

- They may be expensive, although the cost varies considerably depending on the basic design.
- They require a three day water supply in reserve unless battery powered.
- They can draw water from open water sources or wells.
- They can be used to power a pressurized system to push water for long distances.

ENGINE POWERED PUMPS

Engine powered pumps are capable of pumping large volumes of water for long distances and more than 100 feet of elevation. The cost is generally reasonable.

NRCS

Engine powered pumps are a good option when electricity is not available.

Important considerations for engine powered pumps include:

- You must protect them from flood waters.
- The machine pumps water until it is shut down or it runs out of fuel. Some operators know about how long they want the pump to run and put a small amount of gasoline in the tank and let it pump until it runs out of fuel. Some overflow of the tank may occur and should be directed away from the tank.

In all cases with watering systems that pump from flowing streams, it is important to flood-proof the installation as much as possible. Many of the options described above will suffer serious damage during floods. All systems require some maintenance. They cannot be put into place and expected to operate without any attention.

The positive aspect of these systems is that they will provide water in locations where electricity is not available or where water cannot be pumped or hauled. In this respect, they are well worth considering.

HAULING WATER

This is a practical way to meet the needs of livestock in smaller herds and in situations where the cost of other methods is excessive for the benefit.

Livestock Watering System Layout

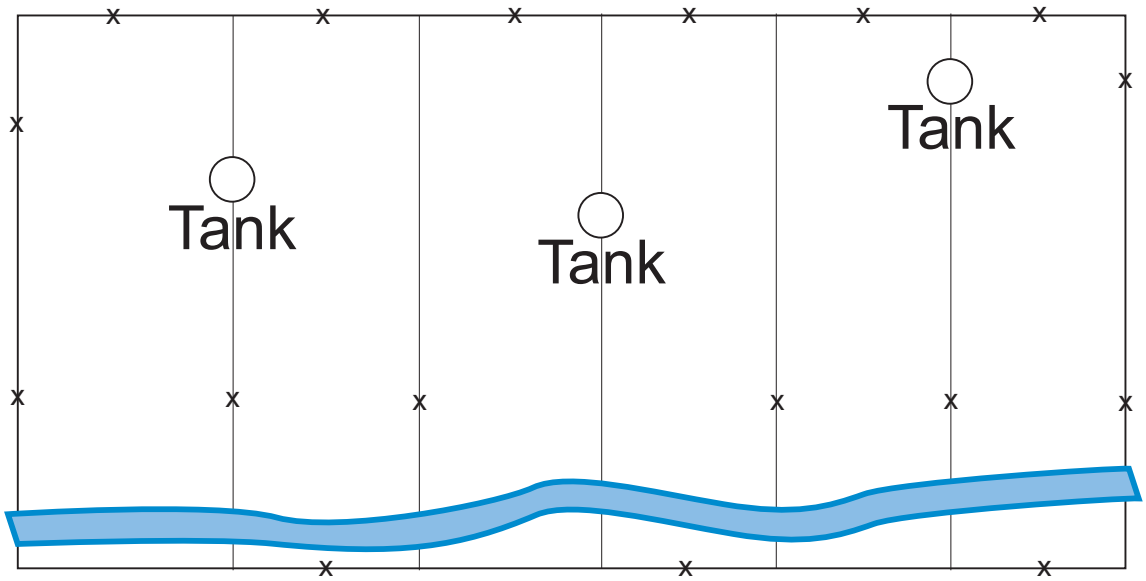
The placement of pumps is restricted, to a large degree, by the kind of pump chosen and the source of water. Pumps can draw water for only relatively short distances, but some can push the water for very long distances.

Livestock powered pumps, sling pumps, and some solar/battery powered pumps are useful for pulling water from a stream for use in paddocks adjacent to the stream. Livestock water access points are only useful for the paddocks in which they are located, unless a lane is provided for livestock to travel to the access point from more distant paddocks.

Gasoline powered pumps and more powerful solar/battery powered pumps can draw water from streams and transport it long distances to watering facilities in paddocks that are not adjacent to the stream. These systems allow for subdivision of the pasture in a manner that does not require each paddock to contain a section of the stream. You can install a better grazing system in this case that will reduce the incidence of zone grazing and will reduce trailing for water over relatively long distances.

In some cases it is advisable to extend a pipeline system from a well, typically at the farmstead, to watering facilities in the paddocks. This should be your first option if it is possible, since a pipeline generally requires less maintenance and is more reliable. The cost of this must be weighed against the cost of alternative pumps, the cost of their installation, and the amount of maintenance expected in a season of use.

Water tanks placed a distance from the stream.



If livestock are placing excess pressure on a stream, causing damage to the soils, vegetation, and water quality, a simple solution may be to place a water tank in the streamside paddock at some distance from the stream. It has been demonstrated that livestock will water from the tank more often than from the stream, especially if direct access to the stream is difficult. Most livestock would prefer to drink from still water and prefer warmer water to the cold water from spring-fed streams.

Major drawbacks to having livestock travel long distances to water, even in travel lanes, is that they tend to deposit a significant amount of their manure in the lane that leads to and from the watering facility, and that they tend to lounge in the area of the watering facility. These issues defeat two major advantages of managed rotational grazing systems: keeping the livestock on the desired paddock so that they consume forages, and spreading the fertility (in the form of feces and urine) through the entire pasture rather than at lounging areas and watering points.

Crossing streams with pipelines can be difficult. The larger the stream, the more difficult it is. The major consideration is to keep the pipeline in place during flood events. The recommended method is to shallow bury the pipeline through the floodplain, bringing the pipeline out of the ground at the stream and elevating it above the water by hanging it on an elevated pole or cable strung across the stream. When preparing a grazing plan that includes stream corridors, it is advisable to cross the stream in as few locations as possible.

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This illustrates one method for crossing a stream with a water pipeline.

The major issues with fences in stream corridors are protecting the fences from floods and constructing fences across the stream that will contain the livestock even during periods of normal and low flows.

Fence System

Flooding easily causes damage to fences.

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You can minimize flood damage to fences by minimizing the number of crossings needed, especially for permanent fences. This is done by planning the grazing system so that the stream corridor is a single paddock that can be subdivided using temporary fences. In this system the only permanent fence crossings are at the upstream and downstream ends of the stream corridor.

Construct fences that use fewer strands of wire in floodplains that are subject to flows that will damage them. For example, a single strand electrified fence will catch less debris than one with four wires, reducing the maintenance requirements.

Another strategy is to construct the fence sections that are prone to damage by floods in a manner that will allow them to "break away" from the rest of the fence. This will minimize the damage.

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The fence in this photo is clearly marked for canoeists and has "break-aways" to allow one end of the wire to unhook during floods.

For electrified fence, a good method of "closing" the opening where it crosses a stream is to string one electrified wire across the channel and install wires or chains that hang from it to a point close to the water surface. This will provide a deterrent to livestock that may want to walk in the stream channel to escape from the pasture.

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One method of keeping livestock from going past a fence that crosses a stream channel.

For barbed wire fences, the same type of system may be used, but you need to add some weight to the wires to keep tension on them so that it appears to the animals that they cannot move beyond them.

Plan the fence system to allow for easy movement of livestock from one paddock to any other in the pasture. This reduces stress on the animals when they are being moved and it allows for easier management of the entire system.

For More Information on Managed Rotational Grazing

Additional sources of information are available to help plan and manage managed rotational grazing systems. These include:

Grazing Systems Planning Guide by Kevin Blanchet, Howard Moechnig, and Jodi DeJong-Hughes. Revised 2003. Extension Distribution Center, 405 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. Phone: (800) 876-8636. Website: www.extension.umn.edu Listed as publication BU-07606-S.

Understanding Grass Growth: The Key to Profitable Livestock Production by Steven S. Waller, Lowell E. Moser, and Patrick E. Reece. 1985. Trabon Printing Co., Inc., 430 East Bannister Road, Kansas City, MO 64131. Phone: (816) 361-6270. Website: www.trabon-paris.com

Pastures for Profit: A Guide to Rotational Grazing by Dan Undersander, Beth Albert, Dennis Cosgrove, Dennis Johnson, and Paul Peterson. Revised 2002. Cooperative Extension Publications, 432 North Lake Street, Rm 103, Madison, WI 53706. Phone: (877) 947-7827. Website: learningstore.uwex.edu/pdfA3529.pdf Listed as publication A3529.

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