Sacrifice a little pasture to save a lot!

Greener Pastures
Dear Readers,

Very few horse owners haven’t had to deal with some sort of mud problem in their pastures or paddocks at one time or another. The majority of horse owners would prioritize the health of their animal (and perhaps, the physical structure of the barn) over the health and well-being of their paddocks. Therefore, they would choose to turn out and exercise their horses, regardless of the potential damage to the soil and grass. See if your paddocks have experienced similar difficulties to the true scenario outlined below.

At the University of Vermont (UVM) Ellen A. Hardacre Equine Facility, we had chronic ice and mud issues during the winter and spring seasons. The long winter and "mud" seasons were worsened by the paddock layout. As with many equine operations, we do not have the optimum setup for equine, human or environmental issues. Several factors that work against our efforts (both design and use patterns) to maintain "dry and healthy paddocks" are listed below.

- The slope of the paddocks runs north to south, and the gates are located on the south end (bottom).
- The paddocks are large enough for exercise, but do not contribute significantly to the horses' nutrient intake (food source).
- The gate areas are extremely compacted and do not support healthy plant growth.
- The water source is located in the high traffic area.
- The horses are turned out regardless of weather or ground conditions.

Due to these factors, we annually deal with wet paddocks that turn into mud, and then freeze. We have to maneuver around both deep frozen hoof prints and sheets of ice that form.

- Turn-out can be hazardous to both the horse and the handler, and the horses have a higher risk of sprains, strains or even bruising from the uneven and slick surface. Finally, when we go through a melting period, the water runs directly through concentrated manure that sits on compacted soil. Although we do have a grass buffer and some French drains, this is clearly not the best management practice for horses, humans or the environment.

As with most livestock operations, the "run-off" aren’t overflowing and priorities go to horse care costs such as high-priced shavings and hay. Since we didn’t have barrels of money to throw at the problem, and since these issues are common on all livestock facilities, we acquired some funds to try out methods that might be financially feasible for the average equipment facility. Although the solution we found was not a perfect one, the changes made such a difference that we acquired more funds (through a UVM Environmental Grant and other sources) to improve the remaining "problem paddocks" in the same manner.

So, if mud is a problem in your pastures, we have provided some new and old ways to get more green in your pastures with less green from your wallet. Please read on and learn methods to improve your paddocks from the work we did to improve ours.

Currycombs and carrots

Betsy and Rachel
Improving Your Horse Paddock/Pasture Issues Using Geotextile Fabric and Stone

The original project was an effort to improve paddock drainage and water quality at the UVM farm and to share our experiences with livestock owners through extension activities and publications. This entire project involved collaboration among many partners including the UVM Equine Program, UVM Extension, Risk Management Agency, UVM Center for Sustainable Agriculture, the local Natural Resource Conservation District, UVM Environmental Council, and the UVM Horse Barn Cooperative. The available funds allowed us to re-work the paddocks with the worst drainage, and we observed that this method is a worthwhile one that can be adapted for many equine facilities.

### How does it work?

A layer of topsoil (or mud, depending upon the season) is removed and replaced by a series of layers of geotextile fabric and stone of various sizes. Each layer has a specific purpose, as described below, and illustrated in pictures (see pages 5-7). These materials and methods are what we used for our paddocks. You can use this information to determine what aspects of our project apply to your situation.

#### Dirty Pea Stone

This 4" layer replaces the compact surface soil with a stone that will pack solidly over time. The pea stone retains a stable surface, even during "mud season"—stones and water don't make mud. Other materials such as SunPac can also be used.

#### Geotextile Fabric

The geotextile fabric keeps the pea stone from sinking down and filling the spaces in the crushed stone layer below. This maintains space and drainage in the underlying layer of larger stone and keeps a solid layer of pea stone on the surface. Using two layers of fabric keeps the layers separated and decreases the "disappearing gravel/sand phenomenon," with which many horse owners are familiar, when gravel is put down to improve footing and help reduce mud problems. Without geotextile fabric, the gravel or sand gets mixed into the mud or lost in short order, and its usefulness is decreased.

#### Crushed Stone

(1/8" - 3/4") The 4" depth of large diameter stones creates pore spaces, providing a pathway for water movement to the drainpipe. Runoff, surface water, and shallow groundwater drain into this layer. Another layer of geotextile fabric separates the crushed stone from the two layers (pea stone above and the ground below). Water flows through and down to the lowest point, eventually reaching the drainpipes.

#### Drainpipes

Buried pipes carry water from the lower layer of stone across and under the travel lane to the grass buffer below (south). These are placed at a slight downward angle (over an inch per foot) at the depth of the crushed stone and with one end at the lowest point of the paddock. They run perpendicularly across the travel lane to the grass buffer below. This allows water to pass through the crushed stone layer to the grass buffer, providing a cleaner path for runoff.

Our French drain is located at the bottom of the grass buffer strip and runs parallel to the travel lane between the grass buffer and the horse barn. It was installed at the time the barn was built to catch and divert the runoff from the paddocks, since the barn is downhill from the paddocks. A typical French drain consists of a buried fabric-wrapped perforated pipe to channel water away from buildings, lanes, and paddocks. The fabric allows water to enter the pipe, but keeps soil from clogging the small perforations. The ditch is usually filled in with large stones to allow water runoff to drain through to the pipe.

### Material

<table>
<thead>
<tr>
<th>Material</th>
<th>Purpose</th>
<th>Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dirty Pea Stone</td>
<td>To improve footing without mud</td>
<td>$6.00 per ton</td>
</tr>
<tr>
<td>Geotextile Fabric: 15’x360’non-woven filter fabric #351</td>
<td>To separate stone layers (Highly recommended)</td>
<td>$300.00 per roll</td>
</tr>
<tr>
<td>1/8”-3/4” Crushed Stone</td>
<td>To improve water drainage</td>
<td>$7.00 per ton</td>
</tr>
<tr>
<td>Drainpipes 4”x13’ DR35 PVC solid pipe</td>
<td>To divert water</td>
<td>$10.00 per pipe</td>
</tr>
</tbody>
</table>

*Costs are based on 2005 prices and vary based on geographic location.

### Problems

The horse paddocks at the UVM Ellen A. Hardacre Equine Facility are directly adjacent to Spear Street and are a favorite stop for daily visitors. As with any stable that manages horses on small acreage, UVM has issues with compaction in the areas of highest horse traffic. The soil compaction results in reduced grass growth and seasonal mud and ice problems. In addition, the paddocks are naturally sloped from north to south, resulting in water runoff passing directly over the high impact areas near the gate and water tanks at the south end of paddocks. Due to the compaction, water filtration and absorption capacity of the soil is limited, and rain and snowmelt either stands or runs through mud and manure at the high impact areas and across the travel lane (See Figure 1).

A good pasture or grass stand serves as a natural filter to clean surface water of organic matter prior to entering lakes or streams. If the soil is compacted, it is not able to sustain healthy grass growth and does not absorb water. Proper land and water quality management dictates either diversion of the water under or around the areas of high animal traffic and manure concentration (See Figure 2) and to the grass buffer below.

### Solution

We renovated a 15x2’ foot area in the high traffic section of the paddocks closest to Spear Street to divert water under the compacted horse traffic area. (See Figure 3)

Renovation involved replacing compacted topsoil with layers of geotextile filter fabric, large stone (1/8”-3/4”), filter fabric, and dirty pea stone (See Figure 4).

This provided a pathway for runoff water to travel under the compacted, high traffic areas to drain pipes under the travel lane to a grass buffer below (south) and to an existing French drain.

We combined funding from several sources to test this method on a known mud/ice/safety issue site at the UVM Farm, and incorporated it into an educational venture for UVM Extension and UVM students. The money was used for materials and to hire a local contractor to do the excavation work that was necessary to complete the task. Based on the costs for four paddocks previously done, the cost for labor, trucking, and materials averaged $1,600/paddock. While this may seem to be a sizable amount, the lessons we learned and the outcomes of the work were valuable. You may be able to use some or all of these methods in your paddocks.
Figure 5. Visitors and passersby could easily see our mud problems.

**The Process in Pictures**

Figure 6a and b. One sunny day, Bud Carpenter (BCI Construction, Inc.) peeled away about 8 inches of compacted topsoil. The soil was stockpiled and then used elsewhere on the farm.

Figure 7. The 15-foot wide strip of exposed ground was ready for work.

Figure 8. Wrapped geotextile rolls and drainpipes.

Figure 9. Horse Barn Cooperative students put some back into the work as they roll out the first layer—a sheet of geotextile.

Figure 10a-c. A dump truck load of 1 1/2"-1 3/4" crushed stone is deposited and spread to a 4" thick layer.

Figure 11a and b. A second layer of geotextile fabric (not shown) is rolled over the 1 1/2"-1 3/4" stone and 4" of dirty pea stone is dumped and spread on top of it. Figure 11b shows dirty pea stone (foreground) from the first paddock project that has been through a winter with horses on it. When we did the last three paddocks, we freshened up the first set of renovated paddocks. Note the weathering of a year, but still intact!
Benefits

This project demonstrates responsible land management to avoid potential water quality issues related to horse paddock water runoff.

Land/Water Management: This is a proactive management of a high traffic area (feed/water/gate), using water diversion through the rock drainage area to the grass buffer strip across (south) the travel lane. As a result, water doesn’t stand on compacted soil or run across the manure. Instead, water is transported under the constructed sacrifice area and filtered by the grass buffer strip located south of paddocks.

Increased Safety for Horses and People: During the fall and spring, the area had been wet and muddy (up to a foot of mud). As a result, horses made deep divots, lost shoes, and could have strained tendons and ligaments in the mud. People also had safety issues such as slipping while handling horses. During the winter, the divots left uneven ground and standing water froze, forming sheets of ice. This had provided a high potential for hoof bruising or abrasions and strained sprains, and for people slipping and falling while bringing horses in and out of the paddocks. With the installation of the drainage area, these problems have been significantly reduced. The paddocks are now safer for horses and people alike!

Project Outcomes for the Farm
- The UVM Ellen A. Hardacre Equine Facility was used to create a student and extension teaching opportunity, while improving the drainage and water quality issues on site.
- UVM Extension developed a project that included many land and water quality partners to provide an educational event at the facilities which could include the public as well as UVM Horse Cooperative Students.
- The UVM Ellen A. Hardacre Equine Facility now could demonstrate responsible land and water quality management.

Figure 13.
Water drains from the low point of the sacrifice area. Drainpipe carries water under travel lane to grassed buffer. The grass buffer filters drainage water, and some water infiltrates the soil as it passes over the grassy area. Excess water is carried away in the French drain on the far side of the buffer.

Figure 14.
The layers stand up to traffic – No mud here! Mud is evident in the paddocks without repair. The upper paddocks (muddy ones shown at top of photo) were renovated in May 2005.

If you aren’t ready to take the steps described above, the following are some immediate and simple changes that can be added to your horse care routine to make your grass healthier and keep your horse happier. In general, horses that graze more and eat less processed feed are calmer and more agreeable. As an added benefit, many things that make for nicer paddocks usually also mean better care for our environment. In addition, these changes will also help you comply with Vermont’s Accepted Agricultural Practices (see pages 16-11).

If your horse is on pasture that looks weedy and muddy, you might want to try some or all of the following:

1. The best way to manage a larger pasture is to divide it into smaller paddocks. Rotate your horse(s) between the paddocks to avoid over-grazing in any one area. A good rule of thumb is to put horses into a paddock when the grass is about 6 to 8 inches tall and take them out when grass is down to about three inches. Horses are selective grazers, meaning they will eat their favorite plants first. They will leave weeds behind to grow. If horses stay in any small paddock for more than three days, they may do some real damage, turning the paddock into a field of weeds and mud! Best results for paddock quality occur when your horses are rotated once or twice a day.

2. After taking horses out, try to mow the paddock and break up the manure. Mowing is usually something left to do when the rest of the chore list is done, but if you are having a problem with weeds, mowing can be your best investment. It will help the tasty forage plants out-compete the weeds the horses have left behind. You should try to mow down weeds before they go to seed, stopping future weed growth. Another advantage to mowing is that it will spread out the manure so it breaks down more quickly.

Photo by Guywack Harris
Some AAP Pertinent Pieces and Parts for Horse Owners

The AAP list below includes new language that is proposed as of 6/21/05.

4.01 Discharges
(b) Barnyards, manure storage areas, animal holding areas and production areas shall be managed or controlled to prevent runoff of wastes to adjoining waters, groundwater or across property boundaries.
(c) Adequate vegetative cover shall be maintained on stream banks by limiting livestock trampling and equipment damage (except at defined crossings) to protect stream banks from excessive erosion.

4.02 Nutrient and Pesticide Storage
(c) Manure stacking sites and storage of fertilizer and other nutrient sources shall not be located within 100 feet of wells or property boundaries unless it can be demonstrated to the Secretary that there is no suitable alternative site. Fertilizers may be stored within 100 feet of wells provided that they are stored in structures suitable for that purpose.
(d) Stacking or storage of manure shall not occur on lands subject to annual overflow from adjacent waters unless it can be demonstrated to the Secretary that there is no suitable alternative site.

4.07 Construction of Farm Structures
(d) All waste storage facilities constructed or expanded after July 1, 2006 shall be designed and constructed according to USDA Natural Resource Conservation Service standards and specifications or an equivalent standard certified by a professional engineer licensed in the State of Vermont.

4.08 Ground Water Quality
(a) Farm operations shall be conducted so that the concentration of wastes in groundwater do not reach or exceed the primary or secondary groundwater quality enforcement standards identified by Appendix One of the Groundwater Protection Rule and Strategy for Vermont, in accordance with 10 V.S.A. Chapter 48.
(b) Farm operations shall be conducted with the goal to reduce the concentration of wastes in groundwater down to the protective action levels (PALs) of the primary or secondary groundwater quality standards identified by Appendix One of the Groundwater Protection Rule and Strategy when monitoring indicates the presence of these wastes in groundwater that exceed the enforcement standard.

Steps Used for Renovating Our High Traffic Area

1. Determined the desired size, shape, cost, and items needed for the project.
2. Prior to lifting a shovel, called appropriate people to locate and mark water lines, power, and telephone cables.

CALL BEFORE YOU DIG!

3. Made arrangements with a contractor to establish cost, timing, materials needed, hauling, etc.
4. Took down electric tape fence (2 lengths) from each paddock to allow adequate width for large equipment to pass through.
5. Used a skid steer with a chain on the bucket to pull out the fence posts (1 per paddock).
6. Removed 8" of topsoil using a skid steer with bucket and loaded it into a dump truck; stockpiled it at another location on the farm for a future use.
7. Rolled out first layer of geotextile fabric.
8. Hauled loads of 1/2-1 1/4" crushed gravel from the local gravel yard.
9. Stamped spreading and leveling the layer (4" depth) on the paddocks while driver was hauling loads of stone.
10. Rolled out the second layer of geotextile fabric over the crushed stone.
11. Hauled and spread (as above) dirty pea stone over fabric.
12. Drove back and forth over the surface with dump truck and skid steer to pack it down.
13. Dig trenches across the travel lane at the lowest point of each paddock.
14. Put in PVC pipe. Pipe was slightly angled down and away from the paddocks to direct water flow to the grass buffer below.
15. Put in crushed rock at the grass buffer end of the pipe to promote better water diffusion.
16. Filled in trench with soil.
17. Reinforced fence posts and electric tape was put back in place.
18. Spread grass seed and straw/hay over truck path outside of the paddock area.
Notes on our project...

When we decided to do the partial sacrifice area, we included the width of the geotextile fabric as a consideration for the actual size of the renovated space. We wanted to have the horse handler be able to swing the gate in, bring a horse into the paddock and turn it loose while on the constructed area. The 15’ wide roll of geotextile fabric accomplished these desires.

We did not use “drain tile” pipes or perforated pipes in the travel lane because we were more interested in transporting runoff water to the grass buffer, and the travel lane is made of filter fabric and hard packed stone. That would preclude water absorption in that area.

Some of the project was incorporated into both UVM class and UVM Extension activities, so the actual time spent on the project is not cut and dried. The contractor work was done in less than two days, but the hauling of the stone took up a large part of that time. The time spent hauling in stone was greater than the time it took to spread and level the loads (leaving idle time for one of the workers).

We did not put the PVC pipes below the frost line in our project, since the constructed sacrifice layers were less than a foot deep. We know that at a certain point everything will freeze, and the drainage would not occur at that time anyway.

Resources

Harris, Gwyneth, Elements of a Successful Horse Grazing System. Vermont Pasture Network Program. Contact 802-656-3834 for information.

UVM Extension

http://www.uvm.edu/extension

Central/NE Vermont:
802-751-8307

Northwest Vermont:
802-656-5426

Southern Vermont:
802-773-3349

Soil Testing

http://pss.uvm.edu/ag_testing/
802-656-3030
802-244-6402

Other Useful Sites

The Northeast Grazing Guide: Your source of Grazing Information in the Northeast (hosted by University of Maine)
http://www.umaine.edu/grazingguide/

From Rutgers University:
http://www.rcrc.rutgers.edu/horsepastures/

King Conservation District Publications website (particularly the mud management, pastures, general livestock, waste management, and soil links).
http://www.kingcd.org/pub.htm