ECONOMICS OF GULLY EROSION AND STABILIZATION

An Economic Case Study | Last Resort Farm | May 2018

INTRODUCTION

Rainfall intensity is increasing in the Northeastern U.S. Stabilizing gullies is one strategy for adapting to this changing climate. This case study evaluates the costs and benefits of restoring gullies at Last Resort Farm.

The Doyle-Burrs own a 272 acre family farm in Addison County, Vermont. The property had been a dairy farm for over 140 years, before the family sold the dairy. Since 1993 they have been growing organic specialty crops. Today, the farm has a pick-your-own berries operation, farm stand, and a Community Supported Agriculture (CSA) program. The Doyle-Burrs also sell their produce at local farmers markets and to schools, restaurants, and food stores in other areas of Vermont.

Over the past 15 years, Last Resort Farm has seen an increase in the number of extreme weather events with heavy rains.

Farm co-owner Eugenie says, "Storms have been worse, causing soil erosion. In June 2015, we had 20 inches of rain as measured by our rain gauges on the farm, and that was also confirmed by the Addison weather station." This contributes to gully erosion on a forested slope that runs through a portion of the farm's sugarbush (a sugar maple stand tapped for sap to make into maple syrup) and next to Pond Brook. Pond Brook is part of the Lewis Creek watershed that flows into Lake Champlain. In recent years, the gullies have been growing in size. In 2012, the nonprofit Lewis Creek Association (LCA) found increased nutrient loading in parts of Pond Brook. Gullies on Last Resort Farm were identified as important sources of sediment and phosphorus runoff into Pond Brook. Six gullies drain areas ranging in size from 0.2 to 3.8 acres that start in Last Resort's fields.

NAME	LAST RESORT FARM
TYPE	CERTIFIED ORGANIC DIVERSIFIED FARM WITH MAPLE SYRUP, BERRIES, VEGETABLES, EGGS, AND HAY
LOCATION	MONKTON, VT
SIZE	15 ACRES UNDER PRODUCE CULTIVATION, 80 ACRES OF HAY, AND 1,200 MAPLE TAPS
ESTABLISHED	IN BUSINESS SINCE 1986
MANAGER(S)	SAM BURR AND EUGENIE DOYLE AND THEIR SON, SILAS DOYLE-BURR

Last Resort Farm partnered with many groups to reduce the amount of sediment leaving the gullies.

Partners included the Lewis Creek Association and their contracted engineering firm, Milone & MacBroom, Inc. (MMI). Local and state offices of the USDA Natural Resources Conservation Service (NRCS) and the Vermont Department of Environmental Conservation also worked with them. NRCS technical staff and LCA staff studied the erosion of the gullies. NRCS provided designs for rock-lined "hard" engineered waterways to stabilize the two largest gullies. LCA engineers from MMI provided log and stone "soft" engineering designs for the remaining four gullies.

TWO APPROACHES TO GULLY STABILIZATION FOR SOIL LOSS CONTROL

	HARD ENGINEERING	ALTERNATIVE SOFT ENGINEERING
DESCRIPTION	RIPRAP, STONES	ENGINEERED LOG AND WOOD PLACEMENT WITH MINIMAL ROCK APPLICATION
ADVANTAGES	▸ TRIED AND TESTED ▸ POTENTIALLY LONGER LIFE SPAN ▸ LESS FREQUENT MAINTENANCE	▸ MOSTLY ON-SITE MATERIALS ▸ LIGHTER IMPACT ON ENVIRONMENT
DISADVANTAGES	▸ HIGHER COST ▸ HEAVY EQUIPMENT IS USED ▸ POTENTIAL SOIL COMPACTION	▸ LIKELY HIGHER MAINTENANCE ▸ UNPROVEN BUT LIKELY SHORTER LIFE SPAN ▸ MORE MANUAL LABOR

NET BENEFITS OF GULLY RESTORATION OVER 15 YEARS (2017 dollars rounded to nearest $100)

BENEFIT CATEGORIES	LOW BENEFIT (NET TO FARMER)	HIGH BENEFIT (NET TO FARMER AND PUBLIC)
GULLY SOIL	$500	$4,200
FIELD SOIL	$2,200 - $8,600	$80,600
HAY	$0 - $700	$1,100
MAPLE SAP	$0 - $1,000	$2,000
TOTAL	$2,700 - $10,800	$87,900

The total benefits gained from restoring a gully can range from $2,700 to almost $88,000.

Low benefits reflect gains by the farmer. Estimates for low benefits are based on the avoided costs due to loss of productivity due to continued gully erosion. High estimates are those benefits to both the farmer and to society. They reflect lower costs to the farmer and less sediment into Lewis Creek and Lake Champlain. Sedimentation reduces water quality in Lake Champlain. This can have negative effects on water treatment, recreation, fisheries, and navigation. A study by USDA's Economic Research Service[1] estimated the costs based on a dollar per ton of soil loss. For field soil benefits to the farmer, the range reflects a difference in opinion of the engineer (lower estimate) and the farmer (higher estimate) as to the number of acres that will be affected.

CONCLUSION

The number and intensity of heavy rain events in Vermont and the Northeast will likely increase.

To meet Vermont's conservation and water quality objectives, it is critical to find ways to reduce soil erosion and soil loss from farms. The cost of two approaches used to repair gullies at Last Resort Farm are similar over the 15-year project time frame. But the timing of maintenance and related costs are significantly different. For the hard engineering rock-lined approach, most of the costs occur upfront at the time of construction. Because rocks remain intact, future maintenance and associated costs are low. In contrast, costs for the soft engineering approach with logs and branches are distributed over time. Regular maintenance is required to replace rotting logs/branches to minimize runoff and soil loss.

Deciding on which restoration approach to use can depend on how involved the farmer wants to be and when the problem of erosion is discovered. The soft approach requires farmers to regularly check the gullies, especially after major storm events. Repairs can be made as needed, and a smaller erosion problem can be fixed before it becomes a crisis situation. When faced with larger gullies, farmers may prefer to use a hard engineering practice. This will solve the erosion problem with less need for maintenance. The upfront costs of installing rock-lined gully repairs can be prohibitive for many farmers. Funding support from NRCS can help make sure the project is financially viable.

Aesthetics and material availability can also sway the choice of gully repair options. A farmer may prefer logs and branches because these organic materials may be found on site. They also blend with the landscape and can lessen the impact on the environment. Regardless of the approach used, it is clear that the benefits of gully repair reach beyond that of the farmers' own fields. Transport of sediment to Vermont's waterways is reduced and water quality is improved. These benefits are shared by the wider community. As storm intensity in the Northeast increases, the erosion risk will also increase. The benefits of gully stabilization on farms will be even greater in the future.

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[1] Hansen, L. & Ribaudo, M. (2008) Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment Technical Bulletin no. (TB-1922) USDA ERS, Addison County VT values, adjusted to 2017 dollars using the consumer price index (CPI)

FRONT IMAGE: Hard engineering gully stabilization, Sept. 2017
BOTTOM IMAGE: Close-up of soft engineering gully stabilization, Sept. 2017

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