Trail Erosion Mitigation at the Fairfield Osborn Preserve

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Introduction

Fairfield Osborn Preserve has many trails that are composed of dirt with some wooden components. During the dry summer this is not a problem for the preserve, however once it rains there are complications. Trails that are placed on hillsides become the path of least resistance for the rain runoff. Any time water is flowing over an area of exposed earth it will become saturated with dirt particles and if not given an adequate area to filter through, the runoff will carry the sediments into the nearest water system. The runoff will pollute the river or stream and will possibly fill the pore spaces in the gravel bed. As for the health of the trail, when the water is running down the trail it become incised and transform the trail from a pleasant walking surface to a saftey hazard. When a staircase is incorporated into the trail, the water will flow around the edges of the wooden steps and slowly undermine the integrity of the stairs. This was the case with the staircase I worked on, and the water had also flown under the steps and occasionally pooled on the flat surfaces between them. This creates a situation where the dirt is being removed from below the wooden step and given enough time the step will collapse downward, possibly as someone is walking upon it

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Purpose

During a heavy rain event the water that flows over the staircase will cause the following issue:
Decrease in water quality
Loss of pore space in stream bed
Soil loss
Erosion
Next to the trail worked on there is a small stream, and every time there is a heavy rain event the sediment-filled runoff flows into the stream. The sediments pollute the stream, and fill the pore spaces in the gravels and rocks that make up the bed. Soil is lost on the trail and it will become incised which creates safety issues. Also the area directly under the steps is eroded out, leaving a poorly supported structure that can seriously harm a visitor. Runoff must be diverted from the trail to prevent the continuation of these issues, and damaged steps must be replaced.

Methods

Data collection

Data was collected along the whole length of the staircase and the sections above and below to asses where the erosion was occurring using a 100 foot measuring tape, six inch ruler and a measuring stick. Erosion on the right, left, and directly below the step was logged, as well as where the water was flowing into the stream and pooling was occurring between the steps. This information will aid the preserve staff in observing how effective the treatment to the area was, and if the treatment is worth repeating at other sites.

Data

Step number	Erosion Along Horizontal Lengt	Undercutting Of Step	Additional Notes
1	3'4" wide, 6.5" deep		
2	3'6" wide, 9.5" deep	3"	3" eroded under step
3	3'3" wide, 6" deep	6"	Pooling for 2' in front of step
4	2'8" wide, 8" deep		
5	3' wide, 9" deep	2"	Most erosion occuring at left side of step
6	2'11" wide, 6" deep		Looks sunken, as if fallen from under cutting, but no visible undercutting
7	2'10" wide, 7" deep		Has been pushed forward, possibly due to force of flowing water
8	3'2" wide, 10.3" deep	3"	Pool 2" deep that extends to step 7
9	3' wide, 7" deep	2"	
10	3'11" wide, 8" deep		
11	3'3" wide, 11"deep		
12	4'6" wide, 10" deep	2"	Erosion mainly on right side, step is tilting to the right
13	5'10" wide, 11 deep	9"	Worst undercutting of all steps, occuring at the middle
14	5'10" wide, 7" deep		Has ant hill
15	3'7" wide, 10" deep		Large sediment deposit in front (filling space between 15&14)
16	3'8" wide, 10" deep	3.8"	
17	3' wide, 7" deep		
18	2'8" wide, 8" deep	.5"	
19	2'6" wide, .5" deep		Water goes over step
20	2'5" wide, 4" deep		

The bottom of the treatment area is 29′6″ from the first step, distance traveled over the stairs is 41′, and the treatment area extends to 49′3″ from the last stair.

Methods

Land management prescription and treatment

Land management prescription and treatment began with a group of land managers and land stewards hiking out to the site at the Fairfield Osborn Preserve. After they arrived and made sure that they were in the correct location they began to observe where the runoff was coming into contact with the trail, and where it was leaving. Data was collected of the erosion occurring at the staircase using a 100 foot measuring tape, a six inch ruler, and measuring stick. With some guidance from Suzann it was determined that the area would need two drainage ditches, one water bar, and three strategic steps added to it as well as nearly all of the steps being relpaced.

Drainage ditches and strategic steps were prescribed at this location because it is believed to be the plan with the least amount of disturbance to the preserve while still achieving the desired effect. East of the trail the hillside rapidly steepens, and if a new trail were to be constructed in that location it would have undermined the integrity of the hill. A large rain event would have left the trail covered in debris, and there would have been the possibility of the hillside sliding down in the next earthquake. There are many healthy trees that would have needed to be removed, and the slight elevation gained would not be enough to ensure the problem would not persist. To the West of the trail there is not adequate room for a new route due to the nearby stream bank. If a trail was to be placed on or near the bank, it would surely cause severe damage to the stability of the bank and a collapse would be imminet. A switchback is also not possible due to the trail being the most narrow at the locations of most extreme erosion, along with the previous reasoning.

The first drainage ditch was marked for being between the 12th and 13th steps, with the second 45′6″ from the topmost step with the water bar incorporated into it. All three of the strategic steps were planned for the area above the 20th step. The first strategic step was planned for 13′2″ away from the end of the stair case, and the second strategic step 12′ from the first. 49′3″ uphill from the end of the stairs is the last strategic step. All of the strategic steps will work together to slow down the water before it can reach the ditches. 29′6′ from the bottom most step there lies a fallen tree that has been determined to be beneficial to the trail because it acts as a natural water bar that would slow down any remaining runoff after treatment. The area where the lowermost drainage ditch was to be placed was cleared of debris and *Toxicodendron diversilobum*, otherwise known as poison oak, by the end of the first day. On the next day the land managers and land stewards dug out the lower ditch to a length of 24′. Once that was completed the group cleared the area for the second ditch and dug the ditch out to a length of 31′. Materials used for the treatment included loppers, McLeods, pick-mattocks, and bow saws.

Conclusion

This project is still in progress at the preserves. At this point in time both of the drainage ditches have been dug out, with materials added to them to further slow down the water. River rocks line bottom most portion of the lower ditch. Woody debris has been placed at an angle in the bottom of the upper ditch to further guide the water away from the trail. When viewed frim the bottom of the trail a visitor would not be able to see th editches until they are right next to them. The stairs have yet to be replaced , and th estrategic steps have not been added. Unfortunately there has not been a rain event since the ditches were constructed to see if they are functioning as planned.

Acknowledgements

I would like to thank Suzann DeCoursey, Vanessa Fonti, Megan Gaitan, Maya Hoholick, Jeff Johnson, Marissa Merrigan, and Max Polkabla for helping me collect data, create a viable treatment plan and offering their time to work on the trail with me.