Changing vegetation and points of erosion over time in the Cannon Valley Wilderness Park

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Introduction to Geology

Introduction

This paper will document our investigation into the changing vegetation and points of erosion over time in the Cannon Valley Wilderness Park. The methods used will be a variety of aerial photos and interpretations of ground photos. We studied aerial photos of the area from past years and also took our own aerial photos during the fall of 2005. GPS units were used to pinpoint significant locations in the park and to get a general idea of the present day topography of the area. Photos were also taken, using digital cameras, of these significant locations so that those in the future may compare them with the actual site. The ultimate purpose of this study is to provide a base for future Carleton geologists to continue in the study of erosion and change in the park. Even in our few short weeks of examining the streambed, we noticed that the nick points had migrated each time. This occurred even when little rainfall had reached the area. It will be exciting to see what sort of changes ensue over a period of years.

Comparison of Old and New Aerial Photos

Two aerial photos taken on April 11, 1938 were compared to the photos taken this year in November 2005. Ground photos chronicling the nick points and their locations along with documentation of erosion were coupled with the aerial photos along with a topographic map. By combining the evidence we hoped to draw tentative conclusions about the change over time in the Cannon River Wilderness Valley.

The photos taken in 1938 were taken from a much higher altitude and therefore are much less detailed than the recent photos. It is difficult to discern the exact

topography of the area considering the earlier aerial photos are not focused directly on the Cannon River Valley and the pictures that were taken at present are partially obscured due to vegetation and dead leaves. There is a sloping down into the riverbed that the Cannon feeds into when it is overflowing, and one can assume that the erosion and sloping implied in the dark shadows are more eroded and deeper than the earlier photos. Comparing the topographic map (Figure 1) provided by the Carleton College Geology Department, we can see the changes in that the nick points have migrated and there is increased depth in the valley.

Over time, nick points have migrated, and gullies and drainage basins have increased in depth. Compared to the topographic map, they are much deeper now than in 1938. Coupling the aerial photos with ground photos we can clearly see a visible change in the erosion and increasing depth in the drainage basin. This projects hopes to be able to document the features of the Cannon River Wilderness Valley and serve as a foundation for other geologists to measure change in the future.

New Aerial Photos

While looking at the Cannon River Wilderness Valley our group realized how indispensable aerial photos of the area would be. By taking current aerial photos we would be able to get a better idea of the topography as well as compare the area to aerial photos taken during the 1930's. We contacted Carleton senior Mara Morgenstern, a philosophy major and a commercial pilot as well. Mara has been flying since she was sixteen and often flies students and faculty above the Carleton campus. So on Tuesday, October 1st Mara, Bereket, and Hannah drove out to the Stanton Airfield armed with a

digital camera and just a few butterflies. Before taking off, Mara did a thorough check of the Cessna 172 airplane (see Figure 2) we would be flying in. Mara took off with ease, and before long, the only thing to be seen was the breathtaking view from above. The plane circled the Cannon River Wilderness Valley about five times between 500 and 1000 feet above ground level so we could get pictures from a variety of different angles. Landing went just as smoothly as takeoff and Mara maintained her status of being one of the best pilots, having an equal number of takeoffs as landings.

Back in the lab our group analyzed the aerial photos taken. From the photos, you can see the steep decline of the valley that slopes towards the riverbed. In the left corner of Figure 3 this decline is especially noticeable. In Figure 4 we can see where the riverbed and valley meet the Cannon River. Before reaching the Cannon, a small dip in elevation is noticeable. In all of the photos we also noticed that the trees are angled slightly inward, sloping towards the middle of the valley. Because it was fall when we took the photos, the trees were full of colorful leaves. Although this makes for beautiful pictures, it makes seeing the topography of the area extremely difficult. Because of this, we can only draw a few basic interpretations from the pictures. Our group also has plans to go up in the air again sometime next week when more of the leaves will probably have fallen off.

Discussion

Figure 5 is a picture of the first nick-point after which the stream bed becomes narrow and deep. Until this spot, the stream has been a small dent in the gulley, but here

is where it becomes difficult to climb out of. As this point is continually washed over with each rainfall, the dirt will be washed away and the stream will grow deeper farther downstream. This point is at UTM: 15T 0484541-4914509, and a second reading of 15T 0484577-4914495.

Figure 6, though not readily visible, is a picture is of a place in the streambed where there was once a wider shallower area, but now the water has now cut a smaller channel through it. The upper ledge has not seen any erosion or disturbances in a while, and so has become overgrown with foliage. It may happen that in the future heavy rains lead the stream to grow and return the small channel that holds the current drainage, to the size it must once have had from the presence of this site. UTM: 15T 0484509-4914532.

The trees in Figure 7 appear to have fallen relatively recently. Some evidence of this is that there is a considerable amount of dirt still attached to the roots. It's most likely that the tree's root system held the bank together while water flowing around it eroded the support away until they fell in the direction that was weakest (i.e. where the water flow was heaviest, directly parallel to the stream). We believe other trees along the bed, such as those seen in Figures six and seven, will eventually fall much as these ones did. GPS Location: UTM 15T 0484597-4914497 and 15T 0484507-4914501

Figure 8 shows the point at which another streambed intersects with the major one that we followed. Where the person in the picture is standing is the tip of the land that juts into the intersection. The sides of the banks are both rather steep at this particular stretch of the bed. This means that the composition of the soil in this area is more easily eroded than in other areas where the bed is very shallow. According to the GPS units

used to pinpoint the location of this intersection, the coordinates are UTM 15T 0484461-4914566.

Figure 9 is a photo of another nick point or a point where there exists a difference in the degree of erosion. At this nick point, the bed of the stream suddenly becomes deeper. This could show that the composition of the soil in the area above the nick point is slightly more difficult to erode than that of the area below where the water has been able to more easily erode away the soil. Figure 10 shows the nick point from another angle, looking at it from the more eroded side of the streambed. A helpful way to measure erosion or change in an area is to monitor its nick points. Even in the few weeks that we have been studying the area, we have noticed that this particularly nick point is considerably changed. It is even more eroded than before. The GPS coordinate for this nick point are UTM 15T 0484276-4914543

Figures 11 and 12 are of trees and their roots that are in the line of erosion of the stream bed. The trees are located approximately across the bed from each other at the GPS location of UTM 15T 0484424-4914514. It can easily be said that they will soon end up like those trees in Figure 7. These trees provide another obvious way, other than nick points of measuring the degree of erosion in a specific area. It will be interesting to see how long it takes for the trees to completely topple over. The same case is true for several of the trees that line this bed. At the rate of erosion that seems to be occurring, some of them will not remain upright for much longer.

Conclusion

Both the photographic and written documentation taken during this study are meant to provide a starting point for future monitoring of the erosion in the Cannon River Wilderness Park. Because we had no real photos besides aerial photos taken over 70 years ago, we had to start from scratch with our own research and photographic documentation. From our aerial and ground photos we can determine that continuous erosion is occurring in the drainage basin of the Cannon River Valley Wilderness Park as is evidenced by the observed changes in nick points, increasing depth of some areas as well as alterations in the condition of vegetation. We hope that our research and photos will serve as a foundation for future investigations.

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12