Analysis of the Cripple Creek Restoration Project

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Description:

By documenting and analyzing data relating to the failure, reevaluation, and eventual success of the Cripple Creek Restoration Project, we aim to be able to apply the successful project plan to future watershed restoration projects in the arctic, particularly to habitats that are prioritized as fish passageways and spawning grounds.

Abstract:

The Cripple Creek restoration project was implemented with the intention to restore flow into the original Cripple Creek channel and prioritize the restoration of Chinook salmon habitat. After six years of research and construction, the newly established flow within the original creek-bed washed out the spillways during the spring melt in 2021, resulting in a failure to restore the original creek's flow. Engineering plans are currently in motion to reevaluate the project and implement new and improved infrastructure to the drain. As this is the first project of its nature in the subarctic to install a potential dam to focus on fish habitat and passage, documentation and analysis of this project is crucial to future projects within Alaska. By using GLOBE Observer Landcover App to document the extent of land disturbance and the fall 2021 freeze-up process that occurred within this project , we aim to improve future projects by analyzing contributing factors and preventing the same mistakes. In studying the original failure and eventual success of the Cripple Creek restoration project, we can implement the successful measures in other fish-centered hydrology restoration projects across the Arctic and subarctic.

Research Questions:

-Why did the original restoration of the Cripple Creek fail?

-What can be done differently in order to have a successful second restoration?

-Can the techniques used within the Cripple Creek project [eventually] be applied successfully to other restoration efforts?

Introduction and review of the literature:

In 1935, due to gold mining operations, Cripple Creek was rerouted and bypassed to an artificial drain to carry away the waste products of the hydraulic operation [4]. The original channel was a major spawning and rearing ground for an array of freshwater life including the Chinook Salmon, and when it was diverted a major loss of habitat and wildlife occurred [2]. After successfully adding fish passage culverts, the reconnection to the original channel was attempted in fall, 2020. In 2021, after the spring wash-out of the restored channel bank, the Interior Alaska Land Trust, along with the U.S. Fish and Wildlife, DOWL Engineering, and Herrera Environmental Consultants, are still in the process of attempting to reconnect the original channel in order to improve Chinook spawning habitat within Chena RiverWatershed.

While some project partners consider ice to be a factor, it is possible that erosion had a detrimental effect on the attempted channel reconnection. A lack of vegetative cover on the blocks and spillways, and the force of ice flow during and streamflow after spring thaw, likely caused deterioration of the channel banks and resulted in a failure of the restoration [3]. Revisions are being made to the engineering plans. Thus, analysis of the reconnection failure and current channel will prove useful in the engineering design process and beyond. With the loss of the original waterway, the species and local communities alike suffered as fish spawning tapered off. The increase of industrial development within the subarctic has severe effects downstream, consequences that were unknown to miners and developers within the 19th century. The Cripple Creek Restoration, if proven successful, provides an opportunity for other fish habitats that were affected by mining development to be efficiently rehabilitated within the Arctic.

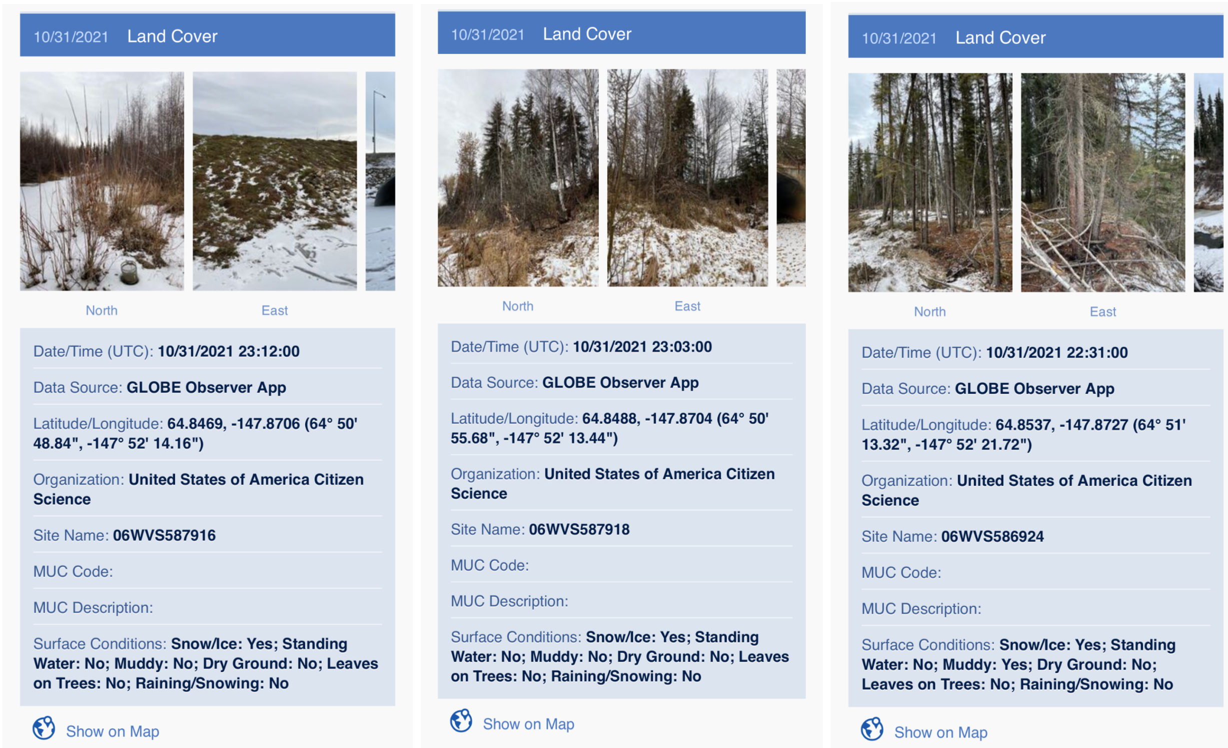
Research Methods:

For this project, we reviewed the original plans and data of the Cripple Creek restoration. We collected our own data to see how the landscape has changed, and came up with our own plans for how we think the restoration project should have gone. Our study site has focused mainly on Happy Creek, the creek that connects with Cripple Creek. We went out to the site several times over the span of two months and collected GLOBE land cover observations. There is severe bank erosion, and the groundwater flow has been disrupted by poor construction practices and erosion by the creek's flow. We calculated how far the bank eroded by calculating the slope before and after the construction occurred. After analyzing our data, we applied our knowledge of watershed management to decide the best way this project should have been conducted, and what the best way to move forward would be. Using the data we collected, the data provided by the construction company and Mitch Osborne, and previous data of Cripple Creek, we have determined how adversely this environment has been affected.

The picture below shows the full Cripple Creek restoration project. The block with the letter "H" is where we conducted most of our research. That is where the confluence of Happy Creek and Cripple Creek is, and that is where the failure occurred. There are spruce and birch trees in this area, and on the bank of the creek there are grasses and other low vegetation. After construction, there is a large area of demolished trees on the north side of the creek. The land that the construction has taken place on is located on the ancestral lands of the Dena people from the Lower Tanana river.


RESTORE
DAMAGED WETLANDS
PARKING/STAGING AREA
SEE NOTE
EQUIPMENT ACCESS
ROUTE
RE-VEGETATE DISTURBED AREAS
PROTECT SIGN
10
9
C
H
HISTORIC CRIPPLE CREEK
HISTORIC HAPPY CREEK
CHENA PUMP DITCH

GLOBE Landcover Observations:

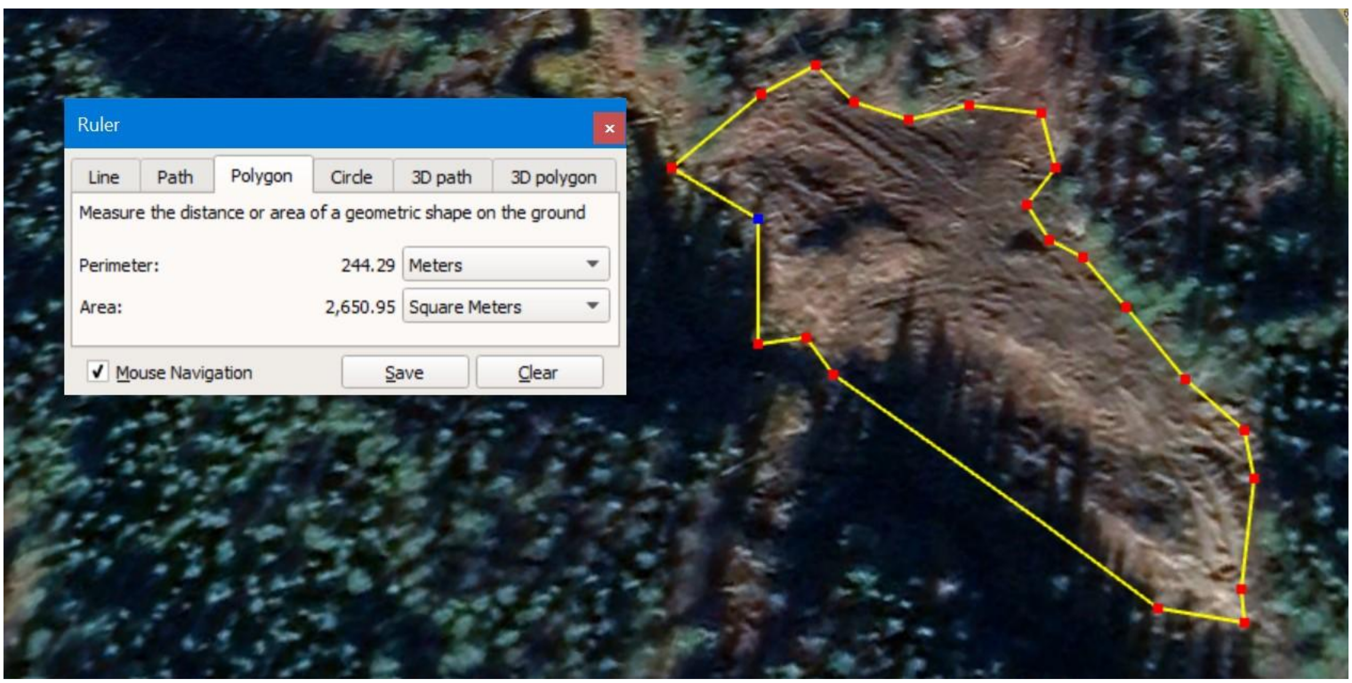


Results:

While analysis was done on the information we currently have, the research is still ongoing. When taking land cover observations at the site, it was noticed that the entire bank had washed away from the flood event causing geotech fabric to become exposed. We found through comparing the bank's slope (at block H) from before the failure to afterwards, the slope went from 22° to 90°. After the reconnection, the creek was 15-20 feet deep. Now, it is only 2-3 feet deep. The site was also cleared of vegetation during construction and there was no sign of regrowth when we visited the site months later.

Discussion:

We believe the erosion of the blocks and bank ultimately caused the failure. The streamflow was too fast and cut into the infrastructure. The clearing of land for machinery access is expected to have weakened the bank's stability, causing mass wasting to begin off of the geotech fabric. They cleared roughly 2,650 square meters, shown in the picture below. Due to the type of fabric used to stabilize the bank, the soil didn't have any support to regrow vegetation. Also, as this is a type of slip fabric, it was easy for the soil to continue to 'slip' down the slope and into the drain channel. Evidence of springtime failure of geotextile fabric has been documented. This sediment quickly builds up and can cause a disturbance in the channel's flow and habitat ability. Currently, it is assumed that the weakening of the bank and the erosion of the blocks due to ice build up during spring melt is the reason for the restoration's failure. It is these elements that the engineers are in the process of fixing in order to apply the science to their new, updated plan.



For this project, we think we qualify for the collaborator badge. All of us: Maggie House, Susan Glade, and Rachel Allen, worked together to make this project what it is today. We all collaborated equally, and brought unique ideas to the table.Without this collaboration, there wouldn't have been as many GLOBE observations, as much correspondence with our mentors, and the quality of work would not be as high as it is.

Conclusion:

The blocks failed as a result of removing vegetation from the banks of the creek and trying to redirect flow almost 90° and uphill. There was a spillway created incase of flooding. It was supposed to be successful over a 100 year period, but it failed after two months. As of right now, there is work being done to build a dam where the H block used to be. This could be successful at first, however dams only work for a certain amount of years and there is currently no fish infrastructure being built. There is also no guarantee that this dam won't fail the same way that the blocks failed. A better solution would be to build up the banks along Happy and Cripple Creek to redirect flow that way. This would have better long term success without adversely affecting salmon habitats. In this project, we had multiple mentors. Christi Buffington is our teacher for Introduction to Watershed Management, and she helped us throughout the process of this project. She is also the one that introduced us to GLOBE. During our time of research, we met with Mitch Osborne, Peder Nelson, and Chris Arp. All three of these professionals gave us important information and helpful advice.

Citations:

1. Interior Alaska Land Trust. (2021, March 2). *Cripple Creek Restoration Project*. Interior Alaska Land Trust | Conserving land north of the Alaska Range for the benefit of the community. Retrieved December 3, 2021, from https://interioraklandtrust.org/land-and-projects/cripple-creek-restoration-project/.
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3. Osborne, Mitch. Personal communications.
4. Hudson Institute of Minerology . (n.d.). *Cripple Creek Mine, Fairbanks District, Fairbanks North Star Borough, Alaska, USA*. mindat.org. Retrieved December 3, 2021, from https://www.mindat.org/locchem-197090.html.
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