Flood Impacts and Risk Assessment of Pleasant Creek in Capitol Reef National Park

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Introduction

- On average, floods are the deadliest natural disaster in the United States, and it is timely and expensive to manage the damage caused (Meko 2019; NOAA 2021).
- Due to the remote nature of Capitol Reef National Park (CRNP), there has been little research on the impacts of flash floods, leading to a lack of hazard maps to warn park visitors and the local communities.
- The goal of this study is to quantify the geomorphic impacts of flooding in the remote, semi-arid landscape of CRNP to better understand the effect flood seasons have in the region and, thus, to apply the findings to areas where people are at risk.

1. **What are the geomorphic impacts of a flash flood season on the area surrounding Pleasant Creek?**
   - What channel changes occur?
   - How does it differ from year-to-year time?
   - Where do erosion and deposition occur?

Study Site

Methods

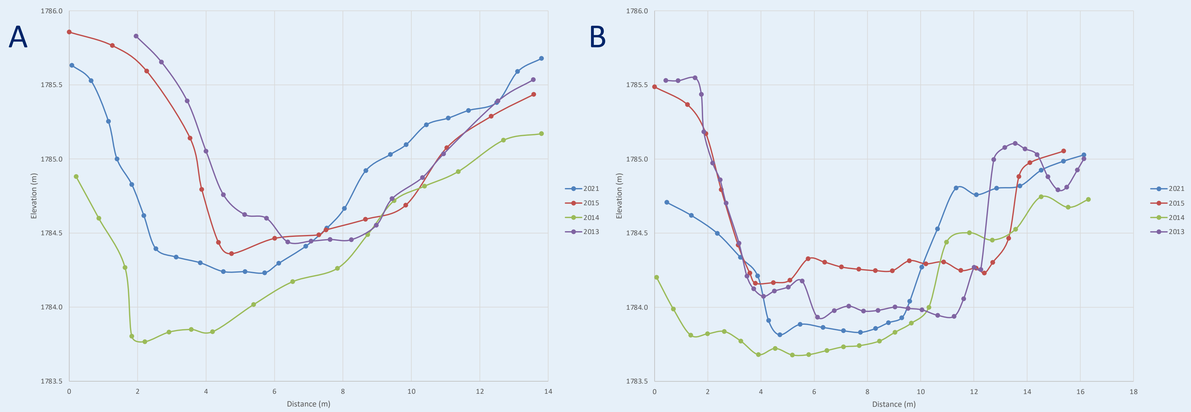
Field Work

- GPS points
- Gravel count
- Grab samples
- High-resolution images

Lab Work

- Online Positioning User Service (OPUS)
- Agisoft Metashape
- ArcGIS
- Raster math

Results: Channel Changes



Figures 1a, b, c. Cross sections for 2013, 2014, 2015, 2021 at sites A, B, and C.

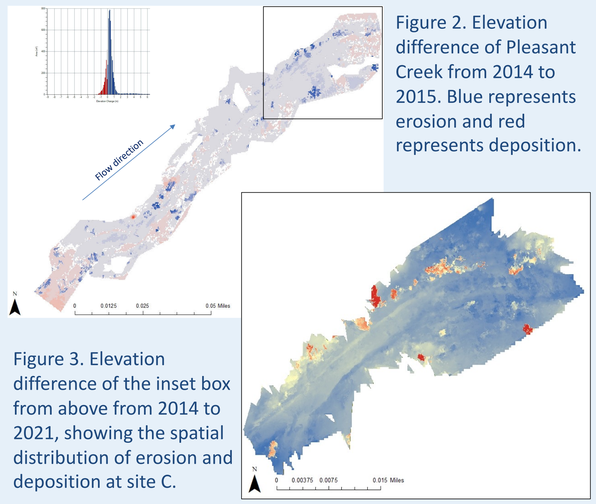


Figure 2. Elevation difference of Pleasant Creek from 2014 to 2015. Blue represents erosion and red represents deposition.

Figure 3. Elevation difference of the inset box from above from 2014 to 2021, showing the spatial distribution of erosion and deposition at site C.

Results: Discharge

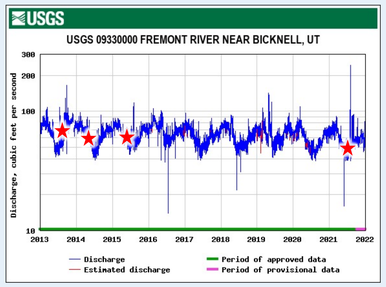


Figure 4. Discharge data of Fremont River for 2013 through 2021.

Table 1. Average and peak discharge of Fremont River

Average Flow	**55 cfs**
Peak Flow	**90 to 250 cfs**

Table 2. Discharge at sites A, B, C.

Site A	**6.71 cfs**
Site B	**4.59 cfs**
Site C	**5.65 cfs**

Results: Gravel Size

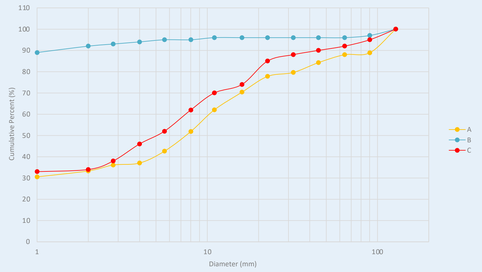


Figure 5. Cumulative percent curve for 2021 at sites A, B, and C.

Table 3. D16, D50, D84 gravel size and sorting of sites A, B, and C.

Site	D16	D50	D84	Sorting
A	< 2	8	45	Extremely poorly sorted
B	< 2	< 2	< 2	Moderately sorted
C	< 2	5.6	22.6	Extremely poorly sorted

Conclusions

- D50 grain sizes and sorting values reflect the geography and hydrology of the site—with site B broader area and slower velocity flow.
- Cross-section data shows 2013-2014 flood season to have the greatest erosion at each site (Figure 1).
- Elevation difference of 2014-2015 flood season shows the channel aggrading overall (Figure 2).
- Elevation difference over 6 years (2014-2021) at site C illustrates greater aggradation than erosion (Figure 3).
- Cross sections vary between flood seasons, but over the study period appear to return to a similar elevation and shape (Figure 1) (Parker 1995).
- Pleasant Creek system experiences varying degrees of flooding every year (Figure 4).

Future Work

- Apply findings to map the range of possible flood extent and identify areas of risk to people
- Create hazard map for Capitol Reef National Park and other parks in Southern Utah
- Further explore data collected in 2021

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