Apr 26th, 4:00 PM - 4:30 PM

# Influence of lithology on erosion along the Dungeness Bluffs

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# Influence of Lithology on Erosion Along the Dungeness Bluffs

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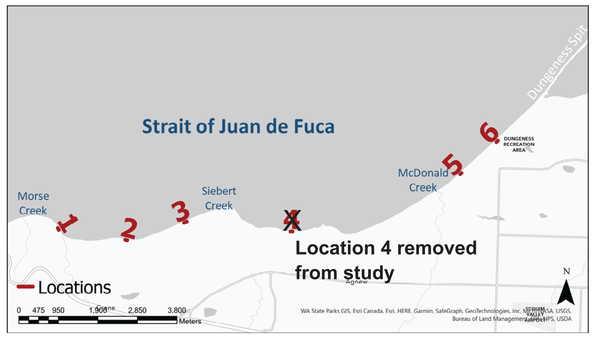
## Introduction

The Dungeness Bluffs in Clallam County, Washington are receding. Bluff retreat is a cause of concern for many land owners living nearby, and is a crucial process in maintaining a healthy beach habitat for species such as forage fish[1].

In this study, we difference point clouds derived from boat-based LiDAR and structure-from-motion (SfM) to calculate bluff retreat and use field methods to map and characterize bluffs at five selected sites. This study aims to understand how lithology influences bluff erosion.




## Methods

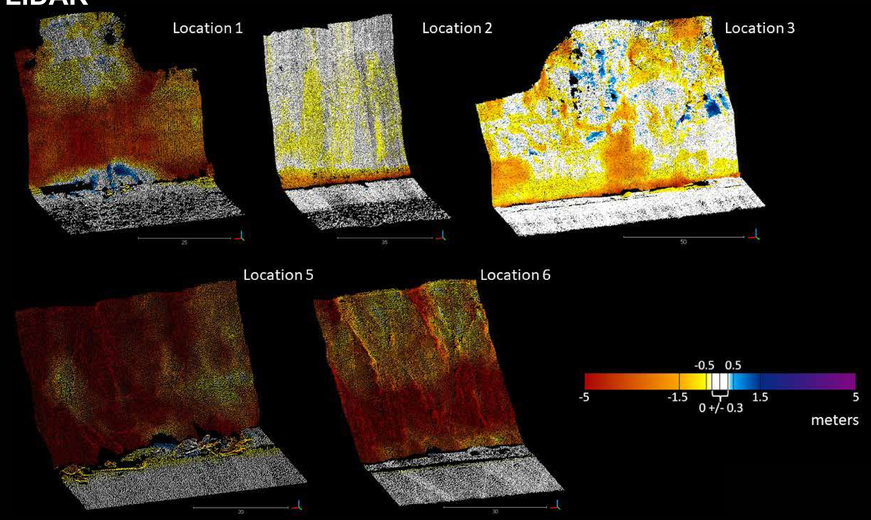
1) Collect data:
   - Boat-based LiDAR
   - Drone-based images for SfM
2) Map and describe existing geologic units at sites.
3) Use M3C2 tool from CloudCompare to difference point clouds.
4) Use CloudCompare, field observations, and SfM model to segment differenced cloud results by geologic units.
5) Calculate retreat rates of geologic units using long-term differencing model.

## Reference

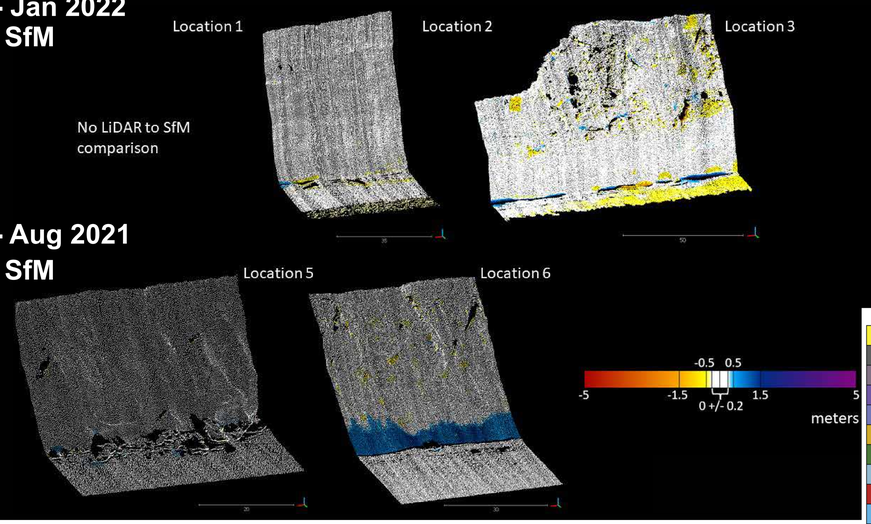
[1]Parks, D., Shaffer, A., and Barry, D., 2013, Nearshore drift-cell sediment processes and ecological function for forage fish : Implications for ecological restoration of impaired Pacific Northwest marine ecosystems: Coastal Education & Research Foundation, Inc., v. 29, p. 984-997.

## Point Cloud Differencing Results

**June 2015 - May 2021**
**LiDAR vs LiDAR**




**May 2021 - Jan 2022**
**LiDAR vs SfM**



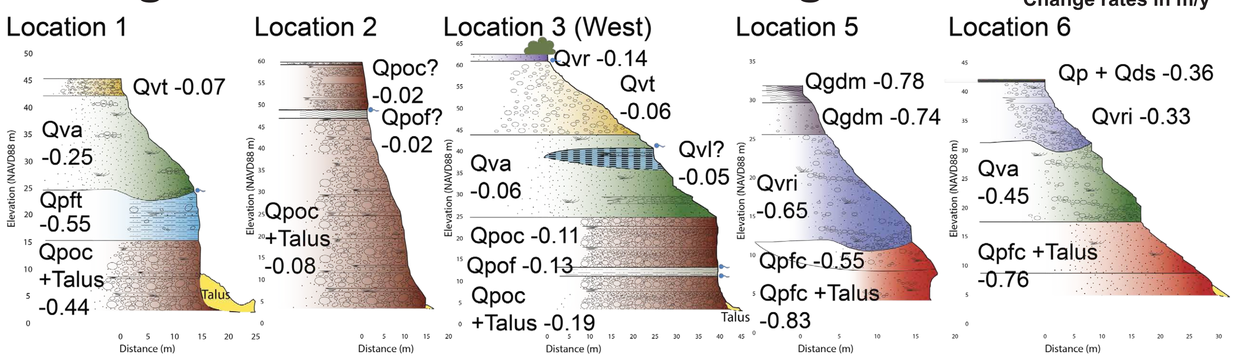

**May 2021 - Aug 2021**
**LiDAR vs SfM**

| Symbol | Unit name |
|---|---|
| Qds | Dune sand deposits |
| Qp | Organic-rich deposits |
| Qgdm | Glaciomarine drift deposits |
| Qvr | Vashion recessional outwash deposits |
| Qvri | Vashion recessional ice-contact deposits |
| Qvt | Vashon till deposits |
| Qva | Vashion advance outwash deposits |
| Qvl | Vashion lake deposits |
| Qpfc | Pre-Fraser coarse-grained deposits |
| Qpft | Pre-Fraser till deposits |
| Qpof | Pre-Olympia fine-grained deposits |
| Qpoc | Pre-Olympia coarse-grained deposits |

Spring

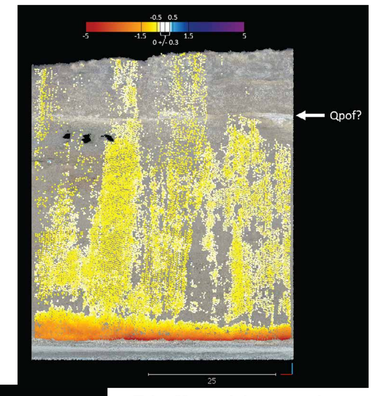
## Geologic Cross Sections and Change Rates

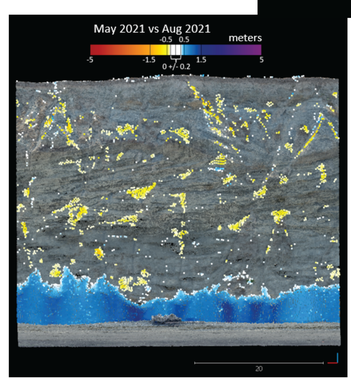
*Change rates in m/y




## Key Findings

- Most of the bluff erosion generally occurs along the lower bluff area, which could be a result of waves.
- Units with larger grain sizes experience less erosion.
- Bluffs that have more compacted materials along the bluff toe experience less erosion.
- Springs and surface water runoff may be increasing bluff erosion.




- Bluffs with weak to no cementation experience dry raveling along rills and bedding planes between spring and summer.

## Conclusion

Our results show that lithology can influence bluff erosion. Therefore, more detailed geologic studies along bluffs should be done.

## Acknowledgments

Thank you to:
- Ruth Jenkins and Green Point Foundation for providing beach access.
- Heather Weiner, Hannah Drummond, Diana McCandless for helpiing with LiDAR data collection.
- Teresa Di Leonardo, Kalpana Prasad, Monica Hill for field assistance.
- Steven Walters for helpful feedback.

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