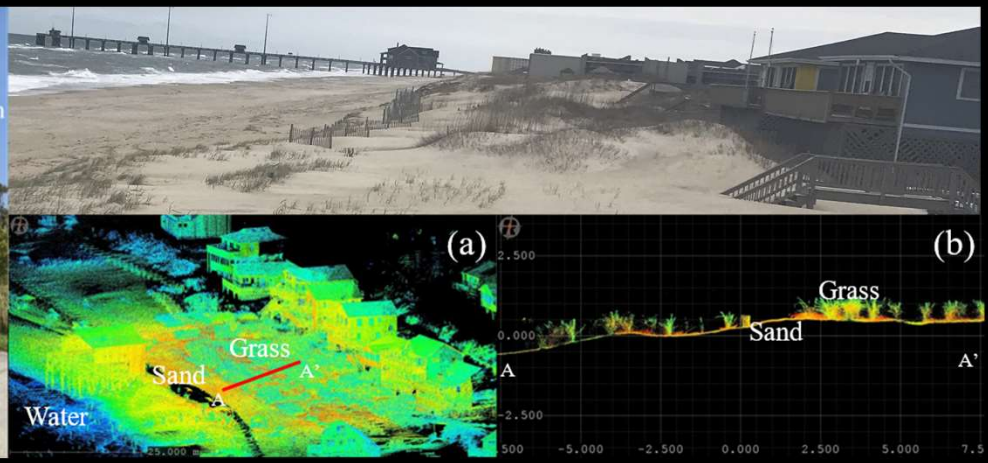
Project: Using lidar to assess impacts of dune restoration on coastal resilience in North Carolina



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Time (EDT)	Title	Presenter(s)
10:00am – 10:20am **20 min**	Welcome and introduction	All
10:20am – 10:50am **30 min**	Project overview	Lin Xiong
10:50am – 11:00am **10 min**	Lidar demonstration	Lin Xiong
11:00am – 11:10am **10 min**	Break	
11:10am – 11:30am **20 min**	Beach nourishment projects	David M. Ryan
11:30am – 11:50am **20 min**	BBOBX overview	Phil Delpierre
11:50am – 12:10am **20 min**	Questions and comments	All
12:10am – 1:00pm **50 min**	Group photo and lunch	All

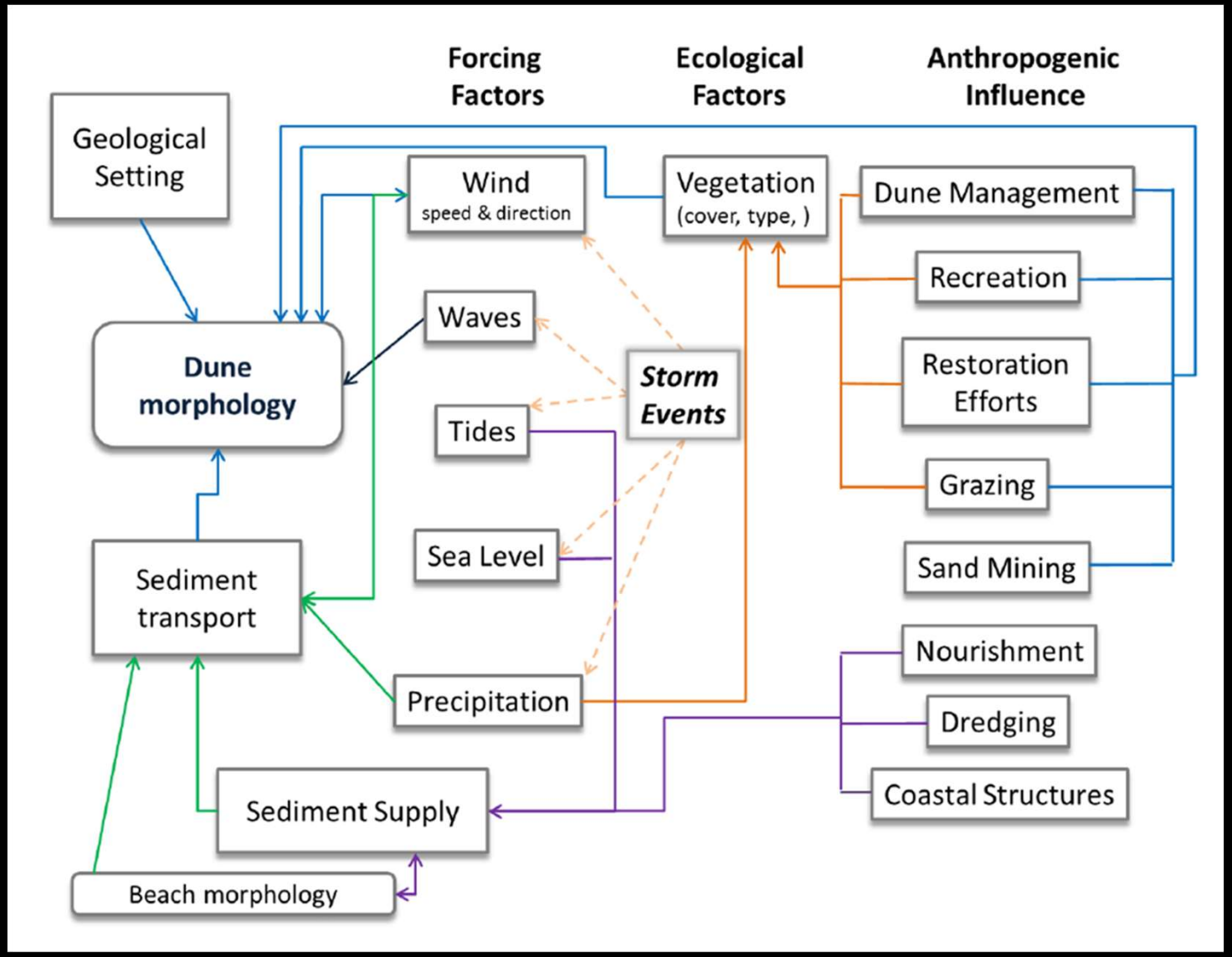
Outline

- Background
- Goals and objectives
- Method
- Expected outcomes
- Project plan
- Preliminary result

Background

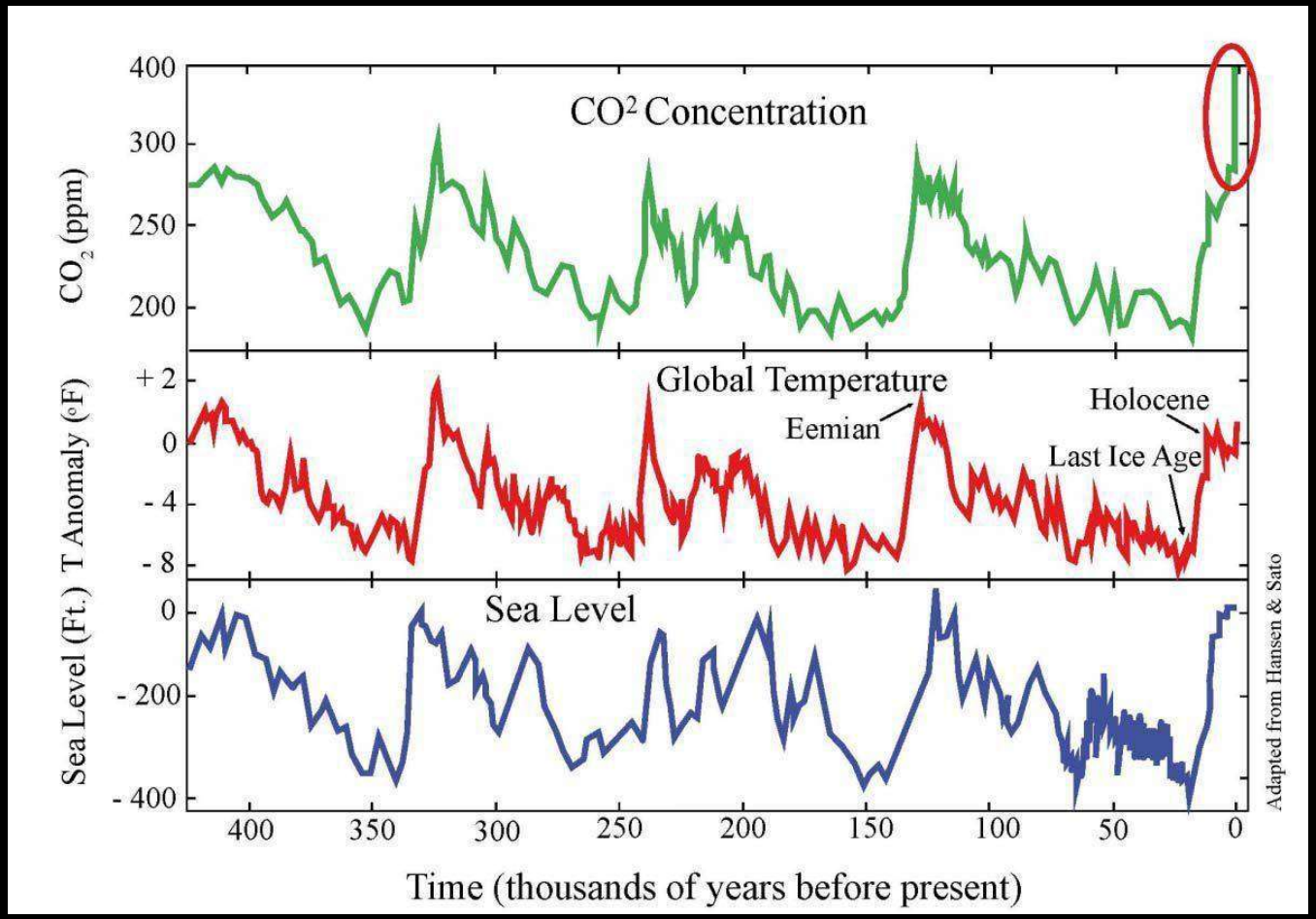
- Coastal beaches and dunes are natural barriers at low-lying coastal margins (Barbier et al., 2011).
- They can reduce flood and protect communities.
- In OBX, these ecosystems support millions of annual visitors and a 2.3-billion-dollar tourism industry.

Drone photo over Nags Head, 2022. Source: https://www.youtube.com/c/4KVin



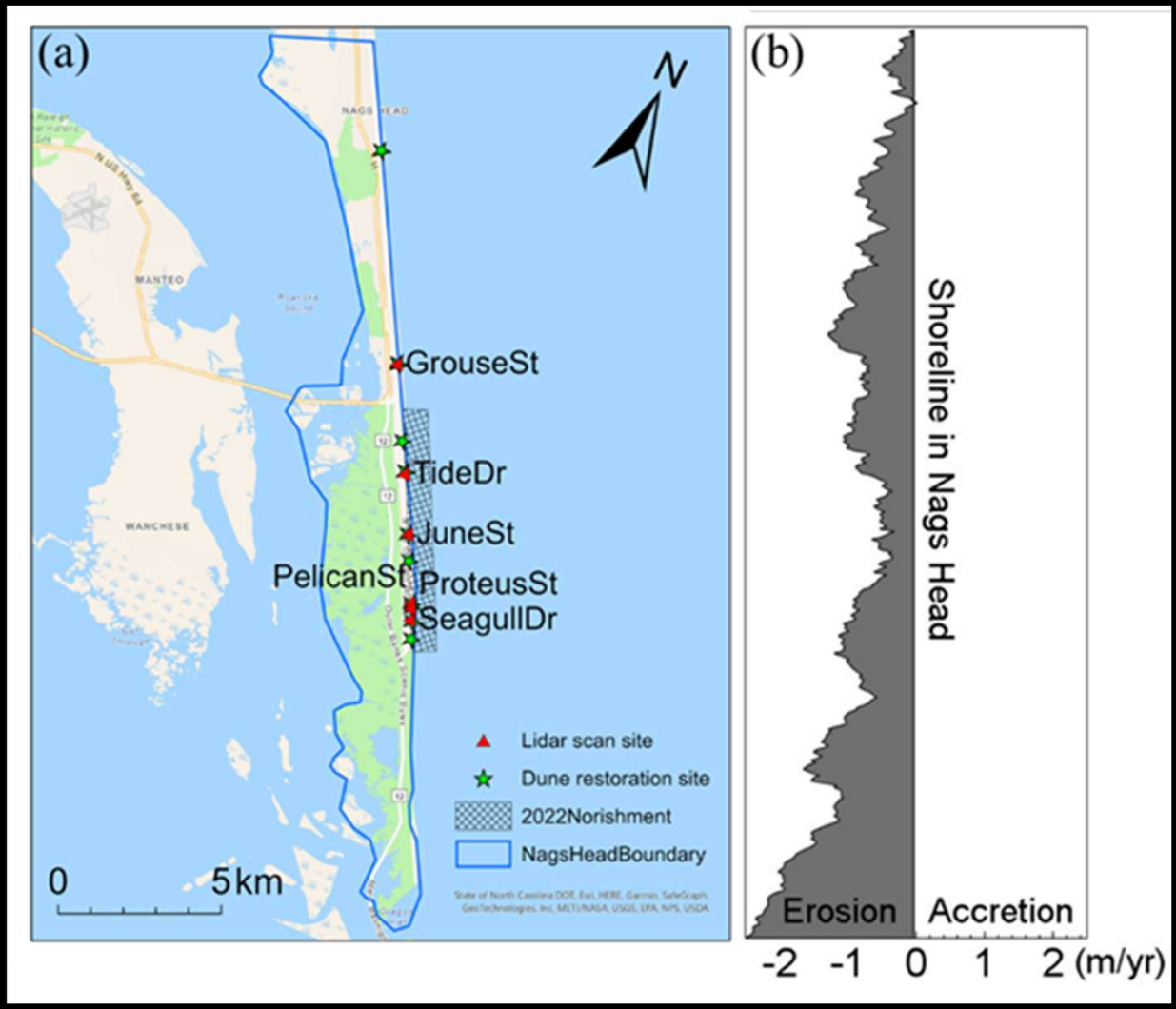
(Del Angel, 2012)

CO2, Temperature, and Sea Level

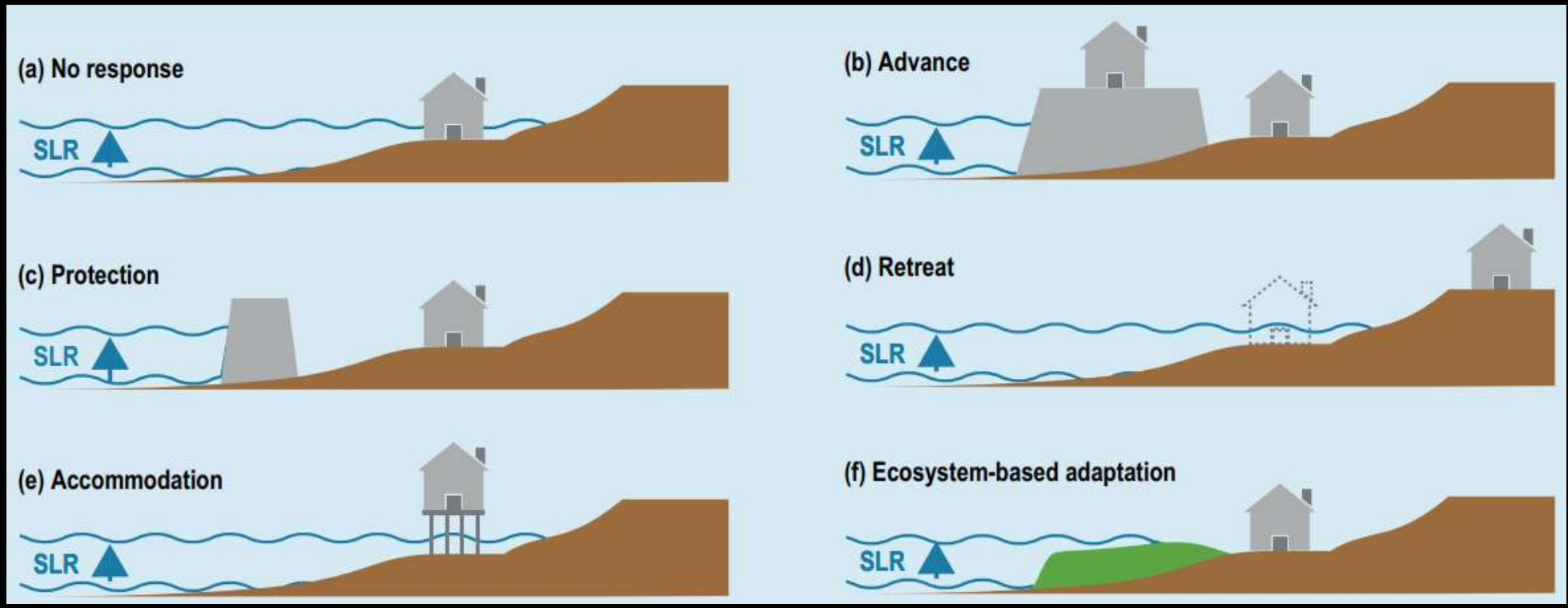


Coastal erosion in Nags Head

- Nags Head is a town in the OBX and sits on a barrier island system that stretches 17 miles separating the sounds from the Atlantic Ocean.
- The town has the largest sand dune system along the US east coast (Mitasova et al., 2005) but has sustained significant erosion over the past 50 years leading to economic damage (Kaczkowski et al., 2018).
- The average shoreline erosion rate from 1949 to 2016 in Nags Head was 0.9 m yr^{-1} with a maximum value of 2.5 m yr^{-1} (NC Division of Coastal Management, 2019).



Different types of responses to coastal risk and sea level rise (SLR)



IPCC report, 2019, Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities.
https://www.ipcc.ch/site/assets/uploads/sites/3/2019/12/SROCC_FullReport_FINAL.pdf

Goals and objectives

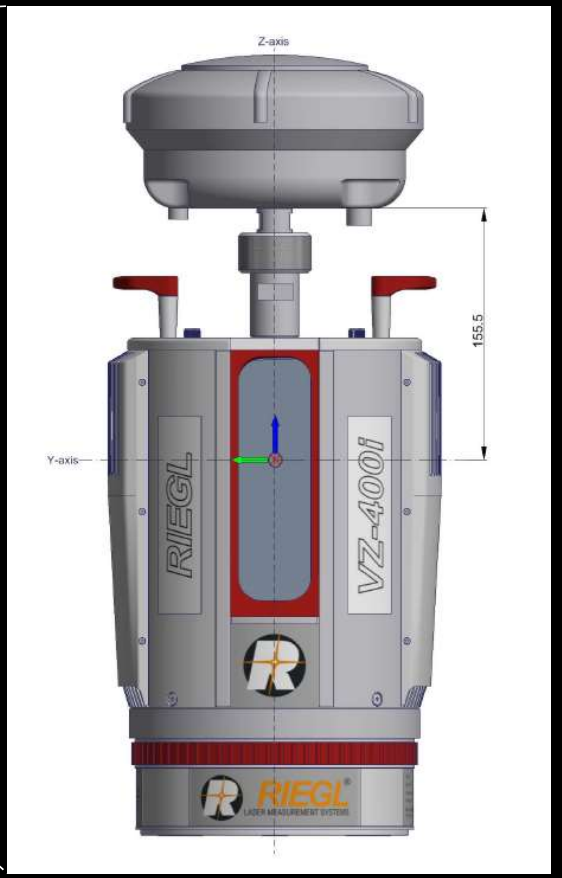
1) Quantify beach and dune dynamics at dune stabilization sites (e.g., dune grass, Christmas trees, sand fences, control)

2) Present findings and recommendations to BBOBX and Town of Nags Head

Nags Head Beach Restoration Project, July 2022

Grass planting by BBOBX, March 2022

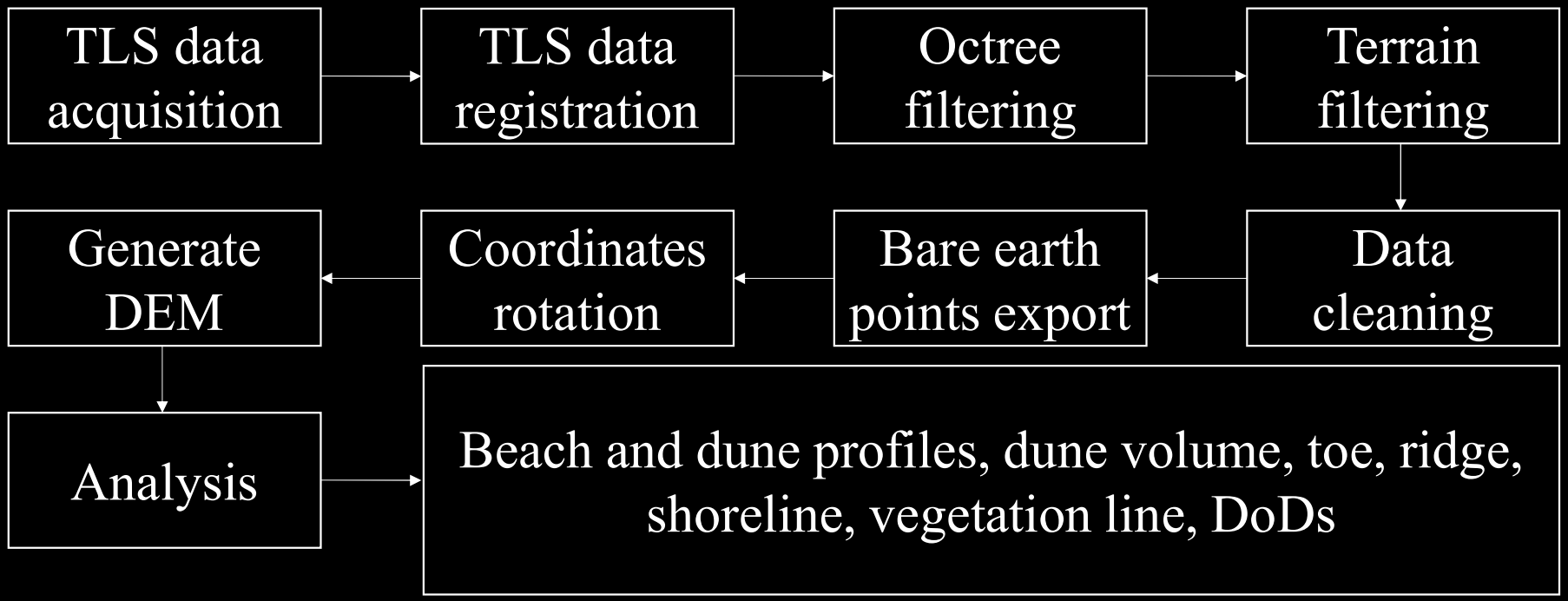
Method (Coastal Laser Scanner System)



TLS introduction

https://www.youtube.com/watch?v=1L4XpR97BRQ&t=149s

Workflow for TLS data processing



(Xiong et al., 2017; Zhou et al., 2017)

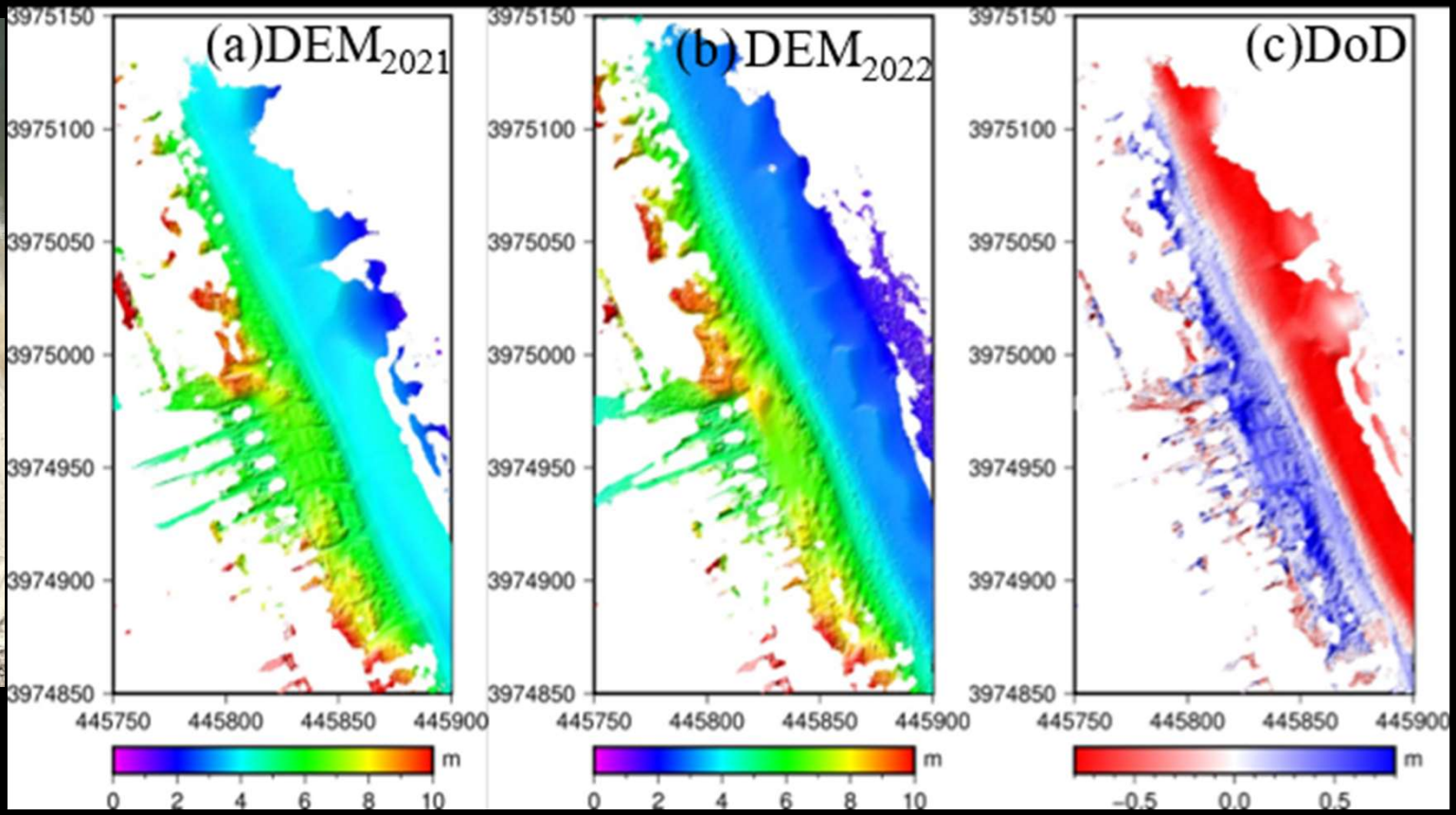
Expected results in the final report

1) lidar point cloud data of coastal beach and dunes in LAS format,
2) data processing codes that will be openly shared in GitHub,
3) high-resolution (10 cm × 10 cm) and high-accuracy (~2 cm) Digital Elevation Models (DEMs) and Difference of DEMs (DoDs) before and after restoration,
4) changes in dune toe, ridge, volume, shoreline and vegetation,
5) interactive webmaps using Google Earth Engine Apps to share results for stakeholders and the community,
6) recommendations for future dune restoration management

Lidar data collection plan

Street name	Grass planting	Lat	Lon	Previous lidar scan	Tentative dates to scan	
				Aug-21	Oct-22	Feb-23
E Hollowell St	2020	35.96879037	-75.62949172	×	✓	✓
Grouse St	NA	35.91764384	-75.60046747	✓	✓	✓
E Hardgrove St	2018	35.89866694	-75.59046745	×	✓	✓
E Tides Dr	2020	35.8912571	-75.58598779	✓	✓	✓
E June St	2016	35.87594669	-75.57819969	×	✓	✓
Juncos St	2018	35.86953018	-75.57482149	×	✓	✓
E Pelican St	2020	35.85909248	-75.56929812	✓	✓	✓
E Proteus Ct	2020	35.85808069	-75.56867672	✓	✓	✓
E Seagull Dr	2020	35.85463535	-75.56706868	✓	✓	✓
10333A S Old Oregon Inlet Rd	NA	35.85018377	-75.56521494	×	✓	✓

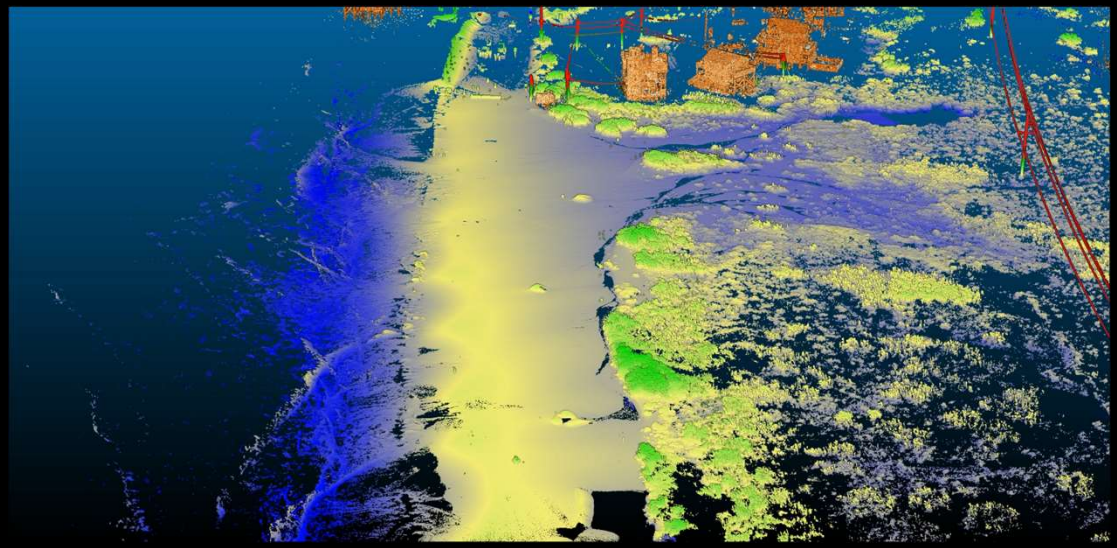
DEMs and DoD of beach and dunes



- Location: Grouse Street, Nags Head, Time: August 2021 and March 2022

Washover area in Mirlo Beach

Drone photo from NBC news
(www.nbcnews.com, 10/07/2022)



https://www.youtube.com/watch?v=UmqcRLaEmww


Questions & comments?