ASSESSING SEASONAL VARIATIONS OF SEAGRASS EXTENT IN THE PORT PHILLIP BAY USING SATELLITE IMAGERY

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Motivation:

Seagrass meadows are vitally important for the stability and overall heath of the ocean system and its inhabitants [1]. Ranging from carbon sequestration to being an integral part of the coastal food web. Rates of decline have accelerated from a median 0.9% per year before 1940 to 7% per year since 1990.[2] These rates of loss combined with their fragility and slow regrowth make seagrass meadows among the most threatened ecosystems on earth.[2]

To better manage these fragile ecosystems is it important to understand their growth/decline over time and the possible influences of change. Previous studies have utilized high-resolution aerial imagery which is costly, time consuming and cannot provide the temporal resolution to detect seasonal trends. Early research [3] shows that satellite imagery can also be used to measure seagrass extent accurately (see key literature below). This study will further this research by mapping and quantifying seasonal dynamics in the Port Phillip Bay (PBB), with the ultimate aim of identifying trends.

Research Questions:

- What are the seasonal variations of seagrass extent across several sites in the Port Phillip Bay over the 2017-2022 period (5 years)?
- Is there a relationship between observed changes and rainfall (increased runoff/sediment transport), temperature, and or turbidity?

Key literature:

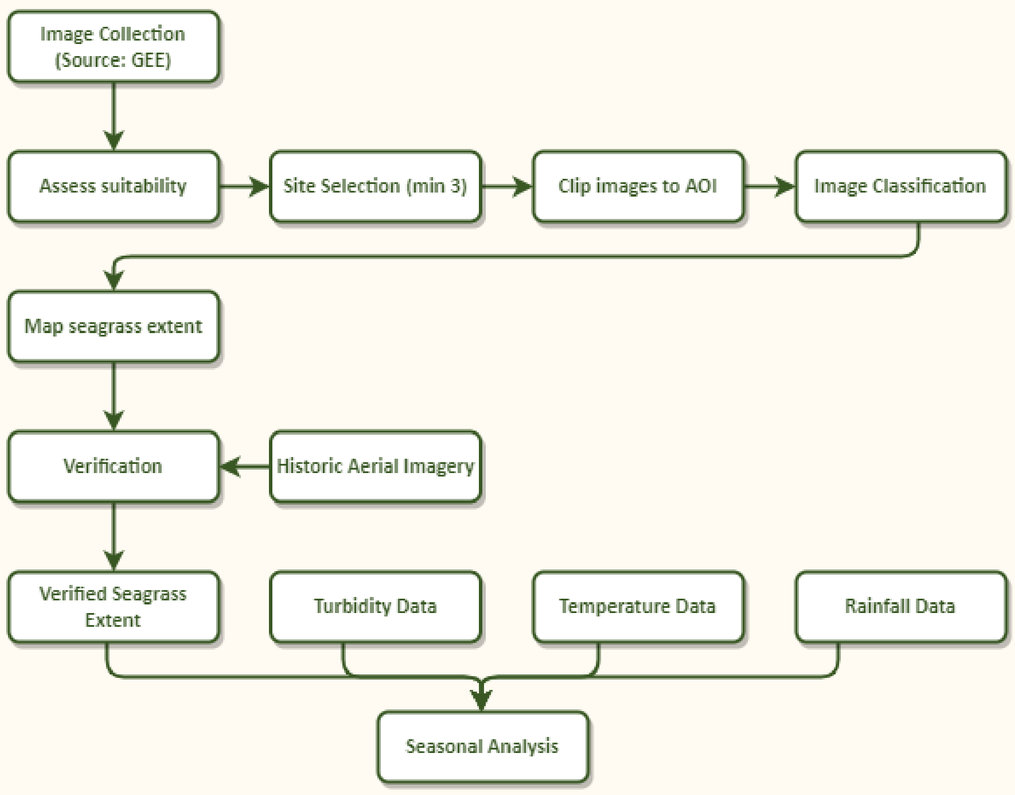
	Year	Location	Image Source	Classification	Results
[3]	2021	Port Philip Bay, Australia	Sentinel RapidEye	Unsupervised	Sentinel provided accuracy of +/-23% to aerial imagery. Trends plotted indicate sentinel is a suitable source to detect seasonal change as it followed similar trends to those acquired by aerial imagery.
[4]	2020	Andaman Islands	Sentinel 2-A Aerial Imagery	Random Forest, Support Vector Machine, K-Nearest Neighbor	Random forest classification proved most effective with 99% model accuracy. Seagrass present as deep as 21m were detected post water column correction.
[5]	2020	European Atlantic coast	Sentinel 2 Field Survey	Semi-supervised	Sentinel 2 calculated seagrass percent cover was mapped with 86% certainty. Due to the temporal resolution of sentinel 2, it was possible to identify and describe the seasonal cycles.
[6]	2019	Vietnam	Landsat	Maximum likelihood	Image classification was between 81-95% accurate and decline in seagrass extend was observed in the last three decades.
[1]	2017	Indonesia	GeoEye1 Field Survey	Maximum likelihood	The results showed that Google Earth imagery can be a reliable direct source of seagrass condition mapping data with good accuracy
[7]	2013	Port Philip Bay, Australia	Aerial Imagery	Automated unsupervised	Temporal patterns of seagrass cover achieved. Variation in annual trends between sites observed. Geographic spread indicated broad scale influences of the variation in seagrass cover.

Study Area:

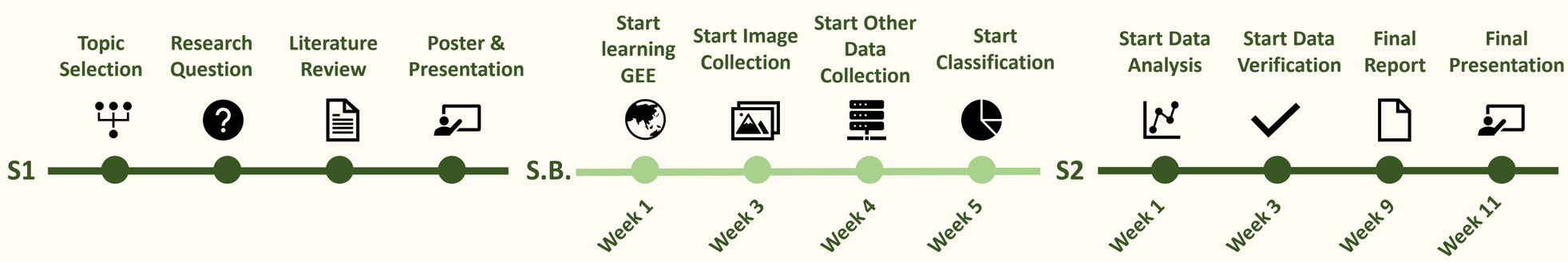
Location: Port Phillip Bay, Victoria, Australia.
Surface Area: 1,933 km^2
Mean Depth: 8m
Water Volume: 25m^3

Sites: Landy (3), gathered sentinel imagery for 6 of the 9 sites that have been assessed through aerial imagery since 1939. This study will select the same 6 sites plus Altona/Pt. Cook to investigate influence of geographic spread on seasonal trends.

Methodology & Approach:



Timeline & Project Plan:



Expected Outcomes:

It is expected that sentinel 2 satellite imagery will be able to detect seasonal variation in seagrass extent in the PPB region and the seasonal trends analyzed with rainfall, temperature, and turbidity data will indicate relationships between extent and influence.

Results:

- Graph(s) of:
  - seasonal trends/site
  - yearly trend/site
- Examination of relationship between change and external factors (e.g., millennium drought)
- Map(s) of seagrass extent of each site at key periods of change

References:

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