Research Context: Eelgrass (*Zostera marina*) is a vital component to the health of many coastal ecosystems being threatened by human-driven climate change. Eelgrass provides a multitude of important ecosystem services, such as reducing coastal erosion, sequestering carbon, providing habitat for coastal organisms, and is a vital component of many marine food webs[1]. Unfortunately, coastal land development and rising sea levels caused by climate change have contributed to a decline in eelgrass populations worldwide[2, 3]. As sea level rises, the depth of water above the eelgrass beds can increase and reduce the amount of sunlight available, which has a negative effect on the eelgrass beds[2]. However, predicting local sea level rise is complicated by the fact that the land may be rising or subsiding due to tectonic or isostatic processes. As local sea level rates may be substantially different from the rate of global sea level rise, predicting future areas where eelgrass beds are most a risk of decline is challenging[4]. The local rate of sea level rise will determine the overall rate of change that eelgrass experience. As sea level rises, eelgrass may be able to migrate shoreward to maintain an ideal depth. However, if there are barriers to this migration, such as sea walls or unsuitable shoreline, then the eelgrass will be prevented from finding suitable habitat[2, 5]. The lack of suitable habitat is referred to as "coastal squeeze."[5] If there are no barriers for the eelgrass, the local rate of sea level rise will determine how rapidly the eelgrass beds must migrate in order to survive.

Research Question: At what rate will existing populations of eelgrass (*Zostera marina*) have to migrate to keep pace with local sea level change, and are there barriers to this migration?

Research Objective: To improve management of eelgrass habitat, areas at risk of rapid sea level change and coastal squeeze need to be identified to inform conservation efforts[7]. In order to achieve this, my research aims to accomplish the following: (1) Identify unmapped eelgrass habitat using remote sensing (RS); (2) Predict future coastline changes due to projected sea level rise and local rates of change; (3) Determine areas at risk of coastal squeeze due to barriers or unsuitable habitat; and (4) Create a series of maps showing existing eelgrass habitat most vulnerable to local sea level changes and coastal squeeze, as well as areas of potentially unaffected habitat. I also aim to create a shareable workflow of this mapping process capable of application to other coastal locations.

Methods: To complete these objectives, the following methods will be used: (1) RS techniques will be used to map eelgrass beds, where they are not already known, to determine the spatial distribution of eelgrass habitat within three study areas (the Englishman River, Little Qualicum River, and Nanaimo River Estuary)[8, 9]. Classification methods, such as unsupervised or supervised methods, will be assessed against existing eelgrass mapping to determine the most accurate RS method for these areas. This will be completed using opensource Landsat imagery such as imagery downloaded from the Global Visualization Viewer[10]; (2) Comparing current and historical shoreline maps, rates of shoreline change will be quantified to predict future shoreline heights[11]. These shoreline heights will be combined with projected sea level rise to provide a more representative prediction of changes in local sea level; (3) A quantitative assessment of coastal squeeze will be calculated by digitizing and spatially analyzing variables such as unsuitable habitat and coastal land development, to determine areas at greatest risk[12]; and (4) Final maps will be created that compare the location of existing eelgrass habitat to areas at risk of rapid sea level rise and coastal squeeze.

Contribution to the Advancement of Knowledge: Knowing how climate change will affect local coastal ecosystems will allow for local planning efforts to effectively plan for future environmental changes[11]. This research will provide an analytical workflow that can be used to help inform restoration and mitigation efforts to protect eelgrass meadows from the impacts of climate change. It will also help to facilitate pre-emptive planning to protect eelgrass beds, which increase biodiversity and provide other ecosystem services to local coastal ecosystems[4]. Additionally, this research can be used for conservation planning by local municipalities such as Parksville, Qualicum Beach, and Nanaimo, which fall within this research study area. Local conservation groups, such as SeaChange, can also add this research to their stewardship network that disseminates knowledge on coastal conservation and research through educational outreach workshops and presentations[13].

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