**Name of Researcher**

Andrew Egan

**Department/Faculty**

Geography and Geology / Interdisciplinary Studies: Environmental Studies

**Position in Department/Faculty**

Instructor / Coordinator

**Project Title**

Schooner Cove: Monitoring and Modelling a Dynamic Coastal Sand Dune Ecosystem

**Term of Project**

Spring 2018, Fall 2018, Sping 2019, Fall 2019, Spring 2020

**Please introduce yourself – include pertinent background information relating to the topic of your research project.**

I am a teacher and an inquisitive person with a strong interest in climate change and its impacts on both the human and natural environment. I have had many different careers but my favorite is instructing students and witnessing the piques in knowledge and interests. I have worked on environmental monitoring projects that measure the impacts of mining operations, construction and road development, and climate change.

I know that climate change is one of the most significant issues facing humanity and our students, and I actively seek opportunities to engage students' experiential learning about different environments. This project blends my background in environmental monitoring and sand dunes, and the ability to provide students with a tangible experience conducting scientific inquiry of the impacts of climate change on the vulnerable Schooner Cove sand dune in Pacific Rim National Park Reserve.

**Please discuss your educational background and your work experience that led you to taking on this research project. If possible, include a quote that helps define your interest in this project.**

I attended the University of Victoria gaining a BSc. in Physical Geography. I primarily studied geo-hydrological processes. I was involved in several research projects involving the impacts of climate change on a variety of environments. My Master's degree was obtained from King's College, University of London in the UK. At King's, I was focused on the monitoring, modelling and management of environmental systems affected by climate change. My thesis was focused on climate change induced increases in wind velocity and their impact on sand dune formation and stability over time.

I have worked for several companies and institutions/agencies creating monitoring and modelling projects to assess the impacts of operations and climate change on a variety of environments. I have brought this experience and coupled it with my teaching skills in trying to create research-based projects. I have applied these skills to different courses at Langara College such as, ENVS 2100, ENVS 2470, GEOG 2210, and more.

When approached by Parks Canada to study small-scale changes in the morphology of Schooner Dune in Pacific Rim National Park Reserve, I saw a great opportunity to engage students in scientific research and a new form of analyzing sand dune change related o climate change.

"I believe this research project increases students' experiential learning and scientific literacy about climate change and related impacts."

**Please explain the concept for your project in terms that others not in your field would understand, like an executive summary.**

Climate change affects a variety of environmental parameters such as wind velocity, sea level, and air temperature amongst others. As air temperatures change so does air pressure; differences in air pressure are generate winds and, in part, control direction. Sand dunes are created and maintained by a source of sand, a uniform and near-continuous direction and velocity of wind. Changes in sand source dynamics and wind velocity or direction can affect the morphology of sand dunes.

The Schooner Cove sand dune covers a small area on the west coast of Vancouver Island, withing the Long Beach section of Pacific Rim National Park Reserve. The sand dune is vulnerable to the effects of climate change. The morphology of the dune is controlled by a variety of parameters that are linked to local and global climate such as, wind speed, wind direction, sea level rise, coastal erosion, vegetation change, and human development.

This project aims to monitoring or measuring some of the parameters that control dune morphology. The collection of this data would enable the creation of a model that may yield insight into the effects of climate change on west coast dune ecosystems.

**Identify goals and objectives for the project, and how the results may be used, perhaps to solve a problem, or to inform further research in that field.**

This project's objectives were to bi-annually study the morphology of the Schooner Cove sand dune using students to measure changes in vegetation cover, dune height and length, prevailing wind velocity and distance. Using a drone to capture images for examining vegetation change, and the dimensions of the sand dune was coupled with local Tofino Airport wind measurements. The outcomes of multiple flights would allow for the calibration of a model that illustrates the weight of the different parameters in defining the sustainability of a west coast sand dune within a changing climate.

**Briefly explain the steps taken to conduct the project research, and the results found.**

The research project involved a number of different steps:

1. Apply for Research Permit with Parks Canada
2. Initial study and capturing of sand dune morphology and vegetation cover.
- 2.a Due to the close proximity of the Tofino Airport - all drone related flights involved registering the drone and flight path in 2018 and part of 2019.
3. Travel with ENV 2470: Field School students to Schooner Dune and collect survey data, fly drone and capture aerial imagery (data) in April
3. Compile data and conduct QA/QC process
4. Create model for estimating dune dynamics
5. Return to dune to collect more data in fall (October) and collect more data to verify and validate model outcomes
6. Repeat annually, eventually increasing the robustness of the predictive model

The results of the initial visits in 2018 illustrated that the project was viable; however, the model would need additional data to improve its operation.

**Who else was involved in this project? How did their involvement help? Ie: other faculty, students, community partners**

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Parks Canada provided a research data and the drone for collecting the data. We worked in partnership using the limited data to inform small changes in management practices.

University of Victoria Geography Department, I was allowed to participate in their field school operations, we both collected data and a base structure for modelling the dune's morphology.

Langara College, Environmental Studies students collected the baseline data in April of 2018 and 2019.

## What were/are you hoping to get from conducting this research?

I was hoping to create a predictive model that would inform Parks Canada on the impacts of climate change on the Schooner Cove sand dune. With time and moderate alterations this model would be applicable to other sand dunes and related ecosystems in the Pacific Northwest's coastal regions. Ultimately this research project's outcomes would allow form improved management decisions enabling improved protection for the highly vulnerable ecosystems.

## Can you share any personal stories that made this research experience memorable/valuable?

Schooner Cove is a beautiful location for conducting research. I engaged with several local Indigenous Elders who explained the significance of Schooner Cove and its sand dune to the local culture. This increased the importance of this form of research in a quickly changing environment to not only the natural world but also its human inhabitants.

## Do you have any tips/suggestions/ideas for applying this research in your field? Or for others in their fields? Or for conducting future research of this kind?

When conducting this form of applied research, a clear understanding of the regulations and future impact changes in regulations may have is necessary. Although, changes may have unpredicted consequences understanding the risks and impacts is necessary.

This project's objectives and outcomes are dependent upon the collection of data using a drone. In 2018, the regulations for operating drones in the vicinity of an airport involved registering a flight plan and receiving authorization from Transport Canada. This portion of the project was handled by through our partnership with Parks Canada.

In 2019, Transport Canada changed the rules governing the use of drones in Canada. The new rules introduced two categories of drone operations and a certification process for drone pilots. The new rules were especially consequential to this project, due to the vicinity of the Tofino Airport, which now fell in the advanced operations category. Initially, the project met all of the requirements, certifying a drone pilot and successfully applying for a "drone assurance declaration" for drones under advanced operations.

However, this was short lived and the manufacturer assurance qualification for the DJI Phantom 3 Pro that Parks Canada was using for this project was not met. In other words, the manufacturer would not provide the necessary assurances to Transport Canada to enable this project to use the Parks Canada drone in the restricted airspace over Schooner Cove.

## Any final comments? What are the "next steps" for this project? And for you?

The project has filed to overcome two barriers in the past year.

First, the project has been unable to secure the funding necessary to purchase a drone that meets the requirements to successfully submit an application for Transport Canada's advanced operations declaration. Moreover, it has become clear that the window of opportunity to collect data using a drone it too small under the circumstances of the "good weather" and a limited time period that ENVS 2470 students are present. As witnessed in 2019, when poor weather (wind) and poor cellular coverage made the drone flight tenuous and complicated data collection. In fact, I had to return several weeks later to collect the data independently.

Second, the regulations and guidelines related to the COVID-19 pandemic restricted the ability of students to travel and work in groups. This resulted in the cancelling of the 2020 ENVS 2470 Field School trip to Pacific Rim National Park Reserve. Moreover, the regulations placed on work-related travel have limited the primary researcher's (Andrew Egan) ability to conduct research at Schooner Cove.

I would like to continue this project in the future and am working with Nathan Jones and Parks Canada to secure the use of a drone.