West Beach Sand Dune: Slope, Exposure and Vegetation Communities on Calvert Island, British Columbia.

By Gillian Harvey, Maria Shallard, Yuhei Iida

A REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR ES 470 2011
at
HAKAI BEACH INSTITUTE

Instructor: Dr. Brian Starzomski
Teaching Assistants: Ashley Park, Abe Lloyd

Abstract

Sand dunes are coastal ecosystems where accumulated sand has formed a geomorphologic hill, allowing vegetation to inhabit in a rare condition where both terrestrial and coastal plant species emerge and blend. Sand dunes are complex and are altered by various factors such as: exposure, wind, deposition rate, erosion rate, and tidal activities. Our question for the sand dune on West Beach, Calvert Island BC was if slope and exposure would affect the vegetation community composition at different locations. Our hypothesis was that there would be a difference in vegetation richness and abundance in different treatments of slope and exposure. We found that there was a significant difference in vegetation community depending if the slope was exposed or sheltered. We also found that sheltered areas with slopes that were more gradual than steep had more species variability than exposed/steep areas. In addition, zones at the north and south ends of the dune had similar vegetation composition than zones in between. The collected data and results will be important for monitoring vegetation health and overall morphology changes of the dune.

Keywords: Biodiversity, Coastal dunes; Conservation; Exposure; Slope; Vegetation gradients

Introduction

Coastal Dune sand ecosystems occupy areas of sand bounded by the ocean, shore and the forest (Ministry of Environment, 2006). Dune environments are harsh due to a number of factors such as exposure to sun, coastal winds, and temperature and create a variety of unique habitats within the boundaries of the dune ecosystem. Sand dune morphology is continually changing due to environmental pressures, their position between ocean and a continental landmass, and the fluidity of the substrates in which it is composed. In the last glaciation, the landscape eroded and as a consequence large amounts of sediment were deposited on the shores (Ministry of Environment, 2006). The scouring caused by the glacier retreat produced significant geomorphologic changes to British Columbia's coastline (Ministry of Environment, 2006). The sediment deposits above and below sea level provide the material that forms coastal sand dunes. Sand dunes are an important component of coastal environments because they provide unique habitats for at-risk and rare plant species such as yellow sand verbena (*Abronia latifolia)*. In addition, many rare and at-risk are important for supporting other organisms or animals in the surrounding area (Ministry of Environment). Sandy beaches are considered a rare type of ecosystem along the mainland coast and beaches with dune ecosystems, like Calvert Island, are important to study because their ecosystems are sensitive to occurrences like marine pollution, invasive species and human influenced/natural erosion (Pojar, 2002).

Goal

For the purpose of this study we chose to use a less documented predictor of vegetation communities on the dune by using slope, distance, and exposure or non-exposure factors. This data will aid in understanding growth patterns and gradients of plant growth and to answer our question of how slope, distance from the tree line and exposure change the dominant upper vegetation canopy in dune ecosystems at West Beach, Calvert Island, British Columbia. This study is the first of its kind to be conducted at the West Beach dune site and will provide an in-depth perspective on plant community richness and abundance. It is hoped that the research conducted on this dune ecosystem will help provide a foundation in which long term monitoring can be based and aid in the understanding of how this dune may change and develop over time.

Methods

Study area and section locations

We analyzed how slope, exposure and distance from the tree line impacts vegetation (upper canopy) community structure and distribution. This study was completed on a single 310-meter long dune on Calvert Island, British Columbia. In order to insure the study would capture a representative sample of different community types along the dune we stratified the dune into four visually distinct sections according to the severity of slope and distance to the tree line behind the highest ridge. The sections cut the dune into sections perpendicular to the shoreline. Each section’s length and start/end points were measured using GPS waypoints and a physical measurement using a measuring tape. The length and GPS coordinates were measured at the point where the exposed slope meets sand and by following the curvature of dune shape. Section 1 began at the northern end of the dune and was 74 meters long. Section two began directly after Section 1 and was 72 meters long. Section 3 began at a large Sitka Spruce tree (*Picea sitchensis)* after Section 2 and was 59 meters long. The final section, Section 4, was 105 meters long. These sections provided the areas in which two parallel transects were placed (8 in total). A permanent benchmark was placed at the base of each transect to mark the location for future monitoring use in each section. Each of these benchmarks has GPS coordinates that can be seen in Table 1.

Table 1: Data Summary of GPS Coordinates (North and West) of Benchmarks Locations for Transect Lines on Dune at Calvert Island

Section and Transect	GPS Coordinates (N)	GPS Coordinates (W)
1A	51° 39. 495	128° 08. 665
1B	51° 39. 489	128° 08. 649
2C	51° 39. 485	128° 08. 615
2D	51° 39. 478	128° 08. 590
3E	51° 39. 467	128° 08. 561
3F	51° 39. 464	128° 08. 554
4G	51° 39. 435	128° 08. 509
4H	51° 39. 431	128° 08. 500

Vegetation survey

We chose to use a systematic sampling technique to measure vegetation richness and abundance. This method was chosen because of its ability to easily show vegetation assemblages along gradients (Krebs, 1999). The locations of each transect within the stratified sections (Sections 1, 2, 3, or 4) were chosen via a random number chart to incorporate a random element within the study (locations in Table 1). Each section had two replicate parallel transects labeled A/B, C/D, E/F, G/H. Each transect was 30 meters in length and ran perpendicular to the shoreline at a 220° bearing, adjusted for declination of the area. A systematic sampling method was implemented so that every 2 meters (starting at 0 meters) a quadrat was placed to the right /north side of the transect line. The one meter square quadrat was divided into 16 equally sized squares with 9 cross sections and placed on the ground so that the lower left corner was touching the 0, 2, 4, 6…. meter mark. Vegetation species were given a number system in the form of a legend to make the recording more efficient. In each quadrat we started the pin drop at the top right hand corner of the quadrat. At each intersection of the string, or the string and the edge of the quadrat, the "pin" was dropped straight down. The first species to be touched with the straight narrow stake was marked down at each point. Unidentified species (mosses, lichens and grass) were assigned a number, placed in a petri dish that was numbered, and later identified under the microscope and recorded.

Slope estimation

We took two slope measurements, the quadrat slope and the aspect slope. Slope data was collected by placing the compass on the middle of each quadrat on the transect line in each section. The slope aspect was taken to represent a more accurate direction of the slope that was taken from the middle of each quadrat. To record our results, one person counted species, another measured slope, and the third person recorded both slope and vegetation data. Each person stayed in his or her roles for the remainder of the study to minimize error. Each slope was measured after the recording of vegetative data to have consistency. Once all slope measurements were taken the dune was stratified again into four distinct categories. This time the categories ran parallel to the shoreline and were based off of distance and slope severity along the transect lines. These four categories were labeled Beach, Exposed, Sheltered and Meadow. The Beach section was the closest section to the shoreline and the meadow section ended at the start of the tree line on each of the eight transect lines.

Data compiling

Data was compiled on an excel spreadsheet with columns for each section, transect, species, and slope aspect. To simplify data analysis, the original data about the vegetation species was counted and measured according to abundance within each quadrat of each section and transect and recorded into excel. See Appendices 8.0 for full details on vegetation surveyed.

Statistical methodology

Due to a large amount of vegetation and slope data along the dune, Primer-E, a computer software program that analyzes multivariate statistics for ecologists was used to analyze multiple variables such as slope, sections/transects, exposure and vegetation. The Excel spreadsheet was used to calculate ANOVA sample similarities, nMDS ordination, and finally SIMPER to determine how the sites were different. The Bray-Curtis similarity gave a triangular similarity matrix between transects and ordination helped map similar relationships between our samples. ANOSIM looks at the similarities within and the similarity between factors. Ordination is a method that helps cluster data and aids in exploratory data analysis. The map was done to non-metric multidimensional scaling (nMDS). No axes are present in the data but multidimensional relationships between multiple variables in two or three dimensions can be presented. nMDS uses the rank order of similar relationships between samples. SIMPER was used to indicate which species were responsible for the patterns that we saw and the relationships between samples.

For the purpose of this study the collected slope data was compiled and categorized into 5 sections. Slope was compiled into: (-80 to -40) Negative Extreme, (-39 to -16) Negative Steep, (-15 to +15) Gentle, (+16 to +39) Positive Steep, and (+40 to +80) Positive Extreme. Sections Beach, Exposed, Sheltered, and Meadow were also analyzed.

Results

The predictors imputed into the Primer-E analysis program were transects, slope and exposure. It was noted that other predictors might also influence community structure, such as distance from the tree-line and quadrat slope. However, when analyzing distance and quadrat slope in Excel, we determined that there were no clear/observable relationships or a biased relationship between distance/quadrat slope and community structure. Therefore, for the purpose of answering our research question we did not include distance and quadrat slope predictors in our Primer-E analysis.

Transect and Community Comparison (Factor: Transects)

We used Primer's ANOSIM test to determine how similar each individual transect was to other transects within the study (transects: A, B, C, D, E, F, G, and H).

This particular test states that the higher significance level, the more similar the transect samples are to each other. The sample statistic that was used was R. We used a significance level of 5.0% to determine the cutoff of what was considered similar or dissimilar. If a significance level was below 5.0% the two transects were not significantly similar. If the significance level was above 5.0% then the results indicated a significant similarity between transects. The results of this similarity calculation are: R=0.15, significance level= 0.1%, p value=0.001 and N= 128. Additional results in showing a similarity between transects, including the significance level and R statistic, can be seen in Table 2.

Table 2: ANOSIM Test Results for Transect Comparison.
Shows similarities between transects. If the significance level is above 5.0% transects are considered statistically similar. (N=128)

Transects	Significance Level (%)	R
A, B	14.6	0.037
A, G	5.3	0.079
A, H	8.7	0.046
B, G	60.3	-0.022
B, H	37.7	-0.001
C, E	28.9	0.011
C, D	25.8	0.02
C, F	30.0	0.012
D, E	25.9	0.016
D, F	70.0	-0.026
E, F	72.3	-0.031
G, H	64.0	-0.023

All calculations in ANOSIM regarding the similarity of transect A, B, G, and H (Sections 1 and 4) displayed significance levels of above 5.0% with relatively low R-values. This indicates that these transects were more statistically similar to each other than they were to transects C, D, E, and F (Sections 2 and 3).

We then looked at transects C, D, E, and F a similar pattern emerged. The test determined that transects C, D, E, and F (Section 2 and 3) were more significantly similar to each other than to transects in Section 1 and 4. This was proven by all C, D, E, and F transects with significance levels greater than 25.8%.

Slope and Community Comparison (Factor: Slope Categories)

To calculate similarity between different slope categories (Gentle, Positive Steep, Negative Steep, Positive Extreme, and Negative Extreme) we used a one-way Bray-Curtis analysis. Slope categories were Negative Extreme (-40° to -80°), Negative Steep (-16° to -39°), Gentle (-15° to +15°), Positive Steep (+16° to +39°) and Positive Extreme (+40° to +80°). This resulted in an ANOSIM calculation of R = 0.104 and significance level of = 0.1% with an N= 128. This showed that there was a significant difference between the categories and in order to determine where the differences were located we conducted a Pairwise test. The Pairwise test showed that Gentle/Negative-Steep, Gentle/Positive-Steep, Gentle/Positive Extreme, and Negative-Extreme/Positive-Extreme all were significantly different with p-values of less than 0.5. The Gentle/Negative-Extreme, Negative-Extreme/Negative-Steep, Negative-Extreme/Positive-Steep, Negative-Steep/Positive-Steep, Negative-Steep/Positive-Extreme, and Positive-Steep/Positive-Extreme were not significantly different because all p-values were above 0.5%. To present this data in graphical form nMDS was used to rank the similarity of each group (Figure 1). This graph illustrates the vegetation community structure when looking at slope categories.

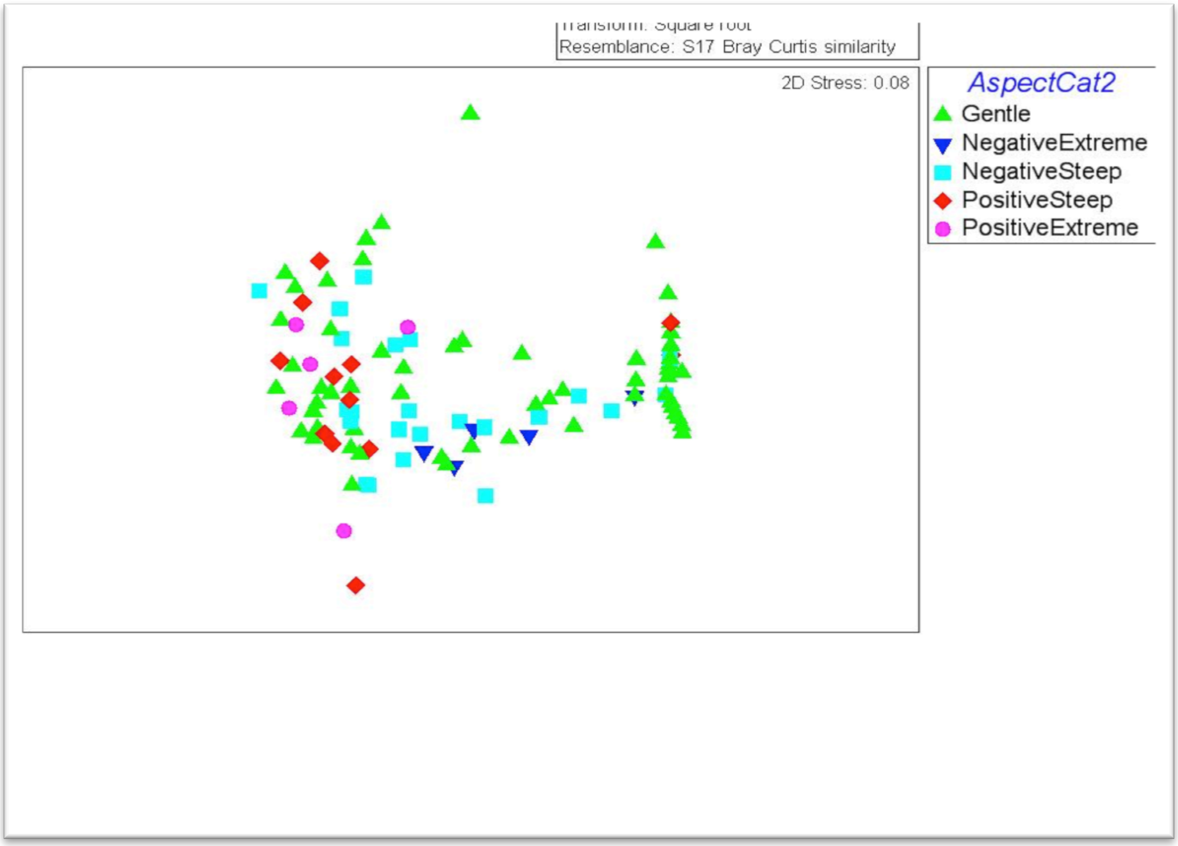

Figure 1: (nMDS) Slope and Community Comparison (Factor: Slope Categories) Dune on West Beach, June 2011. (R = 0.104, significance level = 0.1%, p-value = 0.001, and N= 128).

We found significant differences in the Negative Extreme category, the Positive Extreme category and the Positive Steep category. The graphical output shows that the Positive Steep category (+16°to +39°**)** is visually separated from the Negative Extreme category (-40° to -80°) shown by the lack of overlap between colours. The Negative Extreme category (-40° to -80°) was also appears to be separate from the Positive Extreme category (+40°to +80°) also shown by a lack of overlap. This clustering indicates a higher similarity within their individual category than with other categories, while the separation between different categories indicates a difference in community structure.

The Gentle (-15°to 15°) and the Negative Steep (-16°to -39°) categories had a significant amount of overlap leading us to believe that there were relatively little differences in community structure between these groups.

To determine which plant species are responsible for the differences between the slope categories, we conducted a one-way SIMPER analysis. Results of this analysis can be seen in Table 3. It is clear to see that the dominant species responsible for most differences in community structure are Lanky Moss, Yarrow Beach Pea and Dune Grass.

Table 3: Slope Categories, Average Dissimilarity Between Transects and Species Responsible for Differences (R = 0.104, significance level = 0.1%, p-value = 0.001, and N= 128).

Slope Categories	**Average Dissimilarity (%)**	**Plants Responsible for Dissimilarity**
Gentle and Negative Extreme	56.14	Lanky Moss, Yarrow, Beach Pea, Dune Grass
Gentle and Negative Steep	62.55	Lanky Moss, Dune Grass
Negative Extreme and Negative Steep	48.19	Lanky Moss, Dune Grass, Yarrow, Beach pea
Gentle and Positive Steep	73.33	Lanky Moss, Dune Grass, Beach Pea
Negative Extreme and Positive Steep	63.09	Lanky Moss, Yarrow, Dune Grass
Negative Steep and Positive Steep	59.76	Lanky Moss, Dune Grass, Beach Pea
Gentle and Positive Extreme	74.01	Lanky Moss, Dune Grass
Negative Extreme and Positive Extreme	64.83	Lanky Moss, Yarrow, Dune Grass, Common Indian Paintbrush
Negative Steep and Positive Extreme	58.05	Lanky moss, Dune Grass, Tall Clustered Thread Moss
Positive Steep and Positive Extreme	51.15	Dune Grass, Lanky Moss, Tall Clustered Thread Moss

Exposure and Community Comparison (Factor: Exposure)

Using a one-way ANOSIM in Primer we compared the various exposure habitats against vegetation community structure. The results of the analysis indicated that all exposure categories (Meadow, Sheltered, Exposed, and Beach) had a significance level of 0.1%, an R-value of 0.669, and a p-value of 0.001. The significance level is less that 5.0 and, therefore, there is a significant difference between the community types in each exposure category.

As seen in the nMDS graph (Figure 2), there is a distinct visual difference between Meadow category and Beach category. Although there is a slight overlap between Sheltered and Exposed, Primer determined that these groups were still significantly different (R statistic 0.194, significance level 0.1%, p-value 0.001, N=128).

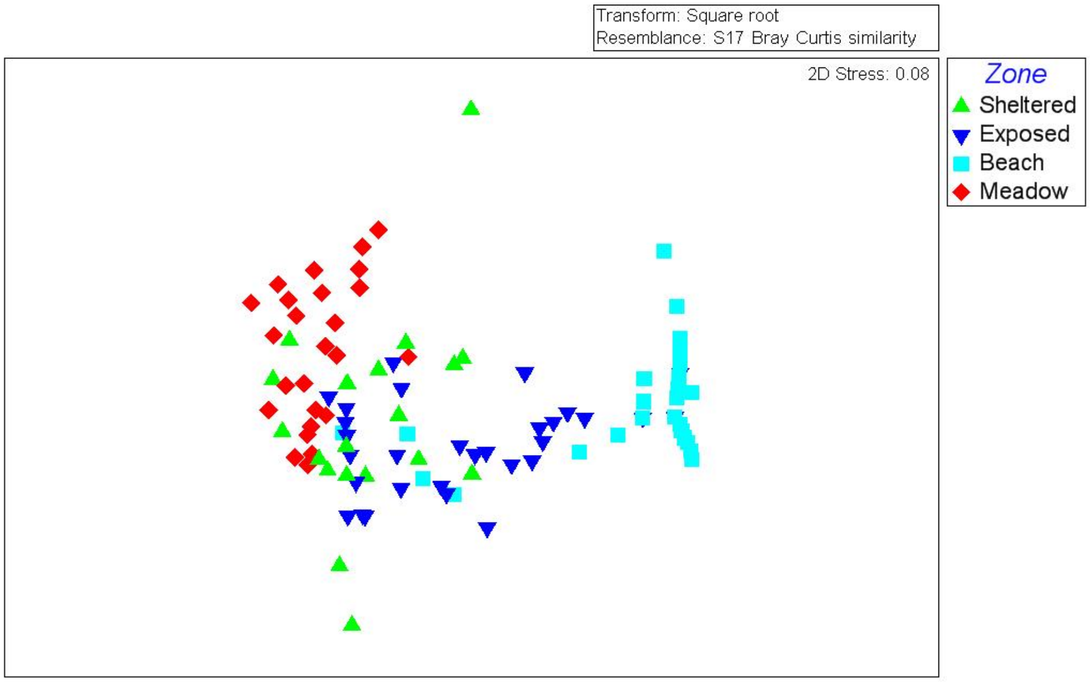

Figure 2: Exposure and Community Comparison (Factor: Exposure) June 2010.
(R statistic 0.194, significance level 0.1%, p-value 0.001, N=128).

In the same way we calculated the plants responsible for the differences in slope categories, we also looked at dissimilarity percentages (using SIMPER) and the plants responsible for the differences in the exposure categories. These results can be seen in Table 4. The first plant species in the list represents the most dominant species responsible for the observed differences in exposure categories. Similarly to the slope category plants, the Exposure plants include Lanky Moss, Dune Grass and Beach Pea. However, there are some different plants such as: Seabeach Sandwort and Tall Clustered Thread Moss.

Table 4: Exposure Categories and Average Dissimilarity and Species Responsible

Exposure Categories	Average Dissimilarity (%)	Plants Responsible for the Dissimilarity
Sheltered and Exposed	54.15	Lanky Moss, Dune Grass
Sheltered and Beach	85.05	Lanky Moss, Dune Grass, Beach Pea
Sheltered and Meadow	50.04	Sea beach Sandwort, Tall Clustered Thread Moss
Exposed and Meadow	62.00	Lanky Moss, Sea beach Sandwort
Beach and Meadow	93.72	Lanky Moss, Dune Grass

Discussion

The results of this study highlight the changes in vegetation community structure as environmental conditions such as slope and exposure are examined. These changes in slope and exposure create vegetation community similarities and differences. An ecological report studying dunes on Savary Island, British Columbia states that, “a characteristic of coastal dune fields is a general gradient of influence from predominantly physical forces near the beach to predominantly biological forces inland” (Strix Environmental Consulting, 2003). These physical and biological forces shape the community structure of present vegetation.

Slope is a good example of a physical force that can drive vegetation community composition. Table 3 helps demonstrate that the Gentle Slope communities have different vegetation than Negative-extreme slope communities. The correlation between slope and our four sections: Beach/Exposed/Meadow/ and Sheltered, demonstrates a general gradient in plant community type from East to West along the dune. The increasing slope creates sheltered areas behind the slope and exposed areas in front of the dune (Strix Environmental Consulting, 2003). These differences in morphology cause the vegetation gradient. For example, the Beach section greatly differs in plant community composition to the Meadow. Because each Exposure category is statistically different from another, the result is a gradual change in species composition from section to section. This gradient, shown in figure 2, by overlapping Sheltered and Exposed categories, shows that the exposure, non-exposure and that the differences between these sections cause a change in plant communities.

The sections Beach/Exposure/Meadow/ and Sheltered help demonstrate some of the trends in vegetation abundance patterns. The meadow section had more diversity in species namely Lanky Moss (*Rhytidiadelphus loreus)* Yarrow (*Achillea millefolium)*, Beach Pea, (*Lathryus japonicus),* Dune Grass (*Elymus mollis*) , Frog Pelt Lichen (*Peltigera neopolydactyla)* and Tall Clustered Thread Moss (*Bryum pseudotriquetrum)* and this section was less exposed to the shoreline than other sections. This leads us to conclude that a decrease in exposure creates a habitat that promotes an increase in species abundance (Strix Environmental Consulting, 2003).

Our abundance estimates of the vegetation were successful in capturing the dominant, upper level canopy composition, however, due to our collection method many rare species were missed. The pin-drop method failed to sample species like Northern Rice Root (*Fritillaria camschatcensi*) and Western Hemlock parsley (*Conioselinum gmelinii)*. This would lead us to believe that there is an overall greater abundance of plants and rare species in some of our categories that may not have been accounted for due to the method in which our samples were taken. In addition seasonality also played a factor in collecting a representative sample of dune vegetation because many plants flowered before or after we collected our samples.

The beach and exposed areas of the dune have more intermittent patches of vegetation and harbour species that must be tolerant of wind and harsh weather conditions, as they are exposed to periodic burial of sand (Maun, 1998). Dune grass (*Elymus mollis*) and Seashore blue grass (*Poamacrantha)* both have long thick spreading rhizomes and thrive in dune environments. Seashore blue grass is one of the best native dune stabilizing plants (Pojar&Mckinnon, 1994, p. 377). Dune grass, also a great stabilizer, has been dominant on dunes until the introduction of European beach grass, which is now more abundant on dunes (Pojar&Mckinnon, 1994, p. 364). The west beach dune does not appear to have any European dune grass and this is an important factor in monitoring the dune long term.

Lanky moss (*Rhytidiadelphus loreus*) was found in great abundance throughout the dune and is often a dominant ground cover in mid-lowland elevations and can create mounds of up to 15 cm high (Pojar&Mckinnon, 1994, p. 473). In meadow sections the quadrat was higher in some areas because of these mounds of moss. Beach pea *(Lathryus japonicus),* also found throughout the dune has slender rhizomes and does well on sandy beaches and dunes amongst driftwood. Yarrow *(Achillea millefolium)*, a rhizomatous perennial is 37.25% responsible for the difference between negative extreme and positive extreme. Northern Rockies Natural History Guide writes that this species can become an aggressive competitor and perhaps this is it appears to be an abundant plant in both exposed and non-exposed areas (Northern Rockies Natural History Guide, 2011).

Dune systems are unstable geomorphologic ecosystems. It is often hard to understand dune monitoring for its complex and frequent deposition and erosion of sand sediments, which alters the slope, exposure and vegetation cover in the system. It is most important to understand dunes in stages of succession, because dunes are a progressive system. Dune plants accumulate and stabilize the soil in the earlier stages of succession (H2.6 Dune System, 424). These plants are namely dune grass and beach grass, both of which have long rhizomes which spread deep into the ground allowing for the accumulation of other primary plant species. Other factors can also be attributed to changes in these ecosystems that were not studied in this research. According to a study done by the Natural History of Nova Scotia, dunes have wind deposited sand that are nutrient poor. As well, sand is not as permeable as soil and plants face exposure from natural elements (H2.6 Dune System, 424). The change in slopes on the dune could provide shelter for some plants, as well as a build up of vegetation could create a more nutrient rich environment as seen in our meadow section (Strix Environmental Consulting, 2003).

Over years when these processes keep progressing, slope gradient would increase creating developed barriers of a high ridge and meadow zones behind the foredune. The soil movement would be less common, and nutrient level would increase demonstrating an increase of upper canopy vegetation. After this point, initial inhibitors would be slowly substituted with the incoming terrestrial plant species, and what eventually happens is the introduction of mid-shrub species and tree species (H2.6 Dune System, 424), which were observed in the meadow area behind the foredune in West Beach, Calvert Island. Eventually tree population would dominate the meadow region, and the entire dune system would be shifted to alternative areas. This can be seen when we look behind the dune on West Beach and can see another dune.

Conclusion

This study used slope and distance to understand and create four sections of the dune: beach, exposed, meadow, and sheltered. This was done to examine how slope and distance from the tree line change the dominant upper vegetation canopy in dune ecosystems at West Beach, Calvert Island, British Columbia based on exposure/non-exposure. Noticeably it could be seen that there was a difference in vegetation communities advancing from the shoreline to the back of the dune. A discussion about the collected plant data gives insight to how dunes are colonized by plant species. This study is important because it creates an in-depth perspective on plant community richness and abundance on the dune at Calvert Island. This habitat had no recorded or visible invasive species, but is still considered a fragile ecosystem in British Columbia and due to external factors such as shoreline, wind, and exposure will be changing over time. An increase in human interaction and the dune is also important in understanding its conservation and preserving the species that rely on this ecosystem. Further analysis using data present in this study can be used to create slope profiles and to monitor progressive or recessive trends on the dune. It is hoped that the benchmarks provided for this study will make this research easily repeatable and accessible in the future to maintain the longevity and diversity of this ecosystem.

Acknowledgements: *A Big Thank you to Eric Peterson and Christina Munck, Professor Brian Starzomski, Abe Lloyd, Katrina Poppe, Ashley Park and Ian Walker for the help, support and opportunity to do research on Calvert Island.*

7.0 References

Appendix 2 Monitoring erosion and change in dune systems. (2000, August). Retrieved 6 18, 2011, from A guide to managing coastal erosion in beach/dune systems: http://www.snh.org.uk/publications/on-line/heritagemanagement/erosion/appendix_2.shtml#a5

Fort Langley, P. H. (2003). *Savary Island Dune And Shoreline Study.* Strix Environmental Consulting.

History, N. S. (n.d.). *Habitat 2.6 Dune System.* Retrieved 6 23, 2011, from The Natural History of Nova Scotia: http://museum.gov.ns.ca/mnh/nature/nhns/h2/h2-6.pdf

Krebs, Charles. (1999). *Ecological Methodology*. Second Ed. University of British Columbia: Addison-Wesley Educational Publishers.

M.L. Martinex, M. M. (2008). The Fragility and Conservation of the Coastal Dunes: Geomorphological, Ecological and Socioeconomic perspectives. *Coastal Dunes. Vol. 171,* 355-369.

Mackinnon, P. A. (1994). *Plants of Coastal British Columbia including Washington Oregon and Alaska.* Vancouver: Ministry of Forests and Lone Pine Pusblishing.

Maun, M. A. (1998). Adaptations of Plants to Burial in Coastal Sand Dunes. *Canadian Journal of Botany Vol. 16, No. 5*, 713-738.

Peterson, S. J. (2003). Burial Disturbance Leads to Facilitation among Coastal Dune Plants. *Plant Ecology Vol.168, No.1* , 13-21.

Pojar, J. (2002, Feburary). Retrieved 6 23, 2011, from RARE ECOSYSTEMS (of the CWHvh2): http://www.citbc.org/b-RareEcos-Pojar-Feb02.pdf

Samantha Flynn, C. C. (2006). *Coastal Sand Dune Ecosystems in British Columbia.* Victoria, BC, Canada: Ministry of Environment.*Plant Ecology Vol.168, No.1* , 13-21.

Appendix

Table 1. Dune Vegetation Species List sampled with Point -drop method

Common Name	**Scientific Name**
Common Indian Paintbrush	*Castillija miniata*
Yarrow	*Achillea millefolium*
Beach pea	*Lathryus japonicus*
Dune Grass	*Elymus mollis*
Coastal Strawberry	*Fragaria chiloensis*
Blue eyed Grass	*Sisyrinchium montanum*
Sitka Alder	*Alnus sinuate*
Wild gooseberry	*Ribes hirtellum*
Sitka Spruce	*Picea sitchensis*
Sea beach sandwort	*Honckenya peploides*
Lanky Moss	*Rhytidiadelphus loreus*
Sand	
Frog pelt lichen	*Peltigera neopolydactyla*
Dead dune grass	*Elymus mollis*
Driftwood	
Dried Kelp	
Seashore bluegrass	*Poamacrantha*
Many flowered wood rush	*Luzula multiflora*
Western Red Cedar	*Thuja plicata*
Red Byrum	*Bryum miniatum*
Black rock moss	*Andreaea rupestris*
Badge moss	*Plagiomnium insigne*
Tall clustered thread moss	*Bryum pseudotriquetrum*