Calamovilfa longifolia's Impacts on Sand Movement and Other Characteristics

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Abstract

Through careful experimental processes, we collected and analyzed data to determine how much the dune-dwelling plant, *Calamovilfa longifolia*, and the sand around it would be affected by human trampling. To begin our research, we planted the *Calamovilfa* in three designated plots and left the fourth one bare. The *Calamovilfa* in two of the plots were spaced out in rows that were equidistant from each other, and plants in the third plot were condensed into a small, dense patch. To gather the data on the effects of human trampling on the dune plants, we trampled the second plot of *Calamovilfa* just as pedestrians on a coastal dune would. Three times per week, the four people within our team made eight passes per person across the rows of plants within that plot. We gathered other information such as the sand temperature, plant height, and moisture content of the four plots using sand samples that we collected each time. Sand traps were also installed at the southern ends of our plots, and erosion pins at each corner so that we could observe the differences of the wind erosion in each of the plots.

Introduction

Vegetation has significant impacts on sand transport for a dune [1, 2]. However, there are limited studies that address whether *Calamovilfa longifolia* is a successful dune management strategy. Our study researched the effects of density and trampling on sand characteristics and deposition.

Study Objectives:

- Investigate levels of erosion or deposition around recently planted *Calamovilfa longifolia*, along with the moisture content of the sand.
- Investigate the effects of trampling and density on the plants and amounts of nearby erosion or deposition
- Compare the dune surface characteristics for the different experimental groups.

Study Location

The study was performed on Perseverance Dune at Calvin University in Grand Rapids, Michigan. Figure 1 shows the location of the plots of *Calamovilfa*, individual plants, and erosion pins.

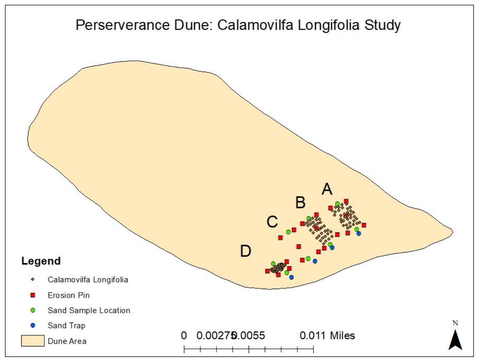


Figure 1: Sampling locations on Perseverance Dune.

Methods

We set up three plots of planted *Calamovilfa longifolia* (plot A, B, and D) and one control plot (Table 1). We measured levels of erosion or deposition around recently planted *Calamovilfa longifolia.*

Study Objective	Equipment Needed	Methods
Investigate levels of erosion or deposition around recently planted *Calamovilfa longifolia*, along with the moisture content of the sand.	Erosion pins, traditional sand traps, a yardstick, and sand samples.	Place sand traps and erosion pins around the research area and collect data/ measurements twice weekly.
Investigate the effects of trampling on the three plots and density on the plants and amounts of nearby erosion or deposition	Trowel, Calamovilfa Longifolia, Sand Plots.	Place plants in 5x7 formation (30cm apart) and trample them each lab period and two other times during the week.
Compare the dune surface characteristics for the different experimental groups.	Sand traps, erosion pins, thermometer, Kestrel, yardstick.	Compare data to other plots regarding sand traps, erosion pins, plant height, moisture content, and ground temperature.

Table 1: The table describes the specific equipment and methods for each study objective.

Results

The plots with newly planted *Calamovilfa longifolia* had higher levels of sand deposition in comparison to the bare sand plot, as it had little to no sand deposition (Figure 2). Increasing the density of the *Calamovilfa longifolia* increased the amount of sand deposition, even creating a visible incipient dune.

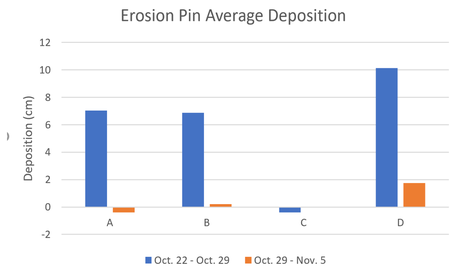
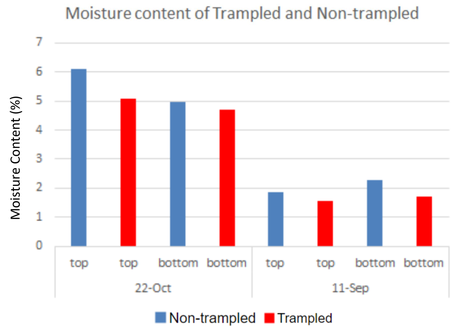


Figure 2: Amount of sand deposited at each plot from averaging the changes at the erosion pins.

The trampling of the plants did not show impacts on the amount of sand deposited, but there were differences in the appearance of deposits. Plot A had visible deposits downwind from plants (Figure 3), but Plot B did not.

◀**Figure 3:** In Plot A there is a small pile of sand (note the sloped sides and peak) deposited behind the plant.

The moisture analysis shows that the non-trampled plot retained more water than the trampled plot (Figure 4). There were no significant differences in the ground temperatures between the plots.



►**Figure 4:** Moisture content results from the top and the bottom of each plot.

Discussion

The presence of the *Calamovilfa longifolia* slowed down wind speeds, enabling more deposition in comparison to the plot with no vegetation.

Moreover, the erosion pins (Figure 5) indicated that the healthy plants with the highest density showed the highest points of sand deposition. Like the study by Arens *et al.* [1], the plot with the highest density of *Calamovilfa longifolia* did show more sand deposition as it created a steep dune just like the reed stem in the article.

Figure 5: Deposition at erosion pin.

The results indicated that the moisture content for plot A was higher compared to plot B. This suggests that the healthier plants retained more water in the sand.

Conclusions

From our study, we have concluded that the increased density of newly planted Calamovilfa longifolia causes an increase in sand deposition. The trampling of the plants impacted the shape of the sand deposition but did not appear to have a significant impact on the amount of sand deposited. Finally, the trampling of the plants caused a decrease in the moisture content in the surrounding sand.

Acknowledgements

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References

[1] Arens, S.M., A. C. W. Baas, J. H. Van Boxel, and C. Kalkman. 2001. "Influence of reed stem density on foredune development." *Earth Surface Processes and Landforms* 26: 1161-1176.

[2] Maun, M. A. 1966. "The effects of burial by sand on survival and growth of *Calamovilfa longifolia*." *Ecoscience* 3: 93-100.