PROJECT REPORT

COMPARISON OF SOIL MOVEMENT IN VEGETATED AND NON VEGETATED AREAS OF THE DUNE

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Introduction

Soil movement is one of the environmental problems facing the world today ((nod) Retrieved January 19, 2009, from http://www.ypte.org.uk/environmental/desert-regions/21). Wind has the capacity to move and create great masses of sand and it is said that desert winds are capable of carrying far more material than any other geomorphologic agent (Alfredo and Marco, 2003). At NaDEET Centre the soil under the houses was moved by wind and most of the camel thorn trees roots are exposed to the surface. The aim of the project was to determine the rate at which soil is moved from an area comparing the vegetated and none vegetated areas.

Study area

The study was conducted in the dunes close to NaDEET Centre (vegetated area) and none vegetated area is close to NaDEET Base. The main aim of the project is to determine the rate at which soil is moved from an area by comparing the soil moved at vegetated and at none vegetated areas of the dunes.

Objectives

The main aims of this study were to:

a. Determine the rate at which sand is moved to and/or from around the tar poles and Camel thorn trees.
b. Investigate which areas (vegetated or none vegetated) are likely to have more soil added and/or removed.
c. Investigate why soil is moved from such areas and not others.

Material used

a. Tar poles
b. Camel thorn trees
c. Paint
d. Metre tape
e. Compass
f. Shovel

Methods

Six tar poles were used for this project and were marked with paint at soil level. The length of each tar pole was measured from the soil level to the top of the pole. The tar poles were marked to indicate the four different directions (**N**orth, **E**ast, **W**est and **S**outh). This was done in case the soil level around the pole is not equal, measurements were taken from the sides and the average was calculated. At both vegetated and non vegetated areas, a pole was planted in the soil using a shovel. Three different locations on a dune were used for the tar poles. At the base of the dune, where there is a Camel-thorn tree near by for comparison, in the middle of a dune and at the top of a dune where no trees were found. The measurements were done using a metre tape/ruler and by checking whether the level of the soil has gone below or above the paint. When below the paint, measurements were taken from the paint to the new level of the soil and were recorded. If it is above the paint, measurements were taken from the new level to the top of the pole and the results were to be subtracted from the original measurements. Measurements were taken on a weekly basis.

Results

The tables show the readings recorded during the study. If during week one the average result was -14cm that means that 14cm of soil has been removed from around the pole since the pole was planted. The second week shows that the result is -8.5cm. From -14 cm to -8.5 cm means that 5.5 cm of soil has been added between week one and two although there is still an overall soil loss of 8.5 cm. The third week shows that its -13cm mean that 4.5 cm more of sand have been removed since week 2 making the soil level at -13cm.

None vegetated

Table 1 shows the readings of soil removed/added in cm and the averages in the non vegetated area

Pole	Base					Middle					Top				
Direction	N	S	W	E	Total	N	S	W	E	Total	N	S	W	E	Total
Week 1	-15.5	-15	-13	-12.5	-14	-7	-4	-8	-7	-6.5	-14	-13.5	-15	-13.5	-14
Week 2	-10	-9	-9	-6	-8.5	-6	-3	-5	-6	-5	-13	-10	-12	-11	-11.5
Week 3	-14	-14	-11.5	-12.5	-13	-8	-9	-7	-11	-8.75	-10	-9	-9	-12	-10
Week 4	-13	-12	-15.5	-8	-12.125	-8	-7	-4	-8	-6.75	-10	-11	-5	-6	-8
Week 5	-15	-16	-16	-13	-15	-7	-5	-4	-4	-5	-8	-4	-5	-7	-6
Week 6	-12.5	-14.5	-13	-11	-12.5	-8	-6	-3	-6	-5.75	-7	-2	-2	-8	-4.25
Week 7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Week 8	-13	-11	-10	-13	-11.75	-8	-5	-4	-4	-5.5	-4	-5	-6	-6	-5
Week 9	-12	-10	-9	-13	-11	-8	-7	-4	-5	-6	-6	-5.5	-5	-4.5	-5.5
Week 10	-12	-10	-10	-12	-11	-8	-6	-6	-5	-6.25	-6	-4	-3	-7	-5
Week 11	-9	-9	-9	-9	-9	-9	-6	-7.5	-4	-6.625	-5	-3	-6	-7	5.25
Week 12	-10	-10	-10	-8	-9.5	-8	-4	-8	-7	-6.75	-10	-7	-8	-10.5	-8.875
Week 13	-10	-10	-9	-7.5	-9.125	-8	-5	-7	-6	-6.5	-9	-8	-8	-9	-8.5
Week 14	-10	-10	-8.5	-9	-9.375	-9	-4	-6	-8	-6.75	-9	-4	-6	-8	-6.75
Week 15	-10	-10	-8	-9	-9.25	-9	-5	-5	-7	-6.5	-8	-8	-9	-7	-8
Week 16	-10	-9	-10	-9	-9.5	-10	-4	-5	-9	-7	-9	-7	-9	-10	-9.75
Week 17	-10	-10	-10	-10	-10	-9	-6	-7	-8	-7.5	-5	-7	-8	-6.5	-6.625

Vegetated area

Table 2 shows the readings of soil removed/added in cm and the averages in the vegetated area.

Pole	Base					Middle					Top				
Direction	N	S	W	E	Total	N	S	W	E	Total	N	S	W	E	Total
Week 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Week 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Week 3	0	0	0	0	0	0	0	0	0	0	-3	-2	-2	-1	-2
Week 4	0	0	0	0	0	0	0	0	0	0	-4	-2.5	-1	0	-2
Week 5	0	0	0	0	0	0	0	0	0	0	-4	-2	-3	0.5	-2.375
Week 6	0	0	0	0	0	0	0	0	0	0	-4	-2	-3	-1	-2.5
Week 7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Week 8	0	0	0	0	0	0	0	0	0	0	-4	-3	-2	-2	-2.75
Week 9	0	0	0	0	0	0	0	0	0	0	-3	-4	-3	-2	-3
Week 10	0	0	0	0	0	0	0	0	0	0	-3	-6	-5	-4.5	-4.625
Week 11	0	0	0	0	0	0	0	0	0	0	-3	-5	-4	-3	-4
Week 12	0	0	0	0	0	0	0	0	0	0	-2	-4	-3	-1.5	-2.625
Week 13	0	0	0	0	0	0	0	0	0	0	-2	-3	-2	-1.5	-2.25
Week 14	0	0	0	0	0	0	0	0	0	0	-5	-2	-4	-3	-3.5
Week 15	0	0	0	0	0	0	0	0	0	0	-5	-3	-3	-0.5	-2.675
Week 16	0	0	0	0	0	0	0	0	0	0	-5	-3	-2	-2	-3
Week 17	0	0	0	0	0	0	0	0	0	0	-4	-1.5	-3	-3	-2.875

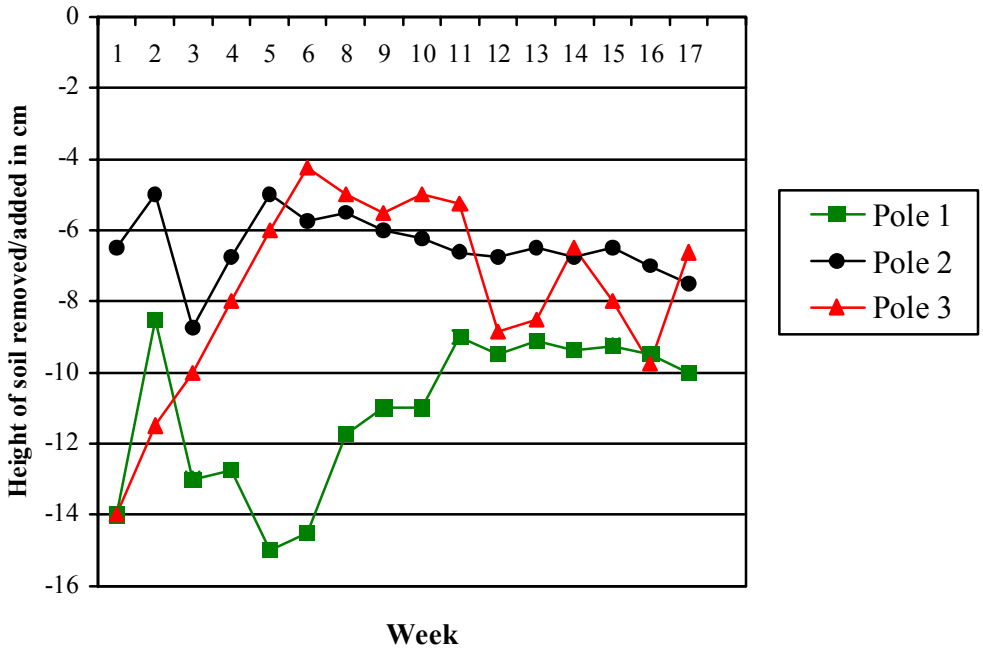


Figure 1 the average soil removed/added in the non vegetated area

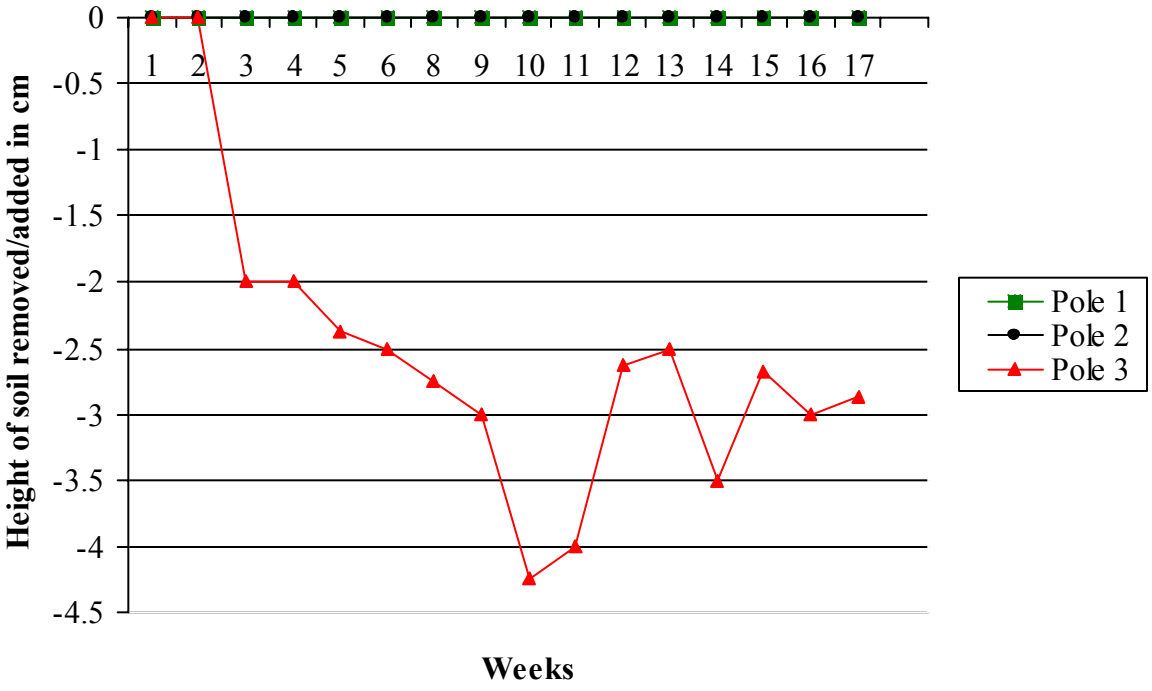


Figure 2 the average soil removed\added in the vegetated area

Rainfall figures for NaDEET area

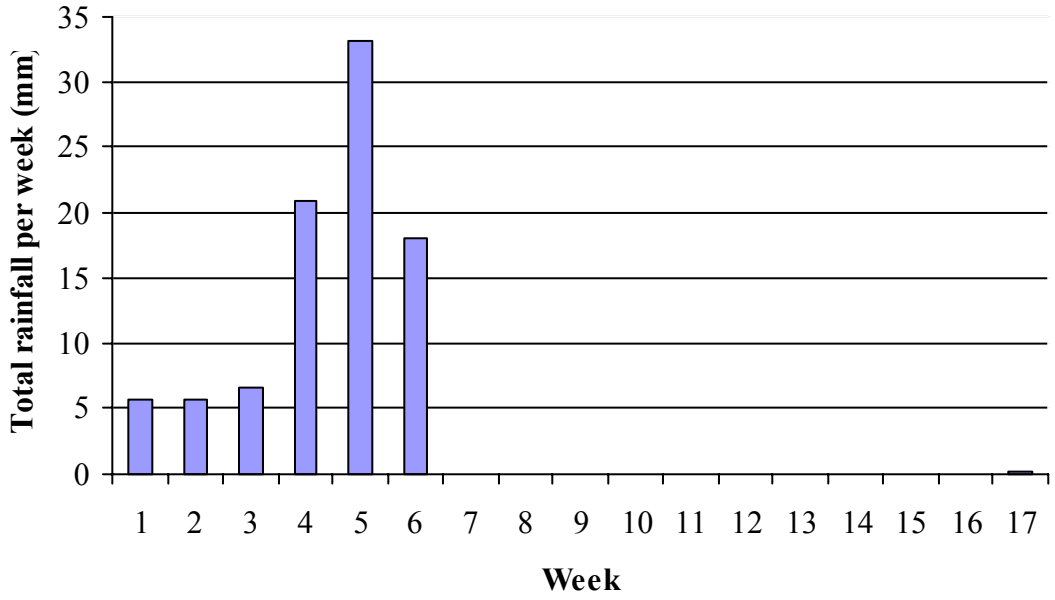
NaDEET base

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
5			31									
6		2										
7			2.2									
8		3.6										
9			3									
10			15									
11		2										
12		1.5										
12												
13		2.2										
14		8										
15												
16												
17												
18												
19		3										
20												
21												
22		3.5				1						
23		16										
24												
25												
26		5										
27												
28					0.1							
29												
30												
31												
Month Total	0	46.8	51.2	0	0.1	1						
Year Total												

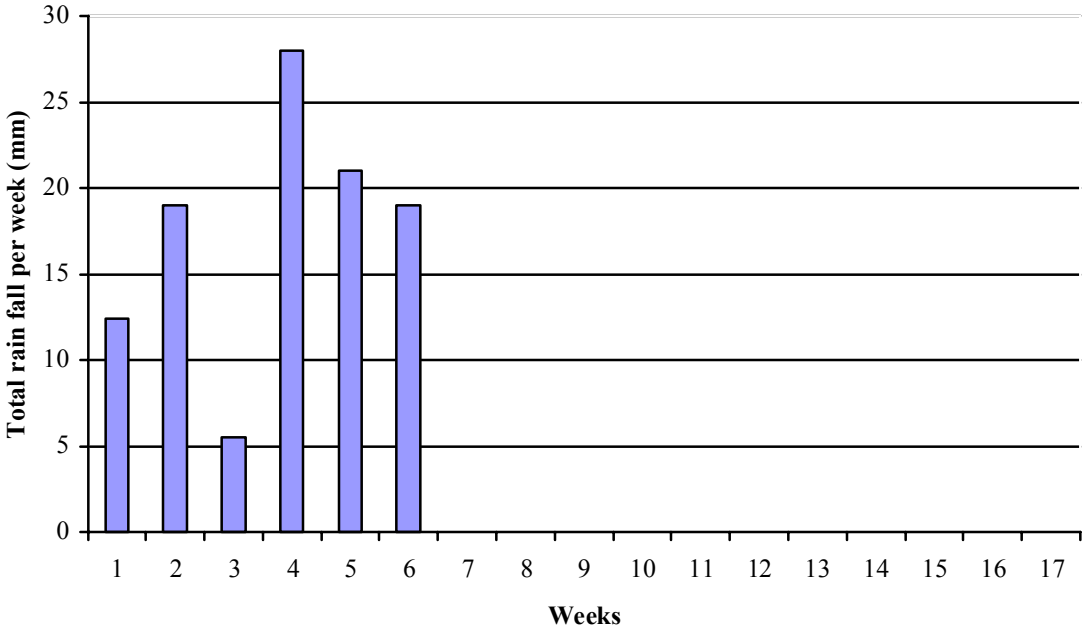
NaDEET Centre

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
5			21									
6		3.4										
7												
8		9										
9			11									
10			8									
11												
12												
12												
13												
14		11										
15		9										
16												
17												
18												
19		0.5										
20												
21												
22		5										
23		20										
24												
25												
26		8										
27												
28												
29												
30												
31												
Month Total	0	65.9	40	0								
Year Total												

NaDEET Base



NaDEET Centre



Discussions

The rain did not have so much impact on the movement of the soil because more soil was still removed from the poles for example the first week where 5.6mm of rain was received in the vegetated or the area close to the none vegetated area and still the soil up to 14 cm was removed and in the vegetated area was 13.4mm. The reason why the soil was still removed is because it only rained twice or three in seven days and the soil dry up very fast because of too much sunshine and that is why soil was still removed.

Pole 1- Base of Dune (None vegetated and vegetated)

As expected the soil has been removed and added around the pole although not above the paint. During the first week the soil removed from around the pole was high due to the fact that when the poles were planted in the soil and therefore, the soil surface had been disturbed and therefore loosened. At the base of the dune the soil removed began to add up because its particles are now moving together and keeping the soil around firm. The soil has been removed and added up from time to time and in some cases no movement at all because in some days there was no wind at all. One of the reasons is that there were days were it has been raining even though it was not heavy rain. The soil that was removed during the 1st week started to build up over the 2nd week but during the 3rd week more soil was removed rapidly and from there it started to build up again in the none vegetated area. When the rain falls the soil particles are kept together because of the moisture but the soil always dries up faster and the soil from the surrounding start to add up around the poles when the wind blows. At the base of the vegetated dune no sand was removed or added because there is vegetation all around the pole which prevented the soil to be moved.

Pole 2- Middle of Dune (None vegetated and vegetated)

At the pole in the middle of the none vegetated dune, more soil was removed during the first three weeks and started building up on the fourth week but after that it has been removed slowly by slowly. This was because of the sloppiness of the dune. In table 1 it is shown that more soil is always removed from west and north this is due to the fact that the wind that mostly blows is the northwest wind causing more soil to be removed on the western and northern sides of the pole and building on the opposite sides (personal

observation). At the pole in the vegetated area, no soil was removed or added because the vegetation is preventing any movement of soil.

Pole 3- Top of Dune (None vegetated and vegetated)

At the top of the dune the soil was removed during the first few weeks, started to build up and was removed again in the none vegetated area. This is because the dune is exposed to the wind and more and more soil is being removed. The more soil which was removed was because there was nothing that kept the soil together. The landscape on top of the dune has also changed. At the beginning of the project it was sloppy but as the time goes by it seemed like forming a new dune, the shape of the dune completely changed. In the none vegetated area the sand was removed at the sides of the pole which was exposed to bare soil **(the sides being north, west, south west)** and when the wind is blowing the soil is added to the side where there is vegetation. As time goes by the sides which were covered by vegetation the soil started to be moved and as from there it was just removed from week and then added again.

The soil around the poles except pole 1 and 2 in the vegetated area, has been removed in the beginning, added and later removed again. Although this will not happen during the germination of a young plant over time as the plant grows the soil will be moved leaving their roots exposed. In case of infrastructure built in the same environment the same can happen to them.

Conclusion

If it took about five months and only about 2-10 cm of soil has been removed how long did it take for the roots of the camel thorn trees to be exposed? The soil that is removed around the camel thorn trees was 1 meter, which took probably 5 to 10 years or more because of the vegetation around them. One will come to the conclusion that what happens to the camel thorns can also happen to infrastructure built in the same environment. To prevent this from happening one has to either plant vegetation around their infrastructure, especially grasses, which will stabilize the soil and prevent it from being removed. In case of the plants it is a very slow process and nothing can be really done by human beings to prevent more soil from being removed. This will have many

impacts on the environment as the more the roots are exposed the deeper the tap roots will grow and the more the competition will become for the underground water which will lead to shortage of water in many parts of the country. The none vegetated areas are more likely to have more soil movement due to the fact that there is no vegetation to hold the soil particles together.

Project limitations

- It was very difficult to find a dune which is completely vegetated and ended up using a dune which is partially vegetated.
- Camel thorns were only found on vegetated areas and only at the base and in the middle of the dune.
- At the top of the vegetated area one side of the dune was completely vegetated leaving the other side exposed to bare soil.
- Materials to indicate the wind direction/speed were not available at each pole and wind speed was not recorded.

Recommendation

For the project to be successful dunes entirely vegetated and dunes which are not vegetated all could be used. Wind vanes should be put up at each pole to indicate the accurate wind direction and speed.

Acknowledgments

This project would not have been possible if I hadn't been given a chance to do my training at NaDEET. I would like to give my sincere thanks to the Director of the Namib Desert Environmental Education Trust for giving me the opportunity. I would also like to thank all the NaDEET staff who has helped me throughout the entire project. I would like to thank Dr Jankowitz for all he has contributed to this project throughout the training. Many thanks to my colleagues Rosalia Iileka and Elizabeth Lukas for all the support you have shown during that time. I thank you all.

References

Marco, C. S. & Alfredo, B (2003). Deserts: A Firefly guide. Firefly books LTD Toronto

Soil erosion (n.d).Retrieved January 19, 2009, from
http://www.ypte.org.uk/environmental/desert-regions/21