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MONITORING AND EVALUATING EROSION AND DEPOSTION RATES BY WIND IN OASES AREA

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ABSTRACT

Oases of New Valley governorate lie in hyperarid zone, where wind erosion and deposition by wind threaten sustained agricultural production. The annual rate of soil mass transport by wind was measured by installing BSNE samplers on the flat, bare fields in different sites of El-Kharga, El-Dakhla, El-Farafra and Paris oases during the period from 1/2/1999 to 10/6/2004. Data showed that wind soil erosion and deposition rates in the study area are very high and differ from site to another.

The annual rate of soil mass transport by wind was dependent on soil texture, percentage of dry stable aggregates,>0.84mm, soil surface conditions and wind erosivity. At each oasis, the average annual soil loss decreased as percentage of dry stable aggregates >0.84mm increased. Soil losses rates due to wind erosion varied from 1.15ton.ha^{-1}.yr^{-1} at Abu-Monkar area (Clay soil, El-Farafra oasis) to 16.43ton.ha^{-1}.yr^{-1} at El-Qase area (Sandy loam soil, Paris oasis). In average, wind soil erosion is significant in the case of sandy and sandy loam soils.

The rate of deposition by wind is more pronounced than soil erosion by wind in the studied area. The annual rate of soil materials being deposited over agricultural soils varied from 4.4ton.ha^{-1}.yr^{-1} at El-Kharga oasis (East Well 2 El-Kharga area) to 110.6ton.ha^{-1}.yr^{-1} at El-Farafra oasis (Qarween plain area), which corresponds to addition of 3.1 to 76.9mm depth of aeolian sediments on top soil each year.

In each oasis, the average annual deposition of windblown materials was greater than the average annual eroded soil by wind. For further studies, the classification of New Valley oases according to the deposition or erosion rate by wind should be put under consideration. This study confirm the urgent needs for implementation of a successful soil conservation practices to combats the hazards of erosion and deposition by wind in order to attain the potential productivity of the New Valley oases.

Keywords: Western desert, El-Kharga oasis, El-Dakhla oasis, El- Farafra oasis, Paris oasis, wind soil erosion rate, wind deposition rate.

INTRODUCTION

New valley governorate lie in hyperarid zone, where 28° latitude at north of it. The area is characterized by high temperature and wind velocity as well as rare rainfall or not occurs. It covers an area of about 376000 Km^2 from Egypt area. Recently, this area has witnessed pronounced agricultural expansion using ground-water resources. Wind is an agent for eroding the cultivated soils and deposition of sand in the form of dunes and sand sheets. Windborne topsoil may be transported over long distances and it is usually deposited when the wind speed is decreased. In the traditional cropping systems in this region, the most predominant manifestations of wind erosion are the burial of seedling and crops under sand deposits and the removal of topsoil.

Wind soil erosion or deposition was considered in mapping desertification worldwide. *Chepil (1946)* found that the soil flow rate began with zero at the upwind edge of the eroding field, and then approached different maximum values at different rates depending on the soil type and surface conditions. *Moldenhauer and Duncan (1969)* showed that sandy soils are very erodible. Clay soils are less erodible because stable units of larger than the erodible size are formed. The potential for wind erosion is influenced by severity of the climate, susceptibility of the soil and surface protection, *Fryrear and Saleh (1996)*. *Chepil (1950)* observed that soil aggregates <0.8mm in diameter was highly erodible. *Fryrear et al. (2000)* stated that wind is responsible for many landscape features, including soil deposition of wind-eroded materials called loess or eolian sands. *Woodruff et al. (1977)* reported that wind erosion or deposition seriously threatens an area of high temperature, evaporation and wind speed, where drought is frequent. *Abdel Sami et al.* (2000), Sharaky *et al.* (2002) and Yousef and Nor El- Din (2002) showed that wind soil erosion or deposition and sand dune movement are active processes in the Western desert oases, especially El-Dakhla and El-Kharga oases. The Western desert includes 90% of sand deposits, which threaten the cultivated fields, irrigation channels, artesian wells, houses, roads, settlements, and converted some agriculture fields to barren desert lands. *Fryrear et al. (1991)* showed that the loss of eroded materials degrades the source areas, deteriorates the atmosphere in the transport area, and impacts citizenry throughout the depositional area.

Although it is widely recognized that soil mass transport by wind threaten sustained agricultural production and is the main factor of desertification., very little information is available about the rates of wind soil erosion and deposition in this area. The purpose of this study is to monitor the annual wind soil erosion or deposition rates in the oases of Western desert of Egypt as a guideline to choose suitable soil conservation practices or soil erosion models for controlling wind erosion or deposition hazards in the area.

MATERIALS AND METHODS

A field study was conducted on a flat, bare soil representing some selected sites of Paris, El-Kharga, El-Dakhla and El-Farafra oases during the period from 1/2/1999 to 10/6/2004. Observation of the landscape at New Valley oases area showed accumulation of drift materials on agricultural soils, which would further support the high deposition rates in this area. The dimension of each site is 100 x 100 meter. Big Spring Number Eight (BSNE) samplers described by *Fryrear (1986)* were used to collect eroded or deposited soil materials. The samplers were installed down-wind on the field at selected sites in 1/2/1999. The BSNE samplers were installed in smooth fields with relative uniform soil texture. These samplers were placed 50meters apart in the erosion fields and 100meters in the deposition fields. The differences in the mass transported of soil materials collected for each height above the soil surface using BSNE samplers at upward and leeward sides were taken as the net amount of soil materials transported by wind along field length. The amount of eroded or deposited soil materials were measured at 10, 50, 75 and 100cm height above the soil surface, where the sampling height was measured from the soil surface to the center of the sampler inlet before collect eroded materials. Samples collected in each sampler were dried at 55°C for 72hrs and weighed. The sample weight ($g.cm^{-2}$) and sampler height (m) data were analyzed to find out the highest significant relationship between height and weight of collected eroded materials. The best-fit equations were integrated to determine the total mass of transported materials from 0.1 to 1.0meter above *the soil surface*.

Surface *soil samples* (0-5cm) were collected from each site at the beginning of the experiment. Particles size distribution using the pipette method was determined according to *Klute (1986)*. Percentages of dry non-erodible aggregates >0.84 mm were determined according to *USDA, SCS (1988)*. Soil erodibility factor, I, was calculated according to *Schwab et al. (1993)*.

RESULTS AND DISCUSSION

The dominant soils of the studied sites are Typic Torrifluvents, Typic Torriorthents and Typic Torripsamments according to *Soil Map of Egypt (1982)*. The chosen sites are over 600kilometers apart and widely differ in their climatic conditions. The studied fields are characterized by their nearly flat surface and deep soil profiles. Therefore, such chosen sites represent most dominant conditions in the oases area.

The Wind Soil Erosion Rates:

Data in Table (1) summarize soil properties related to wind erosion at ten studied sites as well as the amount of eroded materials collected during the period of study. It is evident that soil texture varies from sandy to clay, where contents of sand, silt and clay range from 23.2% to 90.8%, 3.5% to 32.7% and 3.5% to 48%, respectively. The susceptibility of the clay soil at Ain-Hamada area (Balat, El-Dakhla oasis) to erosion by wind reached 37.20 $ton.ha^{-1}.yr^{1}$.Meanwhile in case of sandy soil at Qarween plain area (El-Farafra oasis) reached 434.34 $ton.ha^{-1}.yr^{-1}$. This is due to the lack of dry aggregates (>0.84mm) at Qarween plain area (4.74%) as a result of low percentage of clay fraction (3.5%) and organic matter (0.22%). On the other hand, the high percentage of clay fraction (48%) and organic matter (1.05%) in Ain-Hamada area (Balat, El-Dakhla oasis) led to increase the dry aggregates >0.84mm, and consequently, decrease soil erodibility. Need to mention that clay content enhance the formation of large size aggregates which resist wind erosion. This indicate that the susceptibility of the coarse textured soils to wind erosion are high due to the low cohesive forces among their individual particles, thereby wind forces can readily dislodge particles and initiate erosion process. Nevertheless, high clay content and organic matter in the soil provides higher cohesive forces that bind soil particles and enhance the formation of larger aggregates, which can withstand wind forces.

Table (1) Some soil properties and amount of eroded soil materials of studied fields.

Location	Longitudes - Latitudes	Soil properties: Particles size distribution (%) Sand	Silt	Clay	Texture class	Dry aggregates >0.84mm (%)	Soil erodibility (ton.ha^{-1}yr^{-1})	Period of study	Amount of eroded materials (g.cm^{-2}) as a function of height (cm) above the soil surface: 10	50	75	100	Eroded materials,Q (kg.m^{-1}width): Total	Annual	Annual soil loss (ton.ha^{-1} yr^{-1})
Paris oasis															
El-Qaser	30? 37' 13 E 24? 30' 46	74.0	8.0	18.0	Sandy loam	11.1	337.5	1/2/1999-9/6/2004	167.0	40.5	29.3	20.3	440.2	82.1	16.4
Germashen	30? 33' 53' E 24? 50' 26	78.0	6.0	16.0	Sandy loam	20.0	236.2	1/2/1999-25/11/2000	25.9	13.3	9.2	5.3	105.1	35.0	8.0
Well 25 El-Max	30? 38' 48" E 24? 32' 13	74.9	7.5	17.6	Sandy loam	12.5	317.9	1/2/1999-9/6/2004	102.5	27.8	13.3	7.2	238.5	44.5	8.9
El-Kharga oasis															
West Well 2 El-kharga	30? 32' 20" E 25? 23' 37	72.0	7.8	20.2	Sandy clay loam	7.9	383.5	1/2/1999-10/6/2004	30.2	10.4	6.8	4.4	94.0	17.5	3.5
El-Dakhla oasis															
Ain-Hamada (Balat)	29? 16' 51" E 25? 32' 46	30.0	22.0	48.0	Clay	49.3	73.2	1/11/2001-10/6/2004	20.4	8.9	6.9	5.2	82.3	31.5	6.3
El- Nashawney (Mot)	28? 56' 26" E 25? 32' 30	76.0	2.0	22.0	Sandy clay loam	17.8	257.4	25/8/2001-10/6/2004	30.2	12.8	9.4	7.3	117.3	41.9	8.4
El- Farafra oasis															
Abu - Monkar	27? 40' 55" E 26? 30' 5	40.0	2.0	58.0	Clay	72.0	29.5	1/2/1999-1/11/2001	4.8	1.6	1.1	0.9	15.8	5.7	1.1
El-kefah 10	27? 52' 22" E 26? 49' 04	66.9	13.2	19.9	Sandy loam	8.3	376.4	25/1/2000-1/3/2004	9.5	6.4	4.2	3.5	49.2	12.0	2.4
West Well 6 El-Farafra	27? 54' 47" E 27? 04' 3	23.2	32.7	44.1	Clay	29.5	161.3	16/5/2000-1/3/2004	5.7	3.8	3.0	2.2	31.0	8.2	1.6
Qarween plain	28? 36' 05" E 27? 04' 08	90.8	5.7	3.5	Sandy	4.7	434.3	24/4/2000-25/4/2001	6.5	4.0	2.6	2.1	30.9	30.9	6.2

After collecting the eroded materials, samples were dried and weighed. The amount of eroded soil mass collected from each height above the soil surface during the entire study period was combined for all locations. The vertical distribution of eroded soil mass transported with height above the soil surface is represents in Table (1). Apparently, the amount of eroded soil materials decreased with height above the soil surface, indicating that the most of the eroded soil materials occurred very close to the soil surface. Such results confirm the findings of *Fryrear et al. (1991)*. The variations in the eroded soil mass transported at each height between sites were high due to the variations in soil texture, organic matter content, soil surface conditions (surface micro-topography and roughness), percentage of dry aggregates >0.84 mm, composition of particles being transported, wind erosivity and measurement period. For example, under environmental conditions of El-Farafra oasis, the eroded soil mass transported at 0.1, 0.5, 0.75 and 1.0m above the soil surface for sandy soil of Qarween plain area (during 365 day) was higher than for clay soil of Abu-Monkar area (during 1004 day), regardless of the effect of wind speed, which differ from site to another (data not shown). On percentage basis, the rate of increase in the former approached 35, 150, 136 and 133%, respectively, relative to the latter in the same sequence. In this respect, Fryrear *et al.* (1991) stated that since wind erosion is primarily a soil surface phenomenon, any small variations due to soil surface roughness, soil surface cover and soil erodibility will change the mass of eroded soil materials being transported by wind.

Once, the total mass of eroded soil particles moved along a vertical plane at each site has been modeled, the horizontal distribution across a soil surface can be determined by integrating the fitted equations. A power expression ($Y = aX^b$) accurately described the vertical distribution of eroded materials, $g.cm^{-2}$, from 0.1 to 1.0m above the soil surface. The fitted equations for all sites were significant at the 0.01 and 0.05 significant levels, where r-values exceeded -0.95. The power equation used to describe the vertical profile was integrated to determine total eroded soil mass transported within 0.1 to 1.0m above the soil surface, Table (1). Data revealed that field wind erosion rates exhibit considerable variability between sites.

Under environmental conditions of each site, the expected decline in wind soil erosion rates in response to percentage of dry aggregates >0.84mm was observed. However, the relationship between annual soil loss and percentage of clay fraction is clear only for the studied sites at El-Dakhla and El-Farafra oases, but it is not clear at Paris oasis locations.

In case of El- Farafra oasis, the sandy soil of Qarween plain area represented the extreme condition for wind erosion. The average annual soil loss potential from sandy soil of Qarween plain area is $30.9 kg.m^{-1}$width. Meanwhile, such soil loss value reached 5.7and $8.2 kg.m^{-1}$width in the clay soil of Abu-Monkar and Well 6 El-Farafra areas. This means annual soil loss potential associated with clay soils is less than that of sandy soil by 81.5 and 73.6%, respectively. The highest annual rate of eroded soil mass transport by wind at Qarween plain area is related to the smoother surface and high sand content. The high clay content for Abu Monkar area increased the size and stability of soil colds; therefore reduced the susceptibility of soil to wind erosion *(Hagen et al., 1992)*. Exceptional being is the case of El-Kefah site, where the average annual soil loss rate from sandy loam soil was 38.8% of that for sandy soil at Qarween plain area. Also in El-Dakhla oasis, the obtained data indicate similar trend to that displayed in El-Farafra oasis, where the annual soil loss in the clay soil of Ain-Hamada area is less than by 25% of the corresponding value for sandy clay loam soil of El- Nashawney area. The average annual soil loss potential from sandy loam soils at Paris oasis (clay content ranged from 16%to 18%) ranged from 34.99 to 82.14 $kg.m^{-1}$ width. The erosion field of El- Qaser (18%clay content) yields the highest rate of soil mass transport by wind ($82.14 kg.m^{-1} width.yr^{-1}$) and the erosion field of Germashen area (16% clay content) produce the lowest soil mass transport by wind rate ($34.99 kg.m^{-1} width.yr^{-1}$). From the preceding data, the relationship between annual soil loss and percentage of the dry aggregates >0.84mm is clear for the studied locations at Paris oasis. It is evident that the power relationship ($Y=aX^b$) between annual soil loss and percentage of the dry aggregates >0.84mm is strong, where r-value is 0.84. Although the difference in clay content percentage among locations of Paris oasis was small (2%). The variations in soil surface conditions, human activity, and erosive wind action among these locations during the study period may explain the weak relationship between clay content and wind soil erosion rates. In addition, the protective effect of the natural vegetation was present during the study period in some sites.

At each oasis, the decrease in the average annual soil loss rates with increasing the percentage of dry aggregates >0.84mm could be referred to the role of dry aggregates in increasing the soil surface roughness and consequently, decrease the susceptibility of the soil to erode by wind. In this respect, *Fryrear (1995)* and *Bilbro and Fryrear (1994)* illustrated that the potential of wind erosion is influenced by the severity of the climate, susceptibility of the soil to erode by wind and the surface protection. As soil roughness increases, the soil mass transport by wind decreases. A portion of the wind's energy will be taken up by roughness.

The foregoing results point out unconsistent correlation between soil texture class and the rate of average annual soil mass transport by wind under field conditions. Also, it is evident that for all sites, the power relationship between percentage of dry aggregates >0.84mm or clay content and the rates of average annual soil loss is not significant, where r-values are -0.421 and -0.377, respectively. Therefore, it can conclude that there are many factors other than soil texture and content of >0.84mm dry aggregates effectively affect the rate of soil loss. Among these factors are the variability of erosive wind from site to another and spatial variability of soils and landforms, which need further quantitative studies. In this respect, *Morgan et al. (1997)* indicated that the erosion rate response to change in properties of the soil and severity of the erosive wind action.

According to the results presented in Table (1), the potential annual soil mass transport by wind from all flat, bare fields at New Valley oases area ranged from 1.15 to $16.43 ton.ha^{-1}.yr^{-1}$. Under environmental conditions of El-Farafra oasis, the average annual of soil mass transport by wind increased from 1.15 to $6.19 ton.ha^{-1}.yr^{-1}$, corresponding to a low and high erodibility at

Abu-Monkar area and Qarween plain area, respectively. In soils of Paris oasis, which have the same soil texture, the annual rate of soil mass transport by wind ranged from 8.0 to 16.43ton.ha^{-1}.yr^{-1} at Germashen and El-Qaser areas, respectively. Also, at El-Dakhla oasis, the average annual soil mass transport by wind increased from 6.30 to 8.38ton.ha^{-1}.yr^{-1} as soil erodibility increased from 73.2 (Ain-Hamada area) to 257.41ton.ha^{-1}.yr^{-1}(EL-Nashawney area).The average annual soil loss at west Well 2 El- kharga area is 3.51ton.ha^{-1}.yr^{-1}. It was evident that the changes in the annual soil loss rates among sites of the New Valley oases area are related to the changes in the wind erosivity factor, soil surface conditions, and natural vegetation, which were shown to have changed over the study period. The annual rates of soil mass transport by wind for all fields within the tolerable levels, except El- Qaser area. In this respect, *Troeh et al. (1980)* stated that the levels of erosion tolerance are equal to the annual losses, which vary from 2 to 11ton.ha^{-1}.yr^{-1}.

In conclusion, in the New Valley oases area, every oasis has areas susceptible to wind erosion, but the majority of severe wind erosion occurs in El-Qaser, Paris oasis (16.34ton.ha^{-1}.yr^{-1}). The unprotected soils and erosive winds during the year make the New Valley oases area susceptible to wind erosion.

The Windblown Deposition Rates:

The sites and soil properties of the deposition fields illustrate the range of conditions represented by the sites instrumented (Table 2). The soil texture of the chosen sites varies from sandy to sandy clay soil. The sites were smooth and vegetation-free, so the deposition rates of windblown sediments represented the extreme condition for each site at New Valley oases area.

Data in Table (2) show the vertical distribution of the deposited materials collected at various fields throughout the study period. It is clear that most of the deposited materials occurred very close to the soil surface. To expresses quantitatively between the deposited materials (gm.cm^{-2}) and the height from 0.1 to 1.0m above the soil surface, regression analysis was carried out. The highest significant correlation coefficient indicates that the power formula ($Y = a X^{b}$) are the best fitted equations for describing this relation and can be integrated to determine the total deposition mass of the windblown sediment over the chosen fields throughout the study period. Such equations were significant at the 0.01 or 0.05 significant levels, where r-values exceeded -0.95, with two exceptions at Well 15 El- Max area (Paris oasis, r = -0.92) and El- Nashaweny area (El-Dakhla oasis, r = -0.92).

Data in Table (2) reveal that there are wide differences in deposited materials among sites. The annual rates of soil mass being deposited over agricultural soils at New Valley oases area varied from 4.4ton.ha^{-1}.yr^{-1} at East Well 2 El - kharga area (El-Kharga oasis) to 110.6ton.ha^{-1}.yr^{-1} at Qarween plain area (El-Farafra oasis). It is clear that, the highest annual deposition rate of windblown sediment was found in Qarween plain. This may be related to the wide spread of smooth and vegetation-free sandy soils around the small newly cultivated area, as well as the highest wind erosivity factor.

Table (2) Soil particles size distribution of studied fields and amount of the deposited soil materials.

Location	Longitudes - Latitudes	Soil particles size distribution (%)			Texture class	Period of study	Amount of deposited materials ($g.cm^{-2}$) as a function of height above the soil surface(cm)				Deposited materials, Q ($kg.m^{-1}$ width)		Annual deposited materials ($ton.ha^{-1}yr^{-1}$)
		Sand	Silt	Clay			10	50	75	100	Total	Annual	
Paris oasis													
Germashen	30? 33′ 53″ E 24? 50′ 37″ N	88.0	8.0	4.0	Sandy	1/2/1999-1/11/2001	301.9	52.8	15.3	8.0	474.9	172.7	17.3
Ain-Gammal	30? 36′ 50′ E 24? 33′ 39″ N	74.0	2.0	24.0	Sandy clay loam	1/2/1999-10/6/2004	447.0	86.8	46.9	30.5	920.6	171.7	17.2
Ain-Tefines	30? 37′ 20″ E 24? 43′ 53″ N	47.4	5.2	48.4	Sandy clay	1/2/1999-25/1/2000	374.8	20.9	9.8	5.5	391.8	398.3	39.8
Well 15 El-Max	30? 37′ 56″ E 24? 31′ 15″ N	75.7	5.3	19.0	Sandy loam	25/11/2000-9/6/2004	460.7	145.8	85.9	24.2	1137.8	320.9	32.1
Well 25 El-Max	30? 38′ 45″ E 24? 32′ 13″ N	93.1	5.0	1.9	Sandy	25/11/1999-10/6/2004	642.5	216.9	####	98.6	1969.3	433.3	43.3
El-Kharga oasis													
West well 2 El-Kharga	30? 32′ 36″ E 25? 29′ 58″ N	75.7	1.7	22.6	Sandy clay loam	1/2/1999-10/6/2004	66.8	28.9	16.8	12.8	236.4	44.1	4.4
El-Dakhla oasis													
Ain-Hamada (Balat)	29? 16′ 54″ E 25? 32′ 50″ N	71.6	7.1	21.3	Sandy clay loam	1/2/1999-10/6/2004	1551.4	399.8	####	150.8	3750.3	699.5	70.0
Ain-Abde El-Wares	28? 54′ 16″ E 25? 33′ 15″ N	78.2	10.3	11.5	Sandy loam	25/11/2000-10/6/2004	120.4	17.8	9.8	4.5	204.9	57.7	5.8
El-Shosh (Balat)	29? 14′ 27″ E 25? 34′ 25″ N	65.4	9.8	24.8	Sandy clay loam	25/11/2000-10/6/2004	450.6	138.9	80.9	30.9	1144.6	322.5	32.3
El-Nashaweny (Mot)	28? 56′ 32″ E 25? 32′ 37″ N	80.3	5.8	13.9	Sandy loam	1/2/1999-10/6/2004	350.9	139.4	55.9	22.9	917.9	171.2	17.1
El- Farafra oasis													
Qarweain	28? 36′ 10″ E 27? 04′ 05″ N	90.0	4.8	5.2	Sandy	16/5/2000-1/3/2004	2805.4	299.5	####	125.3	4198.5	1106.5	110.7

The highest rate of sand deposition led to cover the cultivated field with sand, particularly in the fields lies located adjacent to the great sand plain. At the investigated fields of El-Dakhla oasis, the annual deposited materials ranged from 5.8ton.ha^{-1}.yr^{-1} at Ain-Abd El- Wares area (Mot) to 32.3ton.ha^{-1}.yr^{-1} at El-Shosh area (Balat). Meanwhile, at Paris oasis, the deposition rate of windblown sediments varied from 17.2ton.ha^{-1}.yr^{-1} at Ain-Gammal area to 43.3ton.ha^{-1}.yr^{-1} at Well 25.El- Max area. From the preceding data, the deposition of windblown sediments was simply proportional to the wind erosivity and the incoming mass of sediments at each site. This is agreement with the results of *Bielders et al. (2000),* they indicated that the amount of deposition on the mulched plots was simply proportional to the incoming mass of sediments. In some areas, the off-site costs from wind erosion may exceed the on-site costs *(Piper and Lee, 1989),* therefore, the extent of off-site costs of erosion has only recently received attention in these sites.

The accumulation of deposited materials on agricultural soils leads to soil degradation and reduces its productivity over a period of several years. In this respect, Abdel-Samie *et al.* (2000) showed that aeolian sands cover considerable areas of the Western desert. Windblown sands and sand dunes movement from neighboring high lands affects the oases of Western desert. Drift sands and moving dunes threaten many arable areas and converted some agricultural plots to barren desert land.

CONCLUSION

The current work pointed out that under hyperarid conditions of New Valley oases area, the potential annual soil mass transport by wind ranged between 1.15 and 16.428ton.ha^{-1}.yr^{-1}, which is approximately equivalent to the removal of 0.8 and 11.4mm from the topsoil surface each year, respectively, assuming a surface density of 1500.kg.m^{-3}. The annual deposition rates on chosen fields amounted between 4.4 and 110.6ton.ha^{-1}.yr^{-1}, which corresponds to an addition of 3.1 to 76.9mm of aeolian sediments on the topsoil each year. At each oasis, the annual rate of deposition of windblown materials was greater than the annual rate of eroded soil materials by wind. This study confirm the urgent needs for implementation of a successful soil conservation practices to combats the hazards of erosion and deposition by wind in order to attain the potential productivity of the New Valley oases.

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REFERENCES

Abdel-Samie, A. G.; A. Gad and M. A. Abdel-Rahman (2000). Study on desertification of arable lands in Egypt. III: Drift sands and active dunes. Egypt J. Soil Sci., 40 (3): 385-398.

Bielders, C. L.; K. Michels and J. L. Rajot (2000). On - farm evaluation of ridging and residue management practices to reduce wind erosion in Niger. Soil Sci. Soc. Am. J., 64: 1776-1785.

Bilbro, J. D. and D.W. Fryrear (1994). Wind erosion losses as related to plant silhouette and soil cover. Agron. J., 86(3): 550-553.

Chepil, W.S. (1946). Dynamics of wind erosion: V. Cumulative intensity of soil drifting across eroding fields. Soil Sci., 61: 257-263.

Chepil, W.S. (1950). Properties of soil which influence wind erosion: II. Dry aggregate structure as an index of erodibility. Soil Sci. 69: 403-414.

Fryrear, D. W. (1986). A field dust sampler. J. of Soil and Water Cons., 41 (2): 117 – 120.

Fryrear, D. W. (1995). Soil losses by wind erosion. Soil Sci. Soc. Am. J., 59 (3): 668-672.

Fryrear, D. W. and A. Saleh (1996). Wind erosion: Field length. Soil Sci., 161 (6): 398-404.

Fryrear, D. W.; J. D. Bilbro; A. Saleh; H. Schomberg; J. E. Stout and T. M. Zobeck (2000). RWEQ: Improved wind erosion technology. J. of Soil and Water Cons. (Second Quarter), 55 (2): 183-189.

Fryrear, D. W.; J. E. Stout; L. J. Hagen and E. D. Vories (1991). Wind erosion: Field measurement and analysis. Transactions of the ASAE, 34 (1): 155-160.

Hagen, L. J.; E. L. Skidmore and A. Saleh (1992). Wind Erosion: Predictions of aggregate abrasion coefficients. Transactions of the ASAE, 35: 1847-1850.

Klute, A. (1986). Methods of Soil Analysis. Part 1: Physical and Mineralogical Methods. Second Edition. No.9 in the Agronomy Series. Amer. Soc. of Agron, Inc. Publisher, Madison, Wisconsin, USA.

Moldenhauer, W. C. and E. R. Duncan (1969). Principles and methods of wind- erosion control in Iowa. U.S. Dept. of Agric., Dept. of Agron. and Agric. Res. Serv. Ames, Iowa, Special Report No. 62: 19pp.

Morgan, R. P. C.; R. J. Rickson; K. Melntyre; T. R. Brewer and H. J. Altshul (1997). Soil erosion survey of the central part of the Swaziland Middleveld. Soil Tech. (11).

Piper, S. L. and L. K. Lee (1989). Estimating the offsite household damages from wind erosion in the Western United states. USDA-ARS Staff Rep. 89-26. U. S. Gov. Print Office. Washington, DC.

Sharaky, A. M.; T. M. Labib and G. Philip (2002). Sand dune movement and its effect on cultivated lands in Africa: Case study: Dakhla oasis, Western desert, *Egypt. Proceeding* of the National Symposium of Problems of Land Degradation in Egypt and *Africa: Causes*, Environment Hazards and Conservation Methods. 23-24 March 2002. Inst. of African Res. & *Studies. Cairo Univ. Egypt: 269-286pp.*

Schwab, G. O.; D. D. Fangmeier; W. J. Elliot and R. K. Frevert (1993). Soil and Water Conservation Engineering. John Wiely & Sons, Inc.New York, USA.

Soil Map of Egypt (1982). Academy of Scientific Research and Technology, Cairo-Egypt.

Troeh, F. R.; J. A. Hobbs and R. L. Donahue (1980). Soil and Water Conservation for Productivity and Environmental Protection. Prentice-Hall Inc., Englewood Cliffs, New Jersey, USA.

USDA, SCS (1988). National Agronomy Manual, Wind Erosion. Part 502. Title 190. Washington, D. C., USA.

Woodruff, N. P.; L. Lyles; F. H. Siddoway and D. W. Fryrear (1977). How to control wind erosion. USDA, ARS. Agric. Inf. Bull. No. 354: 1-22pp.

Yousef, A. F. A. and M. Nor El-Dein (2002). Desertification in Egypt. Proceeding of the National Symposium on Problems of Land Degradation in Egypt and Africa: Causes, Environment Hazards and Conservation Methods. 23-24 March 2002. Inst. of African Res. & Studies. Cairo Univ. Egypt. 26-43pp.

رصد وتقييم معدلات الانجراف والترسيب بالرياح في منطقة الواحات

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في منطقة واحات الوادي الجديد حيث ظروف الجفاف فان حدوث عمليات الانجراف والترسيب بالرياح تهدد استدامة الإنتاج الزراعي بهذه المنطقة. في هذه الدراسة تم تقدير المعدل السنوي لانتقال حبيبات التربة بفعل الانجراف الريحى في الواحات الخارجة، الداخلة، الفرافرة و باريس باستخدام مصائد تجميع الرمال(BSNE) في الفترة من ١٩٩٩/٢/١ إلى ٢٠٠٤/٦/١٠.

أوضحت البيانات إن انجراف التربة بالرياح ومعدلات الترسيب نشيطة جداً في واحات الوادي الجديد وتختلف من موقع لأخر. أوضحت النتائج إن المعدل السنوي لنقل حبيبات التربة بواسطة الرياح يتوقف على كل من قوام التربة والنسبة المئوية للتجمعات الثابتة (> ٠,٨٤ ملليمتر) وحاله سطح التربة بالإضافة إلى قدرة الرياح الفعالة على انجراف التربة. و قد وجد ان المتوسط السنوي لفاقد التربة بكل واحة يقل كلما زادت النسبة المئوية للتجمعات الحافة (> ٠,٨٤ ملليمتر). كذلك تبانيت معدلات فاقد التربة بالانجراف الريحى ما بين ١,١٥ طن/ هكتار/ سنة في منطقة أبو منقار بواحة الفرافرة (ارض طينية) إلى ١٦,٤٣طن/ هكتار/ سنه في منطقة القصر بواحة باريس (ارض طميية رملية). بصفة عامة فان الانجراف الريحى للتربة كان معنويا في حاله الأراضي الرملية والاراضى الطميية الرملية.

بالنسبة لمعدل الترسيب بواسطة الرياح فانه كان أكثر وضوحا من معدل انجراف التربة بواسطة الرياح في منطقة الدراسة. وتباينت المعدلات السنوية لمواد التربة المترسبة فوق الأراضي الزراعية ما بين ٤,٤طن/ هكتار/ سنه في واحة الخارجة (شرق بئر ٢ الخارجة) إلى ١١٠,٦طن/ هكتار/ سنه في واحة الفرافرة (منطقة سهل قرون) ، وهذه الكمية تكافى اضافة رواسب يتراوح سمكها بين ٣,١-٧٦,٩ملليمتر سنويا فوق سطح التربة.

في كل واحة، فان متوسط المعدلات السنوية للمواد المترسبة بواسطة الرياح اكبر من متوسط المعدلات السنوية للمواد المنجرفة بالرياح. يجب الأخذ في الاعتبار تصنيف أو تقسيم منطقة واحات الوادي الجديد طبقا لمعدلات الترسيب والانجراف بالرياح في الدراسات الأخرى. توصى الدراسة بضرورة الاسراع فى استخدام تطبيقات فعالة للحد من كميات التربة المنجرفة او المترسبة حتى يمكن تحقيق معدلات الانتاج المامولة من اراضى الواحات بالوادى الجديد.