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Identification of detachment zone facieses (Case study: Konarak region)

Naser Rashki[1], Gholam Reza Rahdari[1] and Mohammad Reza Rahdari[2]

[1]*Forest and Watershed Management Organization, Iran*
[2]*Department of Combating Desertification, University of Tehran, Iran*

ABSTRACT

More than75percent of Iran is located in arid and semi-arid and wind erosion is one of the most important processes in these region. Vast areas of Iran have been out of ecological balance due to natural factors and human activities that these leading to land degradation and desertification. Wind erosion, sediment transport and dust storm among the first evident results of this destruction. Among these, wind is the main cause of erosion in these areas, detaching sediments from one place and depositing them in another. Identification of detachment zones must be in the first priority. Source identification of the sediments in Konarak region is carried out in this study that used from the method proposing by Ahmadi and Ekhtesasi as well as composes by two stages of finding the orientation and the position of the facieses of detachment zone. With using by this method the facieses were recognized to be agricultural lands with small sand dunes and nebkas, poor rangelands with semi-active nebkas, semi-active sand dunes with small nebkas, active sand dunes and sand sheets, abandoned agricultural lands with semi active sand dunes, and riverbeds and streambeds. Results show that the major causes of sediment detachment in these facieses are the recent year drought, poor vegetation and destruction of vegetation.

Keywords: Detachment zone facieses, Wind erosion, Sand dunes, Konarak

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INTRODUCTION

Iran is located in a desert belt, with arid and semi-arid regions constituting 75 percent of its total area [1]. Vastness of Iran's deserts encouraged the authors to assess its geomorphologic properties [16]. Enlargement of Iran's deserts together with the destruction of resources has intensified the critical state of the country's arid and semi-arid regions [13]. Increasing population growth rates, resource limitations, and disrupted ecological balance due to human manipulation of nature, especially in recent decades, has led to some problems in the country[15,24,32].Among these can be mentioned destructive flooding and water erosion in highlands and wind erosion in agricultural lands of arid, semi-arid and semi-humid regions[16]. Wind is the main cause of erosion and destruction, detaching soil particles and depositing them in another place. Since wind erosion is composed of the three stages of detachment, transportation and deposition, all these three areas are faced with serious damages and challenges[1].Identification of detachment zones is one primary principal of controlling and fighting erosion, since after detachment zones are identified, one can focus on the causes, rather than the effects, and take executive actions accordingly[1,13].

Operational measures are being taken to fight wind erosion in 14 provinces, at the moment, but considering the vast desert area of the country, which is estimated to be 34 million ha, the vastness of sand zones, estimated to be 13 million ha, and considering the measures taken Iran Forests, Range & Watershed Management Organizationin the last30 years, there is yet a long way to go. Specific policies and a proper outlook on controlling shifting sand are vital to preventing high costs[13]. Considering the importance of the aforementioned issues in developing an overview of the facieses, the types, and the units of the detachment, transport and deposition zones, the objective of this project is to identify geomorphologic issues of the region. Due to the importance of erosion in arid regions, a fair deal of studies has been carried out in this field, providing executive administrations with practical, fundamental information. Ardonin his paper named "Dynamics of nebkas superimposed on a parabolic dune and their effect on the dune dynamics" concluded that there were no significant differences between the rates of erosion/deposition of the five study points placed in each nebka. However, there were significant differences between the rates of erosion/deposition of the nebkas on the dynamic segments of the dunes, due to the emergence of shrubs on the crest, which trapped sand and increased the crest height. The sand trapped on the crest was not deposited on the lee side. In that case, the dune becomes narrower, higher, with a concave shape, during the transformation from a barchan to a parabolic dune. Negaresh[23] in his paper called "Geomorphologic analysis of sand dune growth pattern of eastern parts of Sistan plain in recent droughts" found that the high velocity predominant wind resulted in substantial movements of sand dunes, and also made large scale damages to the farmlands, residential areas, roads, irrigation channels, equipment, etc. over which it blew. The study also suggests that in the coming years the predominant wind will be a great threat to Chah-Nimeh water reservoirs, which are the only source of drinkable water in Sistan.

The importance of the region, due to the existing broadcasting and military installations in there as well as its encircling residential areas, farmlands and the Konarak-Chabahar connecting road has made investigators interested in aeolian detachment and transport patterns of the sediments in the region. The region encircles the coast of Konarak, including the northern coast of the Gulf of Oman and the Persian Gulf. Lots of the sand dunes of the region once used to be fertile lands and were regarded as a source of agricultural production and income to the lowlanders. Due to severe damages to its agricultural lands, however, the region is currently in a critical state. According to their responsibilities, the relevant organs have taken actions to carry out desert greening projects in order to battle growth of sand dunes. Because of the extensiveness of the issue, however, the problem of sand storms is not solved yet, and the region is still in a critical state.

The aim of this study is to introduce the research plan in Konarak region which involves field observations and investigations to identify the facieses present in the deposition zone in order to plan and manage desertification measures.

MATERIALS AND METHODS

Case study

The study of area is located between 2840107to2828886 longitude and 733558to747693 latitude in the UTM system. This area restrict from north and northwest to Nikshahr city, from southwest is limit to Jask area of the Hormozgan province in Iran, the south is by the gulf of Oman and the east curb in the range of Chabahar in Iran. The main river in the region is the Rabch that emanates from the heights of Nikshahr and after a long distance entering to Oman gulf. Coastal dunes with a height of 5meters along the coast have formed and the majority of these hills have been active and moving. In the study area in summer there is monsoon rainfall and so in the winter systematically regime that influenced by the origin of the Red Sea and the Mediterranean. Most of the rainfall in autumn and winter, and the long-term average rainfall are 94.98 mm and the average temperature estimate to 26.6°C. The average relative humidity was 65%, the mean wind speed is 6 knots, the prevailing southwest wind and 40% is the percentage of calm winds. Geologically the study area is part of the Makoran region and also follows from the nature of the zone. And in the long term the average potential evapotranspiration estimated to 2180.3 mm in the region.

Methodology

Lots of methods have been proposed for identification of erosion facieses in arid regions. Since most of these methods are open to personal biases, and identification of the facieses requires great precision, the method proposed by Ahmadiand Ekhtesasiis employed. The results obtained by using the method are presented in a collection named "Originating sand dunes in Yazd-Ardakan region" published by "Iran Forests, Range & Watershed Management Organization".

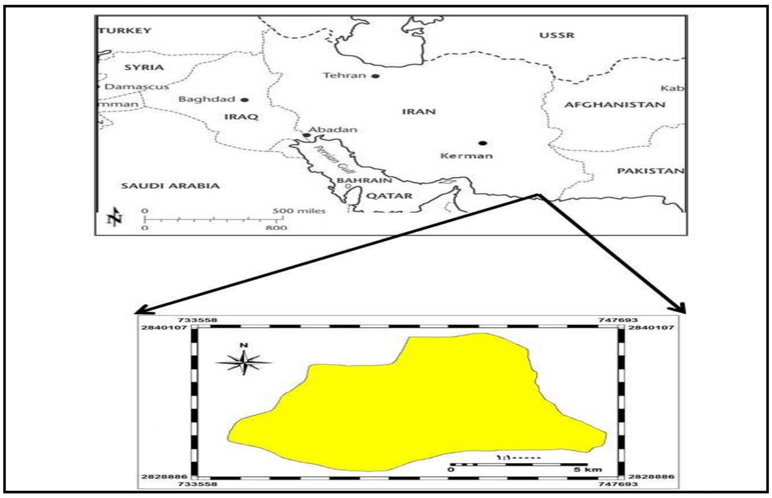

Fig 1.Location map of the study area

The current study employs that method, which is composed of two stages.

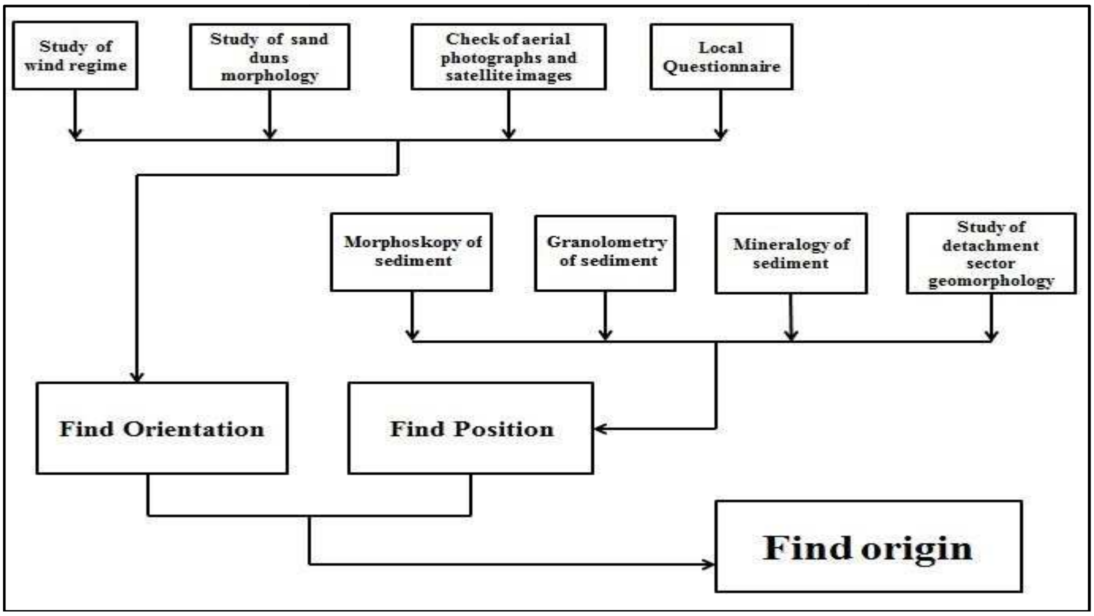

Fig 2.Stages schematic of work in this research

In first section the questionnaire was designed to collect general information on the states of wind erosion, the direction and the intensity of the erosive winds, and also to identify the winds of the region and to benefit from the views of the local people. Apart from providing information about the socioeconomic effects of wind erosion on the region, examination and analysis of the collected data can yield important information about the direction of the erosive winds and the location of detachment zones as experienced through years. Aerial pictures and satellite images of different time periods were studied to identify the direction of sand dune growth and the direction of detachment zones, and to estimate the extent of the sand dunes. Aerial pictures of the years 1344 and 1345, and satellite images from Lands at Satellite were used, and proved to be beneficial. Field investigations were carried out and GPS points were collected to verify the data from the aerial pictures and satellite images. Field operations and field investigations were carried out and 1:50,000 scale topographic maps and 1:250,000 scale geological maps were used to yield a comprehensive collection of data about the sand dunes and other facieses. Identification of the intensity, length and persistence of the winds of the region is highly important. Using the data available in the region's stations and other data related to the wind regimes, wind streamlines were drawn for the winds of the region, and the average wind rose for the region confirmed the results from the questionnaire and the field investigations.

In the second section Considering the importance of the region's morphology and with the aim of sampling from the facieses and examining them through interpretation of aerial pictures, satellite images, topographical maps and geological maps, field investigations were conducted to identify the geomorphological unit types and facieses, and to determine facieses of deposition, transport and deposition zones, afterwards.

RESULTS AND DISCUSSION

1. Identification of units, types and facieses of the region
Final studies revealed that the region under study had the two geomorphological units of pediment and play a, each containing different types and facieses.

1.1. The pediment unit
Pediment units are of vital importance in arid regions. Since the pediment unit covers a large part of the region, and also because the region's agricultural lands, residential areas and actually its entire life cycle is concentrated in the pediment unit of the region under study, the unit plays an important role in providing groundwater and underground water, and has a great effect on the economic situation of the villages and the residents. The unit that is located at the bottom of the high lands, is the extension of the main rock layer of the mountains, and is convex in from. The unit consists of the two types of erosional pediment and covered pediment. Most of the region's vegetation is concentrated in this unit.

1.2. The playa unit
The playa unit is the lowest drainage surface of the region, and includes horizontal layers covered with fine-grain sediments. Fine-grain clay, mud and such clastic sediments as sodium chloride and sodium carbonate are observed in this unit. The unit includes one type, which is a humid one, and two facieses.

The erg is influenced by northeast winds in cold months and by northwest winds in warm months.

2.Identification of the facieses in detachment zone
Identification of the facieses in the detachment zone is a delicate and complex task. Using the public views obtained from the questionnaire and comparing them with the results of the field investigations six facieses were identified in the detachment zone. These facieses will be described in what comes following.

2.1. Agricultural land with sand dunes and small nebkas
This facies includes agricultural lands. These agricultural lands are traditionally cultivated with such crops to fulfill the needs of the region, and part of the needs of urban communities. Agricultural lands of this region are ridges which are influenced by small nebkas. These nabkasare the starting point of the erosion process which happens due to ploughing of agricultural lands, and the grains are then transported by erosive winds.

2.2. Poor rangelands with semi-active nebkas
This facies includes rangelands which have lost their real function and are experiencing more and more critical stages day by day due to the recent year drought, excessive grazing of livestock, fires and cutting of the shrubs by the residents to be used as fuel. The villagers' neglect of the national plan of Balance between livestock number and grazing capacity and the relative organs lack of concern about supplying alternative forages have resulted in an alarming prospect for the regions ecosystem and environment.

2.3. Semi-active sand dunes with small nebkas
The facies includes semi-active sand dunes with small nebkas, which are located in the coastal sediment transport path. Although the vegetation of the facies has lessened the intensity of detachment and transport of sediments, it has not yet brought about a stable situation in the facies.

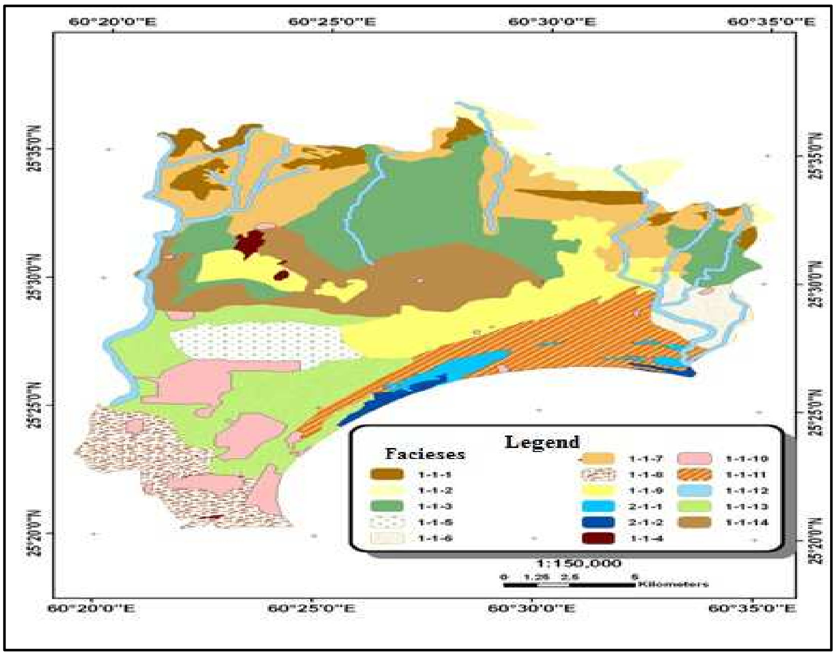

Fig3: The map of facieses in region

2.4. Active sand dunes and sand zones

This facies includes active sand dunes and sand zones, and has different geomorphic forms. Due to its edaphic nature, the facies is highly sensitive to wind erosion, is easily moved by winds and has the lowest wind erosion threshold velocity.

2.5. Abandoned agricultural lands with semi-acitve sand dunes

This facies includes barren and abandoned lands, which could be used as agricultural land a long time ago, due to good agricultural conditions like the presence of water and equipment. Because of the present limitations, however, they are not used as agricultural lands any more. Among the present limitations, lack of annual rainfall is the main one. Currently, these lands have little agricultural potential, and are faced with salinity since they are formed by deposition of Makoran formations in the plain.

2.6. Streambeds and riverbeds

The facies includes riverbed sediments which are detached from the upstream by water erosion and are deposited in the downstream. The sediments are also detached by wind erosion and constitute a great part of the aeolian sediments deposited in residential areas, agricultural lands and the installations in the region.

CONCLUSION

Protection and exclosure projects are carried out in the region, by General Office of Natural Resources and watersheds of Sistan-va-Balouchestan, almost every year. Unwise human interferences in the region and the disturbance of environmental balance have intensified land degradation and desertification of the region. Application of traditional methods of animal husbandry, poor livestock management, and the fact that the common type of livestock is small livestock with goats being most common have facilitated wind erosion and transport of sediments. To battle desertification, it is critically important to handle these factors appropriately. Without focusing on the real origin of these problems, any executive action will have just short-term impacts, and won't result in a permanent solution of the problem. Additionally, lack of fuel for the residents and lack of forage for their livestock has led to extensive cutting of shrub and destruction of vegetation. Preventing the restoration of vegetation, consecutive droughts have further intensified the problem, signaling a critical future for the environment and the natural recourses. We are going to witness complete destruction of natural resources and enlargement of sandy regions, which will ultimately result in the residents' leaving the region. Finally, it can be said that the best region to battle wind erosion and to take executive measures is the detachment region. We hope that effective and helpful will be taken accordingly through executive projects.

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