**Review Morphology coastal dunes and management of Guilan**

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**Abstract**

Dunes known as one of the most important coastal geomorphologic features and has a striking importance with respect to landscape beauty, tourist attraction, coastal birds’ habitats, agriculture, vegetation growth, and other economic issues. The vegetation impacts on the transient dunes and protect them by blocking sands among thick vegetation. [1] In Guilan province, there was a broad spread of dunes before progress of sea water. In recent years, the morphological changes of coast caused by progress of Caspian Sea level, has led to destruction of dunes. The exploitation of sand in construction activities and unsustainable exploitation of sand have several important impacts on dunes devastation. The dunes also have a prominent value from geographical morphology point of view that show the way of coast formation over natural phenomena activities (waves, flow and ebb, wind). A wide range of dunes provide an attractive place for different kinds of entertainment activities which usually has a considerable commercial and cultural value. Dunes are also used for agricultural purposes and sometimes for grazing by animals. In some places, dunes are developed for industrial sites. Running sand has even a considerable importance for construction of coastal bands and dams. Dunes are also important from aerial respects, and military substructures points of view. These various characteristics mean that different individuals and organizations have different views for directing the running sand. But on the contrary, the dunes erosion in Guilan province coasts, in some villages, the vegetation and its cultivation has improved and has also had some good results that at least caused both stability and preservation of sand movements, and provide a beautiful and safe location. However, the maintenance and protection methods have been limited from the protective point of view which different methods have not been used. In this study, we investigated the different protective methods and the condition of these dunes from the morphological and natural ecosystems point of view.

**Keywords:** coastal areas, coastal dunes, agriculture, soil protection.

**Introduction**

**Distribution of coastal dunes (Sand – hills) in Guilan province**

**Coastal boundary in Chamkhaleh– Zibakenar zone**

This zone of southern coastal of Caspian Sea is important from morphological and sedimentation pint of view. Dunes in Guilan province impacted by changes of coastal line that is as a result of natural factors and human activities. The suitable deltoid lands for cultivation attracted local residents to claim and utilize this land. This matter has caused vast degradation of total coastal structure and morphodynamic features (Figure 4).

On interesting distinctions, increasing of distance of coastal – hills (dunes) in areas that nearby of Safie-droud river until to coastal line (boundary) in which, those have kept a length to 1500 meters of costal boundary. The reason for this matter has depended on development of delta area and dried area in Caspian.
sea, that to follow prolong procedure of erosion hills in western and east regions, distance of them had
decreased to coastal bound of Caspian sea (Karami, 2002).

The conditions of coastal improved by biological and environmental management methods by using
natural forces which might have more attention to them in future programs. The cultivation of trees on dunes
in order to conservation and prevent from erosion factors show this matter have had attention by responsible
of natural resources of Guilan in a boat conservation and protection of coastal area.

More important subject of the dunes in this area merely in rural localities like as Chaf, Amir Kiasar, and
Zibakenar to morph dynamic shapes have observed. Dunes height is below of 3 meters. Plant canopy
density is very suitable and it is caused of natural conservation against to erosion factors (Figure

Coastal boundary of Zibakenar – Rezvanshahr

This zone consists of western section of Zibakenar (Eshmak River) to eastern coast of Shafarud River
in Rezvanshahr city. The economic, social and political value of this zone is very important. The industry
centers of Bandar Anzali and Qazvin watershed are main indicators in a bout above matters. Coastal zone in
this section consist of narrow width boundary (150 – 200 m) (Ghodrati, 2005) with small gravel sediments
with direction east to west in case of were nearing northern Talesh uplands to coastal shore have exchanged
to large size of gravel, occasionally in delta of many rivers in which they have exchanged to sand and shingle
high stagnant water in coastal zone and moderate climate have provided very suitable condition for
adaptation of plant cover and plant variety on coastal zone. Therefore, this matter has caused to formation of
natural protection structures (dunes) in the coastal boundary (Gharibreza, 1993).

Unfortunately concentration of urban centers and different land use in coastal lands that are consist of
habitable regions, industry area and fishing area have caused in which dunes have been destroyed; for
example from Zibakenar to direct to Rezvanshar quantity of dune erosion have increased. Distance of
coastal boundary to above dunes are very low (50 – 100 m) and the upper part of beach have comparatively
high slope. This zone has unsuitable conditions because topographical slope of sea bed in this section is
comparatively high which distance of wave surpass district to coastal boundary is very low. Coastal dunes to
east – west to direct from Zibakenar to near of Tazehabad- Rezvanshar city have been observed (Khush
ravan, 2003).

Coastal zone of Rezvanshahr – Astara

The section final of southern coastal of Caspian Sea in region and western south and west is connected
to this zone. Any effect of development of natural protection structures hasn't been observed in this zone.
Unsuitable sedimentary tissue, forest soils on coastal sediments, plant canopy density are very important
factors in presentation of formation or development of coastal dunes in this zone.

Materials and Methods

Effective factor on structure of dune
Change of Caspian Sea level

Change in the Caspian Sea level could be casual and temporarily due to one factors or combination of
multi factors such as climate change, tectonically process and human influence. The effect of any one this
factors didn’t equivalence in total changes of water level. Fluctuation of Caspian Sea level is the cause for
changes on formation and development of dunes (Blooma, 1974).

Change of water level

In addition to changes is periodic form, suddenly changes also are caused to morphological shape of
dunes is exchanged. So it can depredate the biological and structural (mechanical) agents which are made
for due to stabilization of dunes. Change of water level has caused to appearing many problems for example:
to drowned very habitat and commercial area, degradation of gardens and farm lands, dunes, Lagoon
formation, basin, growing bamboo plant and Carex in the lands in which have been effected in cause of
coming up Sea water from Langaroud region to Astara coastal area. The change of water level in coastal
boundary of Guilan providence .The line waves Surpass also have changed for example:
In Astaneh coastal area from Laskou keLayeh area to Chamkhaleh beach, erosion sediments and transition
they have changed to wave Surpass (Kozarev, 1988).

Coastal land use

Transfusion of sand and gravel on dunes in Sea beach have caused to destabilization of coastal area
and water transgression and main changes on Sea water level and waves surpass point have been become
depth and longer. Accumulation of the sand and gravel in coastal line is caused by water level changes. In
where many part of coastal area have been effected to erosion and also coastal line regressed. In sensitive
and critically area, fundament ion of unprincipally structures does to water transgression. Incompatible users of coastal lands are caused unversatility and main changes of coastal lines. In any period of regression and progression have been appeared heavy losses. In every year, users of coastal lands make livestock grazing. This land use has caused to the dunes haven’t resistance force or land reclamation have changed plant cover on beach and on the other hands dunes have become instable. This matter has effected on ecology and environmental and survival of living creatures in beach.

Waves and marine flows
One of the main factors in wave generating is the wind it is caricaturing marine flows. Marine flows are passed on Guilan province and numbers of them are enough reach (low pressure flow Island, Mediterranean, Siberia high pressure and Azure and ...) have important effected marine wave generation. In beach of Guilan province the high wave is being on October month (Autumn Season) and the height of wave is 2.75 – 5 meters and west zone (Astara). Specify time is become to 4 meter height. This generated wave on Sea water recent decade has caused movement of rivers sediments (Alluvial) in all over coastal of Guilan. In part of coastal deposition area form west to east alluvial deposition by wave has moved or deposition to different regions. This extension of sediments has ruled of striking to water level line. On the other hand the waves are main force of formation dunes (or sand – hills) and moving them to coastal margins. This wave with together the winds are important role of formation of dunes.

Human activities
On the base of filed measurement and about results, changes of new sedimentation units and human activities in order to building up Sea ports, roads, cities and creature of small lagoons in back of dunes and they have changed into the coastal geomorphology. The riparian is utilized brought ness materials on the dunes in order to construction of habitats and etc, without any encumbrance comfortably with utilization of machine (Vehicles).

Hill erosion
Hill erosion categorized in two forms
Wind erosion on the beach margins that are to direct of Sea having been depredated. Dunes (hills) formation or erosion normally could be accidental. To follow cases and dangers that plant cover is occasioned for example: drought, nutrient material lass or insensitive grazing, human activities. Transport of machines on dunes, movement of sands on dune in order to structural materials or agricultural use is caused high progression of Sea water to side of beach. If plant cover is damaged, stabilization of sands will’s permanent in Long time winds below, and fatty the sands will move to other area.

Dunes accumulation (running sands)
Main factors for formation of running sands in beach can be abstracted to bellow matters: Stabilization of sands frontal shore, back shore with low volume, severe wind blowing on the end of Season of year. The sands are accumulated on beach and so plant cover and Sea algae are accumulated on them. So the litter or rubbish is accumulated on coastal lines. Primitive plants increase resistance of surface layer of sands against to wind erosion and decreasing of wind velocity on surface of dunes. Dunes on crinite or frontal shore scattered in cause of wave activity (flux and tide). The remained plants in installation dunes in case of laying the sands among them (plants) have been protected (Posford, 1996).

Engineering for stabilization of coastal dunes
Dunes have more important role in conservation of coastal zone against of erosive factors (waves, winds), because they have expanded geometry dimension (length, wide, height) and lie in far distance of on coastal line (Figure 3). The presentation of them in coastal zone will have caused to preventing of seepage of Sea water in abnormal conditions (come up sea water, storm) and so unpresentation of them will have caused seriously degradation or intensity erosion on back shore of coastal area. Dunes have different morph dynamic relief. Their apparent form have differenced as compared with other morph logical relief because in produce of them the wind have rolled very important. This matter is differ from structures have formed in case of moving Sea water and hydro dynamical forces, which they have differenced with other wind – hills for example desert hills.

Sandy bag in order to conservation of coastal lines
Areas of coastal lines that have involved low energy to mediate energy to necessitate have low expenses and temporary protection. Long Life of this structure is lower than five years. Preferences of this engineering method are low expenses, low level of skills, native and local materials in order to protection
have recycled to coastal nature. Sandy bags with different length and their size have been utilized for formation of temporary rows, break water, beads (parting) or retaining walls in sandy-beach.

**Operation**

Structures of sandy bags can be moved with unnecessary to expensive equipments or expert human forces. These bags are utilized to each one of the coastal structures. But the effect of ultraviolet sun is low long life. In order to bury retaining walls in around of dunes, these bags mainly are very benefit.

**Result and Discussion**

**Execution method**

Move to Methodology Methods are suitable for small projects with conditions of low wave energy.

**Gabions**

The study area, sandy coastal areas have involved in medium or high periodic erosion. Coastal structures have effected to come up of Sea water. This structure is useful for conservation of beach but their expenses are high for operating. Different forms of Gabion have been made and we can load them with sands or plants. Their penetrable outer is decreasing wave energy. Gabions similar to sloppy cushion (small pillow) or vertical cub basket have been put in bonk of beach quantify it. Secondary application of them is used to the shore slope or how high, specify stone slope. And they usually don’t useful for utilization in conditions of level plan coastal lines (Figure 11).

**Sandy walls and woody walls**

Suitable area for utilization of this structures are valuable bounds on beach that have been effected coastal strength processes a like, ebb and tide. In this bounds the soils fertilize and recycling the matters, this process is doing the best of condition to coastal or entrance (delta) of large rivers. This system is suitable in open coastal lines in which have evolved natural rubble stones in upland of beach. And so in entrance of large river in order to deviation of water flows are suitable (Figure 1 & 5 & 6).

**Benefits of this structure**

**Help to sustainable of top soils on beach**

Decrease responsibility of keeping to recycling or their fortification. Difficulty of these structures is aloofness of natural process and lake of people to up lands of beach. If the coastal lands will not be controlled, it has been happened degradation of sandy mass (sand – hills) that is carried by Sea water. Woody walls or concrete walls are the structures that decreasing move of water waves on open beach or deviation of coastal wave on entrance (delta) of rivers. This structure on open beach usually is building to series forms. Because this form have been expanded on different points of coastal lines. In delta of a large river, these structures may be building to single from. The structures have been built to stone (as a structural material) and so often they are suitable. But lumber or dusty bags in point of view long life have different times (lumber: 10 to 25 years, dusty bag 1 to 5 years). In order to better conservation of soil of erosion usually retaining concrete walls have been built to fence of stones (Janssen, 1995).

**Stone cover for water flow swarm**

The area have involved in insensitive or continual erosion creating to degradation in which there are importance or precious properties as facilities of back shore. These structures have been utilized to there. The expenses of building these structures are almost high but their maintenance expenses are comparatively low. This protection way is very suitable and high long life in coastal conservation. The influence of sea water could have reduced to wave energy and this matter is caused of establishment increase in higher lands of beach. Stone rocky hinders can be suitable for controller of soil erosion and so they can be utilization to stabilizing of dunes. They increase wind energy that have involved to wave form.

**The fence of stones**

These structures have been built on value area of beach that has been exposed periodic or slight erosion. These structures are well protectors for conservation of beach. Their long life (structures: fence of stones) are between 5 – 30 years. This way for coastal protection has lowered expensive as compared with break water, or rocky break water. One of the main difficulties to this way is low long life, especially in area have been built against at Sea wave. Fence of stones have been utilized in UK (England) for protection of beach in where the protected effects of break water are unsuitable. Flexibility of fence of stones structure is possible provided different goals for coastal protection. They can decrease wave energy (Figure 11 & 12).
Fencing of wood

Other way for protection of coastal area (especially the area is connected to dunes area) is woody fence. This way has been used for protection of sandy coastal area. The use of woody fence must be planning so that with change of water level and wave pressure in coastal area will be resistance. The building structures could have been choice with measuring and resistance requires equipments so that in stormy conditions they wouldn't destroy (Figure 7 & 8).

Sometimes they have been made with cement and concrete material to combination form. Fence of stones have been made on length of dunes wall in order to protection from wave blows. This structures controlled on wave strength. We must pay attention to word; “average” “short time” in about to forecast of climate and marine conditions. These items have been distinguished long life of any functions. Fence of stone is possible available for the use of all the people in beach with danger less. In back shore of beach we can protect with this structure marine erosion dangerous and so gray sandy mass could be protected in there (Figure 7 & 8).

Operation of plant covers and grass lands

The coastal side in Guilan have recently been had density plant cover, but com up of Sea water and change of land use by degradation of beach is doubled and so fun dimensions have been build with high expensive exposed to danger destroyed. To days for protection of beach and prevents of Sea water retrogressive must be to get with mechanical structures suitable plant cover so for conservation of soil erosion and so creating green cover and attraction of tourism. Study on coastal of Guilan shows that different species have been found. In there they are suitable in order to beautification and stabilization of dunes. Accumulation of sedimentary materials to the reason wind below and waves movement on beach and so a large of area haven’t any plant cover have been caused to accumulating of dunes and their depredated or changed. Development of biological methods in order to stabilization of dunes and coastal Lands, and so creating for plant cover area and suitable Landscape can be provided to suitable conditions for tourism attraction (Figure 13 & 14).

This method is caused of economical development and occupation increasing in coastal Lands. The effect of plant cover on prevention of sediments movement and erosion of beach is as one of the methods for protection of beach. Cultivation of meadow plant is caused of stabilizing of dunes. Cultivation of meadow plants to protect soil structures will affect on stabilization of dunes in which they are one of morphological main relieves. Entering of livestock on the coastal area without allowed and unlimited have caused plant cover of beach has destroyed and sandy erosion and movement them to other area have made to high damaged.

Other method is repairmen and transfusion on the coastal

Area in which have involved to wind erosion and etc. we can prevent to erosion by repairmen and transfusion of beach. Repairmen and transfusion idiomatically are means: injection of sand and gravel for recompensing of damages resulting from erosion. If requirement resources are being provided to the same area so this stage is named to “recycling stage”.

The best management methods

All of management programmers on sandy beach must be included the following points because the probability of success will be maximized and the effects to natural or human environments would be decrease to minimum:

- Political of comparative management must be for all of area is operated before other activities had been estimated in there.
- The study on system of sandy- beach and coastal processes nearby to shore for several years and we should have obtained the logical perceive of physical and natural environments. Hastiness activities in about erosion could be make high damages and so no necessary.
- Under how the natural environment couldn’t be accepted any activities unless infrastructure or non portable capitals are being exposed to danger.
- Together with native or local groups of people for example: landlords, confederation of environmental, fishery society and consumers of material recycling have must consulate because it couldn’t be operated any management activities before will get enough information in about to coastal lines and the nearest of area to beach.
- It is always pay attention to general climate and mean of climate or unsustainable short time climate.
- Always pay attention to results of defeats of (failures) programs for example, scattered to remains of building structures in beach, dangers of about public security, destroy of welfare possibilities, degradation of Nature or land scrape.
It is regarded as all of personnel of coastal area pay attention to importance of subtle tasks in order to preventing of environmental damages and preventing of damages to arise from instabilities areas and sand-sloppy areas.

- It must be fencing in public roads to end in beach because by this way we can prevent of trampling of sands-hills (dunes) so that those haven’t scattered to other sides.

Problems of beach
1. Accumulation of population in coastal boundary and their increasing and treating of Natural resources.
2. Personal using of beach.
3. Decrease subsist variety and disappear of injury able species (marine species or arid species).
4. Geomorphologic changes of beach in duration of different time's period by natural factors and no adaptation sustainable politics in beach.

| Table 1. characteristics of dunes from Langaroud to Zibakenar zone |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Along of dune | Distance of dune (m) | Width of dune (m) | Length of dunes km | Length of coastal boundary (km) | Protection structure % | Zone |
| N-S | 100 - 500 | 150 | 20 | 29 | 69 | Chamkhal - Zibakenar |

| Table 2. characteristics of dune from Anzali beach to Rezvanshar Shore. |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Along of dune | Distance of coast (m) | Width of dune (m) | Length of dunes km | Length of coastal boundary (km) | Protection structure % | Zone |
| NW - SE | 250 - 1000 | 100 | 25 | 33 | 75 | Zibakenar - Anzali |

Conclusion

Sand dune is one of important coastal geomorphologic side effects which have a particular importance with providing a pleasant landscape, tourism attractiveness, shelter for coastal birds’ residence and reproduction location, vegetation, protection and other economical matters. The vegetation influences on the transition of dunes and protect them by means of sands location among thick vegetation. Sand suns also establish habitat for nectar plants, insects and different kind of wild organisms (Viles, 1995). A wide range of dunes provide an attractive place for different kind of entertainment activities which usually has a considerable commercial and cultural value (Kadukin, 1991). The dunes are also used for agricultural means and some times for grazing by domesticated animals. Some parts of dunes are developed for industrial sites and along with refusing of seaside dunes, which running sand has even a considerable importance for construction of coastal bands and dams.

Study of geographical morphology of sand dunes provides information about the formation of coastline by natural processes (such as waves, tide and wind). The oversusing and over harvesting of sands from river mouth resulted in changes the morphology of coastline and vegetation types. Most of dominant vegetation across the coast has been destroyed and replaced by some of plants tolerant to salinity. Instability and progression of water toward land has been promoted by harvesting of sand along coastline. The influence of vegetation in preventing of precipitation transition and coastal erosion is one of conservation approaches which will provide long term stability in coast line. The coastal lines of Caspian Sea also conserve biological diversity for some organisms such as scallops.
Fig. 1: grave clapper

Fig. 2: Dune of Jafroud beach

Fig. 3: Free dune

Fig. 4: Image satellite of Guilan province with combination 4, 3, 2 bands

Fig. 5: woody walls to protect and stabilization of sands

Fig. 6: protected walls in Astara’s beach

Fig. 7: Fence of wood for protection of dunes

Fig. 8: Fence of wood for stabilizing

Fig. 9: Fence of wood for protection of running sand.

Fig10: Fence of wood for Protection of coastal lines
Fig. 11: Unaffected concrete Structures
Fig. 12: fence of stones and unaffected marine dams
Fig. 13: stabilization of dunes in Jafroud coast
Fig. 14: Cultivation of plant for stabilization of beach dunes

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