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Investigation of drought effects on vegetation cover of Sistan, Iran

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ABSTRACT

In recent decades, drought events caused many adverse effects on humans and environment, notably in arid and semi-arid regions of the world. This many worsen the desertification process and throw away many opportunities. Several droughts have been occurred in Sistan plain south eastern Iran, and the most recent one (1999-2006) said to be the worst drought in the past 600 years and has much negative environmental, economical and social effects. In this study, changes of vegetation cover was assessed using the pre and past drought data. After interpreting the results, it was found that quantity and quality of plants reduced by 100% and that much of changes occurred in abandoned lands. Moreover, it was discovered that the main causes of plant cover desertification are natural factors and human factor of mismanagement.

Introduction

In creasing population growth, limited resources and disturbance of ecologic balance all brings some problems to the world and in turn to Iran. Some of these problems include destructive floods, severe storms, wind erosion and desertification in arid and semi-arid region.[6] till now many definitions have been propused for desert of which UNEP s definition appears to be the best and more comprehensive which stated in 1997. according to this definition, a desert is a deteriorated ecosystem with low or without plant(biomass) productivity. Common characteristic of all deserts is sparse vegetation. The word desertification refer to land degradation in arid, semi-arid and dry sub-humid (which totally they are called dry lands) due to climate change and human activities[4]. Because of recent severe drought Sistan we decided to examin its effects on plant cover (biological production) of this area. therefore the required data were gathered, plant cover area of 1997 and 2007 was determined and then changes were detected.

Harasheh and Tateishi (2003) investigated the changes in plant cover of west Asia and found that 8.5% of that area was subject to "very sever degradation". UNEP[1] (2006) studied the plant cover of Sistan using ETM, TM and MSS images. Then plant cover was classified according to selected thresholds.

Delf hydraulics with collaboration of ITC [2](2007) conducted a project of IWRM (integrated water resource management) in Sistan under the supervision of Iranian water research institute in part of this study, negative changes of plant cover of human lakes was reported.

Smith et al (2008) studied the longterm changes that occurred in plant cover and soil of England. Results showed positive plant cover change in 1996-2004 period. Soil changes occored because of legume growth and plant diversity.

Arzani et al (1999) studied the effect of enclosure on rangelands of Posht Kuh Yazd for 1986-1996 period. They reported a slow gradual change in plant cover of arid region. They orgued that it is necessary to desighn a monitoring system which records changes of soil and plant cover. Delkhosh (2006) studied the effects of drought on plant cover of Sistan-Baluchistan province. They found that forage prediction reduced by 100%. They also obserred that maternal stands of stands of studied species were reduced 30 to 70 percent. Shafie (2007) assessed plant cover of Sistan using RS and GIS and reported a negative trend in quantity of plant cover.

Materials and Methods:

Study area:

The study area covers 47560 ha between 61°32´ E to 61°56´ E and 31°11´ N to 31°20´ N lies in Hamun Saberi lake bed whithout any noticeable feature. Because of harsh climate, precipitation events is rare with annual average of 60.8 mm and average temperature of 21.8 C. maximum absolute temperature is 51 and minimum absolute is -12.

Generally, conclusions that were made in this study are based on the data which provided by Natural Resources Management Borea. In this study first we euamined the plant cover and then animal husbandry using available data of drought period.

Plant cover of the study area:

Geographical distribution of plant cover:

Depend on soil type and texture, climate adaptability and moisture availability, arrangement of plant composition is as follow:

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- Hydrophill species mostly around human lake including phragmites, Typhaceae
- Hydrophill community Aeluropos lagopoides and Cressa critica in fringes of lands located on the edage of the lake.

Water is a major necessity for these species and today lake of water leads to reduction of these species.

- Determining canopy cover percentage:

We measured canopy cover percentage of trees, shrubs, annuals. Canopy of trees calculated based on mean diameter and number per hectar and for other forms such as shrubs or annuals, we consider density and life form plus that we employed 1×1 to 5×5 quadrates.

- Carring Capacity:

Carring capacity or grazing capacity in annual specices was determined using cutiogand weightiog method.

In shrublands and woodlands with optical estimation the level of annual usage considering animal composition was determined.

- range condition and trend:

trends in annual and shrub species were explored. Those species used as rangeland. We ignored regarding the aridity of study area and lake of climax condition in studied plant communities, we employed four-factor method. With four factors including soil (erosion and plant residual), plant cover (live canopy percentage), plant composition and plant viability, the rangeland condition was assessed. We also used trend ... to determine rangeland trend.

Results:

Because of recent droughts, plant species just can be seen randomally and in tiny spots. Their growth rate is abnormally very low with lower viability so that superficically they are seem to be alive but indeed they are dead plants and should be considered as dead. Table 1 shows the floristic list of the study area.

Due to the drought in the last ten years, it is not possible to make any classification of types. Although a few types have been seen which are presented in table 2:

Aeluropos litoralis type:

This type have covered 11.82% of the study area and includes some parts of lake shore after tides. At present this type have no productivity and carring capacity with negative trend and weak condition. But according to the case studies in normal climate conditions, type condition is medium, trend is constant and capacity is equal to 2.9 AUM per hektar. Associate plant species include: Tammarix Spp, Suaeda Fruticosa, Salsola foetida, lyprus sp, cressa critica, aeluropos lagopoides.

Lagopoides type: Tamarix spp-AE.

This type covers lake edges with area of 22.07% of total study area. Tamarisk trees also suffer from droughts and their buds and browses were dried but lower part of trees remain alive and green thanks to humidity of accumulated sands. Aelorupus lagopoides also have some off-springs. Generally this type have no productivity and capacity with negative trend and very poor condition. In normal climate condition it has 1 AUM capacity, constant trend and poor condition.

Type of humid zone (Pheragmites comonis- Flood land)

This type covers 7.08% of the study area and in normal weather, is a wetland or flooded area. In carrent situation Afghanistan don't let water to enter Iran so Hamun lakes start to drying up and phragmites stands begin to be devastated. At present this type don't has productivity and capacity, its trend is negative and its condition is very poor but in normal and favourable climatic condition trend turn to be positive, range condition will be good and capacity is equal to 80 AUM per month.

In addition to above mentioned types, there are other lands such as:

- Agricultural lands of humid edge with 1532.68 ha equal to 3.23% of study area.
- Pure agricultural land with area of 12718.6 ha or 26.8% of study area.
- Lowlands and depressions with 4670.45 ha or 9.84% of total study area.
- Bare lands with 8822.18 ha, or 18.55% of total area.

Discussion and conclusion

Regard that the study area is sort of a desert ecosystem, its not true to consider every factor as a destructive agent. Indeed some agents like such as natural factors have smoothing or hardening effect on artificial factors. Two types of factors affects on plant cover:

A) Natural factors: includes low precipitation, high tempratures, high rate of evaporation, strong winds (especially 120-days wind in Sistan), droughts all adversely affects plants, increase their evapotranspiration and bring their roots to the surface and finally devastate them.

B) Destructive consequences of mismanagement:

Lake of an integrated management system for plant cover, abuse and misuse of natural resources (early grazing, overgrazing, off road driving on lake bed, cutting shrubs,…) have destroyed plant cover.

According to the results, quantity and quality of the region is likely to be negative and degraded. For example rangeland capacity reduces from 335.6 in 1997 to zero in 2003 and this trend continues moreover, condition of all rangeland in this region after drought period lower to very poor condition and the trend is negative. Delkhosh (2006) studied the effect of drought on plant cover of Sistan. He observed that forage production reduced by 100% and maternal stands were destroyed up to 70%.

UNEP (2006), Delf hydraulics and ITC (2007), Shafie (2007) investigated the trends in plant composition and quantity of plants in Sistan and report a negative trend which is in accord with

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