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## RESEARCH ARTICLE

### INVESTIGATION AND TYPOLOGY OF VEGETATION IN THE WEST COAST LANDS OF MAHARLOO LAKE AT FARS PROVINCE, IRAN

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#### ABSTRACT

Maharloo Lake covers an area of 257 square kilometers that located on 18 kilometers East of Shiraz province. This research aimed to investigate the vegetation of lake's western border lands. To gather the necessary information, the vegetation types were made on the basis of geomorphic and then within each vegetation type, sampling the vegetation was done completely and randomly using transects method and a transect of 30 meters and three transects per each type were performed. Finally, after specifying plant types and plant species and their specifications, they were pointed to the solutions.

#### INTRODUCTION

The vegetation has not formed and developed randomly in natural systems and all flora develop in appropriate site according to their nature and needs. Each vegetation has a special genera with defined limits by virtue of their tolerance, adaptation, ecologic field harmony and development potential and ability and in fact, it reflects the ecologic conditions and evolution process. Reasonable and stable maintenance, management and exploitation concerning the floras and rangelands depends on comprehensive, scientific knowledge. Lack of such knowledge leads to inappropriate exploitation of the vegetation and imbalance among natural ecosystems' elements and the environment depending on the flora changes; then the plants may not protect themselves and survive and gradually the low quality plants replace the high quality and useful ones and finally new ecosystem elements change leads to new flora replacing the previous one (Owfi, 1998). Thus considering the important role played by the plants to balance ecosystem it is unavoidable to know the relation between the plants and environment factors to protect the plants and their stability. Non-normative perceptions and use of these plants for forage or otherwise, would jeopardize the survival of the same. To prevent the destruction of this cover and to protect them first step is to fully understand the relevant ecosystems in terms of ecological, edaphic, botanical, etc.

Given the importance and the need for planning for sustainable use of these plants, answers to the following questions in the survey indicated that Maharloo lake and their marginal lands were saline lands in the country, especially in the Fars province. The research questions taken into consideration were:

- What is the role of plants in the selected region in terms of habitat, soil conservation, production and ethno botanical uses (used by the people)?
- What methods and mechanisms are to be implemented to improve the plants utilization and conservation?

#### MATERIALS AND METHODS

The basin of Maharloo Lake is within the geographical area 52° 14' to 53° 28' East and 29° to 29° 57' North and from the northwest to the southeast it stretches the length of it along the width of up to 160 kilometers along the Sarvestan plain and the maximum region is about 43 kilometers. The pool area is about 4272 square kilometers. The amount of 2323 square kilometers are highlands and 1949 square kilometers are plain areas (Organization of plan and budget of Fars province, 1992). The highest place is Gorr, about 3720 meters height and the lowest point at the center of the northwestern part of the lake is at an altitude of 1460 meters. The average height of the lake is 1,500 meters above sea level (Organization of plan and budget of Fars province, 1989). Figure 1 shows location of Maharloo Lake at Fars province in Iran. By virtue of the statistic data of the Shiraz Synoptic Climatology station, the yearly rainfall (P)

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is 315.50 millimeters in the studied region according to Coppen classification system and the mean yearly weather (T) is 17.50 centigrade and the rainfall is of Winter type in the region and considering  $T < P < 2T$  it is in steppe region.

**Second step:** At this stage, initially due to the topographic maps as a base map, and also to the region and due to the way points are marked on the map, it was attempted to justify the map on the floor and using altimeter and compass, range of



Figure 1. Location of Maharloo Lake at Fars province in Iran

The 37 years statistics confirm that the case study limits have moderate Winter and temperate Summer in a way that the maximum daily mean is 25.60 centigrade and the minimum daily mean is 9.40 centigrade and the maximal absolute daily temperature is 43 and minimal is -14 centigrade. The most regional rainfall begins from late November, decreases in the late April and it is near zero in Summer. The yearly rainfall rate is 315.50 millimeters and the maximal daily regional rate is 43.10 in thirty years. Generally the mean wind speed was low in the case study and Azar (From 22, Nov. to 21, Dec.) and Dey (22, Dec. to 20, Jan.) are the calmest months with 56 percent calm weather and Ordibehesht (21, April to 21, May) and Khordad (22, May to 21, June) are the most windy with 29 percent calm weather. The rapidest wind is 21 knot (Knot = 0.5 m / sec.) in Ordibehesht (21, April to 21, May) and Khordad (22, May to 21, June). The wind direction is mostly northwest and west in all months (Owfi, 1998).

## MATERIALS AND METHODS

The general trend of these studies are as follows:

**First step:** collecting information, documents, maps in the field of study, research and reports done on these topics: At this point, all the research and information that has already been done in the area of vegetation in the region were collected, of course, some of them being used are approved, the topographic maps in scale of 1:50/000 range in each individual case as well as aerial photos in the scale of 1:55/000 were obtained and the mosaics were also taken from them.

different lands were identified and finally detected. Vegetation types based on geomorphic were taken into consideration because the classification of types of vegetation will be based on the geomorphologic units. For this typology, geomorphologic maps and aerial photos were used in each type by performing field operations, mass concrete presentation and in the stands, just complete random sampling line transect method was used. The types are named according to the species or dominant species

**Third step:** This includes headquarters operations, setting information and data analysis has been finalized (Owfi, 2016).

### Sampling

**Sampling method:** The sampling was done randomly completely for flora studies because it is more trustworthy and important in view of statistics though it is more expensive and longer than the systematic method (Owfi, 2016), but it was used because we needed more important data for this study and similar ones. The line transect method was used for sampling because it is more trustworthy in all views and is most careful study method for pasture flora and also used as reference method for the plants' canopy (Moghadam, 1998).

**The transect length:** The line transect length changes depending on the plant covering and if the length is longer, it is more trustworthy but needs more time. Usually if the covering is 5 – 15 percent, the transect is 15 m and if it is less than 5 percent, the length is recommended 30 meters (Moghadam,

1998), here considering the pasture covering is more than 5 percent, the transect length was considered 30 m to have more careful conception about the vegetal covering.

**The number of the transects:** The number of the line transects changes in each type; of course, it has reverse relation with the transect length namely if it is considered longer, it is possible to use less transects. Usually three transects are considered in each type to show acceptable data and of course (Moghadam, 1988), Generally considering economic considerations and manpower it is necessary the samples be the least based on taking into consideration careful study affairs in a way that the maximum data be available (Noe, 2000). Three transects are used in each type in this study.

**Range condition:** Having defined the condition of each plant type the American Forest Service known as Dr. Goodwin's method in Iran was used. The method is based on six factors, on the other hand, it has six grades for the range condition and the grades. in the method there is a table for each factor effective in defining the condition and by virtue of the case study each factor has a point and total points indicate the final range condition (Owfi, 2016).

**Table 1. General information about vegetation types**

Type number	The dominant species	The length on the west coast for each type(Kilometer)	Condition	Trend
1	<i>Artemisia sieberri</i>	1/9	Medium	Upward
2	<i>Astragalus arbusculus</i> – <i>Eryngium bungei</i> – <i>Echinops robustus</i>	5/1	Medium	Upward
3	<i>Echinops robustus</i> – <i>Astragalus arbusculus</i>	3/8	Medium	Upward
4	<i>Juncus sp</i>	8/2	Good	Upward
5	<i>Astragalus arbusculus</i>	3/3	Poor	Upward

**Range trend:** Then the Balance Method was used to measure the range trend; there is table in this method indicating points according to the specifications and range condition; the points relate to regression signs in the plants and soil. Finally, the total positive and negative points are shown by algebraic addition indicating the range trend. If the algebraic addition in two columns is more than +3, the trend is positive or upward and if it is less than -3, the trend is negative or downward and if it is between -3 and +3, the trend is static or fixed (Owfi, 2016).

## RESULTS

Here, the results showed the five types of vegetation so that include each vegetation type, dominant species, some related species, length of the western edge of the lake that cover the type, condition and trend of the type which are summarized in Table 1. According to studies conducted in the region, five vegetation type is identified and presented as follows (Owfi, 2016).

### Plant Type No. 1 (*Artemisia sieberi*)

The dominant species of this type is *Artemisia sieberi* of ompositae family which is a perennial plant with herbaceous

growth and palatability degree of II. Some species of this type include:

- *Stipa barbata* of Gramineae family and palatability degree of III.
- *Astragalus arbusculus* of Leguminosae family and palatability degree of III.
- *Echinops robustus* of Gramineae family and palatability degree of III.
- *Amygdalus scoparia* of Rosaceae family and palatability degree of III.

The tree *Ficus johannis*, however, can be found only in the bases of rocks. Due to improper slope type, there is not any agriculture and arboriculture in the region. The condition of this type is moderate and its trend is upward. In hillsides, the average slope of this type is about 31%.

### Plant Type No. 2 (*Astragalus arbusculus* –*Eryngium bungei* –*Echinops robustus*)

The dominant species of this type, respectively, are: *Astragalus arbusculus* of Leguminosae family is a perennial plant with

herbaceous growth and palatability degree of III. Then, *Eryngium bungei* of Umbelliferae family is also a perennial plant with herbaceous growth and palatability degree of III. *Echinops robustus* of Compositae family is a perennial plant with herbaceous growth and palatability degree of III. The other related type includes *Artemisia sieberi* of Compositae family and palatability degree of II. As type No.1, *Ficus johannis* can be found only in the bases of rocks. In high slopes, *Amygdalus scoparia* species can be found. Due to improper slope type, there is not any agriculture and arboriculture in the region. The condition of this type is moderate and its trend is upward. In hillsides, the average slope of this type is about 27%.

### Plant Type No. 3 (*Echinops robustus*–*Astragalus arbusculus*)

The dominant species of this type, respectively, are: *Echinops robustus* of Compositae is a perennial plant with herbaceous growth and palatability degree of III. Then, *Astragalus arbusculus* of Leguminosae family is also a perennial plant with plant growth and palatability degree of III. The other related type includes *Eryngium bungei* of Umbelliferae family with palatability degree of III. *Ficus johannis* and *Amygdalus scoparia* can be found only in the bases of rocks and in high slopes, respectively. There is not any agriculture and

arboriculture in the region. The condition of this type is moderate and its trend is upward. In hillsides, the average slope of this type is about 15%.

#### Plant Type No. 4 (*Juncus sp*)

The dominant species of this type is *Juncus sp* of *Juncaceae* family which is a perennial with herbaceous growth and palatability degree of II. Its native name is "Khonk". The other related type includes *Taraxacum seratinum* of *Compositae* family with palatability degree of I. In terms of phenology, the time between flowering and seeding is not significant so that in the middle of winter, for a while, the plant can also be seen in the flowering and seeding stage simultaneously. Compared to other types, this type has the highest coverage in the region. Average slope is about 2% which has created a good condition for farming and arboriculture. The main garden areas are located in this region. On the other hand, agriculture is also partly seen in this type. The condition of this type is good and its trend is upward.

Table 2. General information about plant species

No	Species name	Family name	Plant life	Growth habit	Nutritional value
1	<i>Artemisia sieberi</i>	Compositae	Perennial	Grass	II
2	<i>Stipa barbata</i>	Gramineae	Perennial	Grass	III
3	<i>Astragalus arbusculus</i>	Leguminosae	Perennial	Shrub	III
4	<i>Echinops robustus</i>	Compositae	Perennial	Grass	III
5	<i>Amygdalus scoparia</i>	Rosaceae	Perennial	Bushy Tree	III
6	<i>Eryngium bungei</i>	Umbelliferae	Perennial	Grass	III
7	<i>Poa bulbosa</i>	Gramineae	Perennial	Grass	III
8	<i>Atriplex leuocladia</i>	Chenopodiaceae	Perennial	Grass	II
9	<i>Juncus sp</i>	Juncaceae	Perennial	Grass	II
10	<i>Cressa cretica</i>	Convolvulaceae	Perennial	Shrub	III
11	<i>Taraxacum seratinum</i>	Compositae	Perennial	Grass	I
12	<i>Ficus johannis</i>	Moraceae	Perennial	Tree	III

#### Plant Type No. 5 (*Astragalus arbusculus*)

The dominant species of this type is *Astragalus arbusculus* of *Leguminosae* family is a perennial with plant growth and palatability degree of III. The other related types included are: *Echinops robustus* of *Compositae* family with palatability degree of III; *Poa bulbosa* of *Gramineae* family with palatability degree of III; *Atriplex leuocladia* of *Chenopodiaceae* family with palatability degree of II and *Cressa cretica* of *Convolvulaceae* family with palatability degree of III. In abundance, *Poa bulbosa* can be found in arable lands that have a greater distance from lake. *Cressa cretica* can be seen in smaller amount in arable lands that have a smaller distance from lake. The regional average slope is around zero percent and water is visible on the ground. There is a permanent peat and certain plants can be seen that are resistant to high humidity conditions. The condition of this type is poor and its trend is upward.

## DISCUSSION AND CONCLUSION

Vegetation was studied in the five types of analysed area with the largest area coverage belonged to fourth type species *Juncus sp* and the lowest coverage is also seen in the fifth type. Most species in the area of distribution is *Astragalus arbusculus* that is seen dominant at three types and subdominant at one type then another species is *Echinops robustus* that is seen dominant at two types and subdominant at

two types that cause of these is extent of biological spectrum of these plants. The lowest species in the region is *Cressa cretica* at the fifth type fallow farmland with short distance from the lake, and then another species is *Taraxacum seratinum* that is seen in fourth type and then is *Poa bulbosa* that is seen at Fifth type fallow farmland with far distance from the lake. Of all species in the area, just *Taraxacum seratinum* has palatability I. of course, as it mentioned, it is seen at the fourth type with very little quantity. Other species have palatability II and III. Most species are herbaceous and perennial. Regional type from poor to good condition variable is just the fourth type that have good condition and fifth type and other type have poor and moderate condition. All types have upward trend because it is protected by the Department of Environmental Protection as well as the province's Department of Natural Resources. There are high slopes in first, second and third types but they are not in fourth and fifth types. Because of these slopes, we can see *Ficus johannis* species in high lands and border of rocks in first three types, also there is *Amygdalus scoparia* species in slopes of second and third types. In the previous studies conducted in the area, results of "probe is similar to this, except in a few cases, differences are sight.

Sedighian studied in 1975 [2] and Plan and Budget Organization of Fars province in 1992 [14] and Plan and Budget Organization of Fars province in 1989 [13], including research in the region that is in all three cases, Western edge of the lake is divided into five divisions in the recent research and we have five separate types, and just in terms of vegetation parameters, the differences in the results of their research is due to the trend and condition and other parameters that varied vegetation.

#### Suggestions

- Animal livestock in the area are a few, so, is not seen intensive grazing in the area, only when nomads with their herds from cold regions of Kohkiluyeh and Boyer Ahmad province migrate to tropical regions of Fars province and conversely, intensive grazing is seen. Because the road from Shiraz to Sarvestan is along coast of the Maharloo lake, so at this time a lot of animal livestock that pass through this area, graze this rangeland intensively. For solving this problem, the route of nomads migration must change to another route, far from this region
- Cutting plants for cooking and heating in the region are seen as a reason for the lack of urban gas pipelines in the region and need to do this or delivery of gas cylinders should be permanent.

- Due to the proximity of the lake to the city as well as its own beauty, good tourist situation in this region can be seen. According to the principles of conservation, domestic and foreign tourists must be attracted by concerned organisations.
- This area is the most important center for salt producing in the province and the number of factories are being added day after day. It must be taken place based on the principles of conservation and sustainable development.

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