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# Positioning of appropriate land uses for forest management by multi criteria decision methods and GIS (Dareh Vesyeh Watershed in Tehran)

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**Key words:** Multi-criteria decision method, forest development, Vesyeh watershed, AHP, GIS, ecological, plant species.

**Abstract**

According to natural forests deterioration along with human population increase and need to forest services, forest development, and afforestation is of inevitable importance. For this purpose, the present study aims to determine suitable area using multimedia evaluation. Effective environmental criteria were determined in evaluation of area potential with regard to study purposes. In this regard, there counted variable purposes for the present study, including: physiographic, temperature, precipitation, land, soil (depth, texture, and drainage), hydrology and land use planning. Using GIS, required information were overlaid to produce isotope environmental unit. Determined limit was identified by Boolean logic using AHP. Qualitative index and total value were computed using 2-polar comparison and SAW, respectively. Results showed that 1378 ha of 2516 ha lands profited of more suitable for forest development, of which 374 ha, 424 ha, 285 ha and 295 ha had shown more suitable, suitable, weak and very weak situation for forest development. Totally, 798 ha were presented as appropriate land. In addition, paying attention to ecologic units, existence of non-indigenous and indigenous species adapted to area and ecologic needs, following species were suggested: *Juniperus Polycarpos, Amygdalus scoparia, Celtis caucasica, Elaeagnus angustifolia, Berberis crataegina, Pinus eldarica, Amygdalus lycioides, Morus alba.*

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**Introduction**

According to increasing growth of population and vehicles, especially in Tehran as a center of human activities, forest development is greatly effective in improvement of urban environment quality decreasing pollution deduced by Gas and chemical dispersion. We must develop new procedures that help reverting forest deterioration. It is necessary to preserve forests and find a way, from diverse approaches, to manage them adequately, *i.e.*, forests must be considered multipurpose biological systems (Jaimes *et al.,* 2012). Hence, creating green spaces in cities is of vital importance. Nowadays, developed countries, altogether, as well as almost developing countries understood that applying an appropriate land use planning is essential for preservation of natural environment. Therefore, land evaluation studies, as an approach is inevitable to profit from the resources on basis of suitable scientific methods. Forest development throughout the Dareh Vesyeh watershed, as regards the geographic location and access to the indigenous communities is so vital. Because using suitable locating of forest development along with presentation of appropriate species for afforestation, in addition to saving the time and invests, is an effective pace in preservation of the environment and society health. However, different species are found in different climate, hence, presentation process has to be carried out upon study of the area as well as identification of suitable locations, ecologic properties and adaptation. GIS potential in analysis of data could be useful in solve of difficulties and forest and green spaces development throughout the mega cities such as big Tehran. The present study seeks to identify the appropriate lands to forest development using multi-criteria decision methods (MCDM) and GIS along with proposing appropriate species for afafforestation in the study area. (Jozi *et al.,* 2011, Javanmiri pour *et al.,* 2012) assessed the ecological potential of Bolhasan region. Results showed that about 599 hectare (35.59 percent) of Bolhasan Forest region located in high, 471 hectare (27.97 percent) in good and 614 hectare (26.44 percent) in weak situation. In order to land assessment, using GIS throughout western Ilmak and central Black Sea in Turkey, (Dengiz *et al.,* 2010), divided the ecological potential of the studied area into 3 levels: High suitable area for afforestation; suitable area for afforestation; unsuitable area for afforestation. Moreover, for suitable area following species were proposed: *Populous sp; Pinus pinea; Pinus radiate; Pinus pinaster and Salix alba.* (Jiang fan, 2007), presented *Fraxinus mandshurica* and *Pinus sylvestris* to assess forest ecosystem recycle in mountain region**.** (Dangkhoi *et al.,* 2010), using multi-criteria and GIS methods, presented suitable area for wheat cultivation in Tamdao national Park in Vietnam and divided the study area into three parts: The most suitable part (28.1%); Suitable part (28.77%) and unsuitable (19.17%)**.** (Martin *et al.,* 2009) applied remote sensing and GIS. Soil, plant coverage, precipitation, and temperature has been calculated by TM landsat and analyzed by GIS. Results showed that agriculture lands (47%) could increase up to 71%. (Hasmadi, 2009) studied ecological potential of Malaysia Peninsular forest region using MCDM and GIS methods. Results showed that 96% of the area profited from suitable condition for forest development and the rest area would be protected for future developments. (Bobade *et al.,* 2010) investigated Madhya Pradesh region in India using GIS considering soil, climate, and land factors. Analyses presented 2 applications for the area: Forest area: 44% of the study area- agricultural lands: 56% of the study area. To study the afforestation potential of land in Thuthien located at Vietnam, (Nguyen, 2010), applied multi-criteria along with GIS method. In this regard, geomorphologic, environmental and socio-economic factors were investigated. Collected data and maps were integrated to locating forest development. Afterwards, analyzing the outputs, forest was divided into 6 parts: Productive forest; over deforestation lands, agricultural lands, pasture, shrub, and wasteland**.** Overall, there reported 4 groups, suitable for afforestation: high potential afforestation; mean potential afforestation, low potential afforestation and very low potential afforestation.

## Materials and methods

*Study area*

Dareh Vesyeh watershed stretched with 2516.53 ha in northern Iran and southern Alborz Mountain, located in western Tehran and eastern Alborz province. Highest and lowest height of the area was calculated as 2546 m height of sea in eastern and 1318m in southern region on the asphalt way of Tehran-Karaj. Area climate was semi-dry and cold (Fig. 1.).

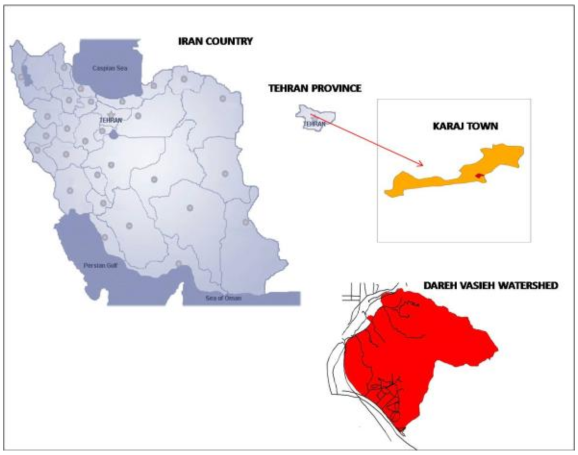


**Fig. 1.** Geographical position Dareh Vesieh watershed.

*Methodology*

*Materials*

The executive organizations provided the topographic map with DGN format, soil map, and geology map with a scale of 1:25000. The maps for height, slope, aspect, hypsometry, isometric, isothermal, river layer, and land use planning were produced in GIS using the information collected from the related region through visiting the region and air photography. Some pieces of GIS software including Arc/GIS, Ozi-Explorer, Expert Choice, and side programs such as Google Earth, Word, Excel and Export to kml were employed in this research.

*Methods*

Basic studies: In this step, ecologic studies including physical factors, includes physiography; soil, geology; climate; hydrology; water resources and biological factors such as plant coverage. Producing the topography map in 1/25000 scale, by DGN format, digital elevation model (DEM) was prepared. Besides, slope, orientation and hypsometry maps were provided using Makhdoum classification function in 1/25000 scale (Makhdoum, 2007).

*Data gathering*

Aggregate the collected information is a major step. To achieve a unit information layer, using GIS maps were aggregated and the units smaller than 10 ha were generalized to the larger ones.

*Removing the limitations*

To accelerate the research process, identification of limitations, which were not along with the study purpose, was so vital. To this aim, Boolean was applied to identify the permanent limitations appeared in soil layers, slope and height. Therefore, layers with weak drainage, stony outcrop, slide, slope more than 65%, and height higher that 3000 m classified in absolute limits and there considered zero value for them. Around river layer in 50 m distance from each side, residential region layer, farms, and agricultural lands were also grouped within absolute limits.

*Identification the effective criteria in forest development and weighting the criteria*

In the study area, 8 effective criteria in forest development, including slope, orientation, height of sea, precipitation, temperature, soil drainage, soil texture and soil depth were identified. This process was carried out using AHP (analytical hierarchy process) method, couple comparison of experts and by help of EXPERT CHOICE. In addition, group AHP was applied to equalization the different experts' opinions (Qodsi Pour, 2008).

*Evaluation of ecological potential using MCDM*

To this aim, in order to location suitable locations for afforestation multi-criteria method was applied in three steps. Firstly, qualitative scale was converted to the quantitative ones. A common way to measure a qualitative factor is use of bipolar scale applied in the current study (Asqar pour, 1998). Second step is unscaling, which aims to measure the converted factors. For this purpose, there reported several methods, of which present research applied linear unscaling. In third step, through using simple additional weight (SAW), which is subtypes of compensatory model, is applicable for total valuing of units. It means that value of each factor multiplies in its weight. Afterward, according to total achieved weight, units were ranked and 25% of the highest values was classified as the most suitable area and 25% of the lowest values was ranked as the most unsuitable area. Totally, there defined 4 groups for the area without absolute limits.

*Suitable species in afforestation*

Determining the appropriate lands for development forest, according to indigenous species in the studied area as well as ecological potential collected from different sources (Sabeti 1977, Karimi, 2002, Mozafariyan, 2004) and also ecological properties, species were specified to each homogenous unit (Fig. 2.).

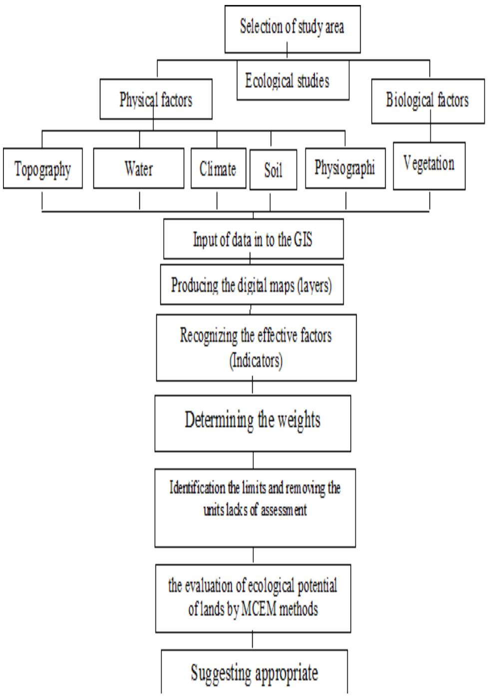


**Fig. 2.** Flowchart of research steps.

## Results

*Ecological factors studies*

Results of ecological factors studies, including physical or biological factors were applied as map and data. Slope map in 9 levels, major part in 5th level (30-65% slope) (Fig. 3.), geographical aspect map in 5 levels, major part in 2nd level (northern) (Fig. 4.), hypsometry map in 4 height level, major part in 2nd level (1400-1800 m) (Fig. 5.), isothermal layers map in 6 levels, major part in 5th level (12-14 °C) (Fig. 6.), iso-percipitation layers map in 10 levels, major part in 2nd level (350-400 mm) (Fig. 7.) and soil map in 10 levels (Fig. 8.) were prepared.

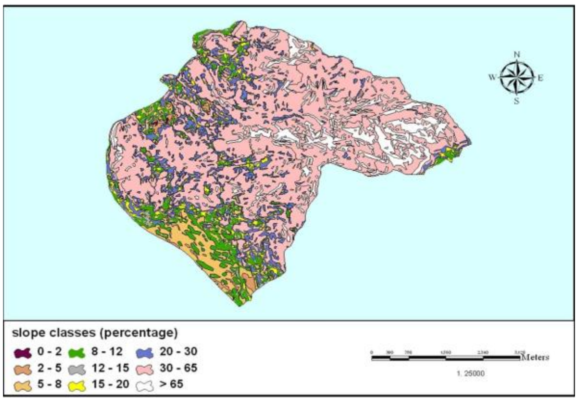


**Fig. 3.** Slope classes in the study area.

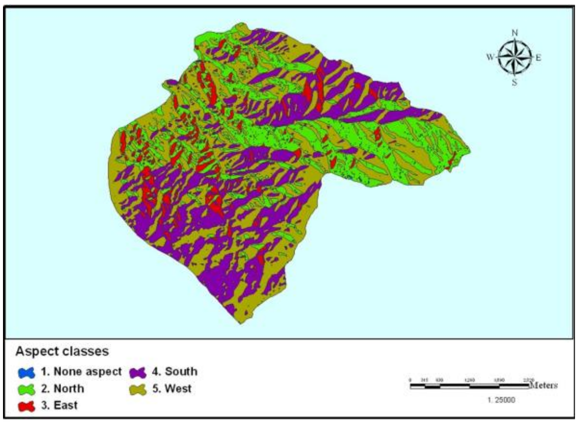


**Fig. 4.** Aspect classes in the study area.

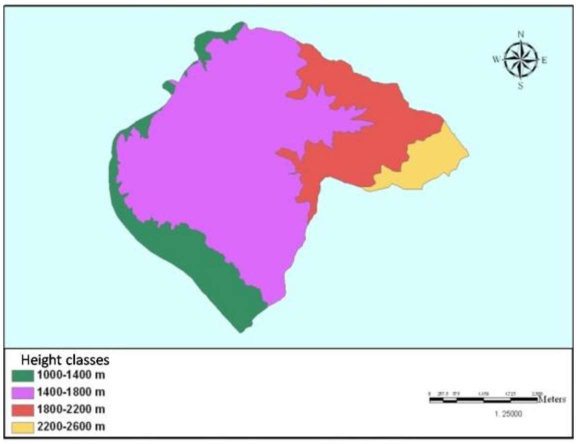


**Fig. 5.** Hypsometry map in the study area.

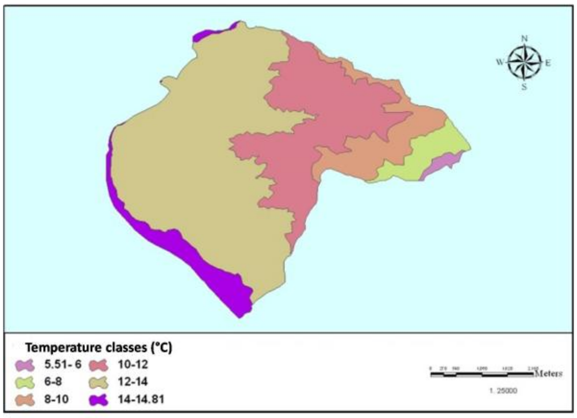


**Fig. 6.** Isothermal map in the study area.

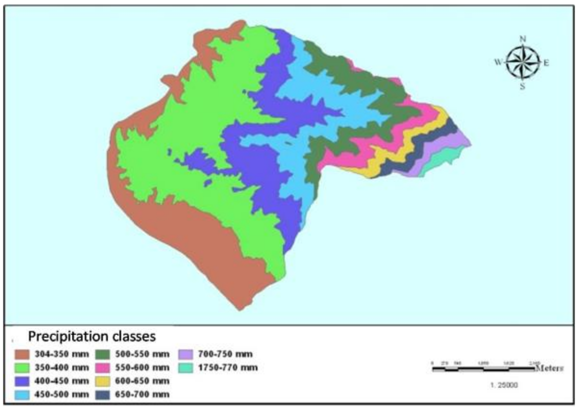


**Fig. 7.** Iso-precipitation map in the study area.

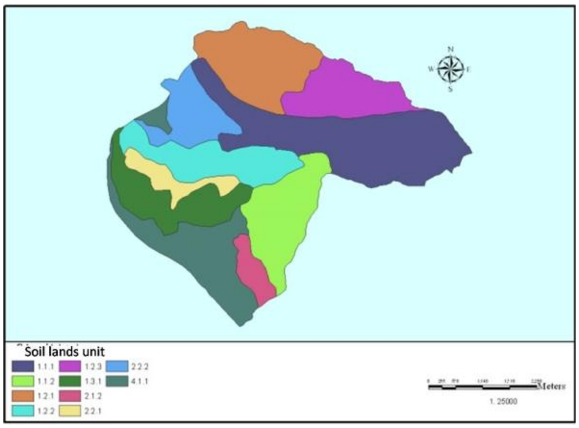


**Fig. 8.** Soil map in the study area.

*Aggregating the Data and Producing the Homogenous Units*

By aggregating eight data layers (thematic maps) and post processing of it, 2949 land unit were established and used for next stage and performing the evaluation methods ( Fig. 9.).

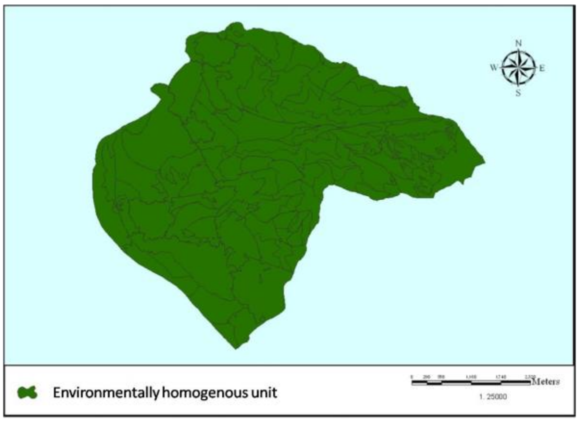


**Fig. 9.** Environmentally homogenous units map prepared by integrating ultimate primary data.

*Removing the absolute limits by evaluation process*

Limits in the studied region consisted of a 50 m limit of 3rd and 4th branches of river stretched in 568.74 ha, residential area and farms totally in 449 ha, stony outcrop layer in 149 ha, slope more than 65%, 316.5 ha, units susceptible for sliding and layers with weak drainage, 71 ha which altogether were removed from ultimate information layer. So that the achieved layer lacks of absolute limit of forest development stretched in 1378 ha consisted of 51 minor ecosystem units (Fig. 10.).

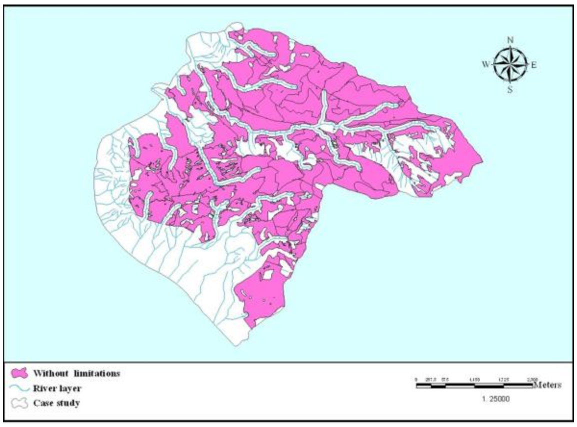


**Fig.10.** Homogenous land units without limitation.

Results of weighting based on experts opinion shows that the most and least total weight reported for height of sea (0.225) and slope (0.060) (Table 1).

**Table 1.** The weights of factor with base on AHP method.

| Factors | Height | Temperature | Precipitation | Soil drainage | Soil texture | Soil depth | Aspect | Slope |
|---|---|---|---|---|---|---|---|---|
| Weights of factor | 0.225 | 0.148 | 0.170 | 0.067 | 0.102 | 0.140 | 0.087 | 0.060 |

*MCDM*

SAW method was applied to determine the total weight of units and results show that 374 ha, 424 ha, 285 ha and 295 of the area without no absolute limit, profited from more suitable potential, suitable potential, weak potential and very weak potential for forest development, respectively (Fig. 12.).

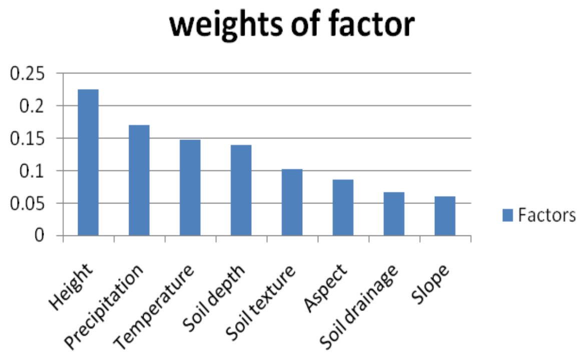


**Fig. 11.** Flowchart of criteria weight.

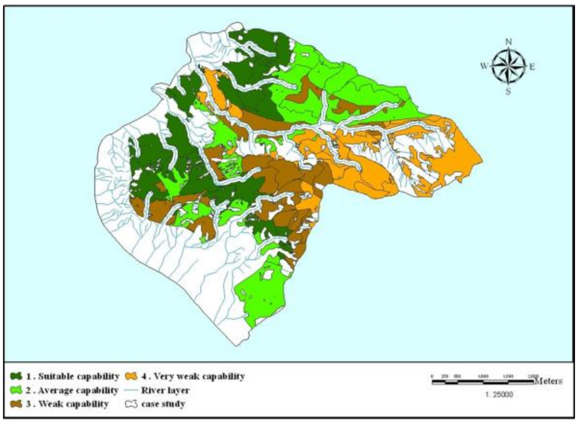


**Fig. 12.** Ecological capability evaluation by MCEM method.

Layer 1. more suitable capability for forest development with 374 ha in area

Layer 2. average capability for forest development with 424 ha in area

Layer 3. weak capability for forest development with 285 ha in area

Layer 4. very weak capability for forest development with 295 ha in area

In the present study, Layer 1 and Layer 2 with 374 and 424 ha area were presented for afforestation project. So that, 798 ha and 26 ecosystem units of the studied area had shown less limits for the study (Fig. 13.).

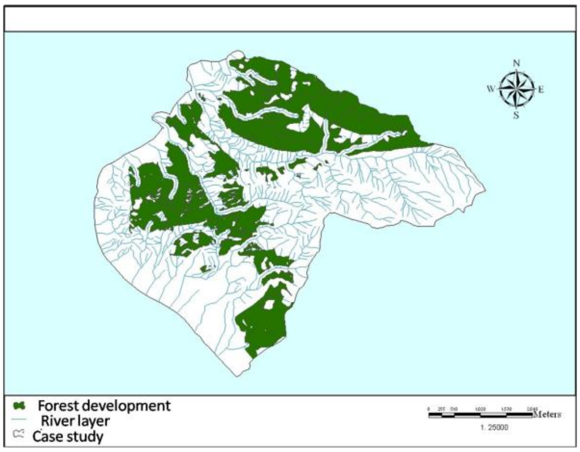


**Fig. 13.** Suitable area for forest development.

*Plants communities*

Existence three different climates, including semi-dry, semi wet and cold, high height calculated using *Ambergeh and Dumarthone and graphical Ombrothermic* methods (Natural resources office of Tehran) as well as variable kinds of soil, height changes, slope, plant coverage of the studied area profited from a great diversity composed of shrub; plant grass; one annual, two annual, three annual plant with low density.

So, to determine their flour, repeated visits is required. On this basis, using field survey in various period all heights, heights; plains, geology units; soil units were identified (Table 2).

**Table 2.** List of studied plant species.

| row | Plant scientific name | Appearance form | cultivation form | location in the study area |
|---|---|---|---|---|
| 1 | *Amygdalus scoparia* | indigenous | Shrub | Height, rocky locations |
| 2 | *Atraphaxis spinosa* | indigenous | Shrub | Plains, sideways |
| 3 | *Berberis crataegina* | not indigenous | Shrub | Lower ranges valleys |
| 4 | *Cerasus microcarpa* | indigenous | Tree and shrub | Sideways |
| 5 | *Amygdalus lyciodes* | indigenous | Shrub | Height, plains |
| 6 | *Ailanthus glandulosa* | not indigenous | Tree | Lower evaluations،sideways |
| 7 | *Celtis caucasica* | indigenous | Tree | Plains, sideways |
| 8 | *Crataegus persica* | indigenous | Tree | Vasyeh, side of water |
| 9 | *Crataegus pseudoheterophylla* | indigenous | Tree | Plains |
| 10 | *Ephedra procera* | indigenous | Shrub | rocky locations, plains |
| 11 | *Elaeagnus angustifolia* | indigenous | Tree | Plains |
| 12 | *Fraxinus rotundifolia* | not indigenous | Tree | side of water |
| 13 | *Juniperus excels.* | indigenous | Tree | Height |
| 14 | *Pteropyrum Aucheri* | indigenous | Shrub | Plains |
| 15 | *pistacia atlantica* | indigenous | Tree | rocky locations |
| 16 | *Salix spp* | not indigenous | Tree and shrub | valleys side of water |
| 17 | *Tamarix spp* | indigenous | Tree and shrub | Valleys |
| 18 | *Platanus orientalis* | not indigenous | Tree | side of water |

However, according to the indigenous species and their ecologic conditions collected from various sources (Sabeti, 1978, Karimi, 2002, Mozafariyan, 2004) as well as ecologic properties of developing regions, for every homogenous unit, a special species was considered. Overly, *Amygdalus scoparia; Amygdalus lyciodes; Juniperus Polycarpos; Celtis caucasica; Berberis crataegina; Pinus eldarica; Elaeagnus angustifolia; Morus alba* were determined suitable for afforestation. Also for the units where more than one species is cultivable, the most suitable species is selected as shown in Table 3.

**Table 3.** Descriptive data about homogenous units suitable for forest development.

| The most suitable species | Species suitable for afforestation | Soil depth | Soil texture | Soil drainage | Temperature (°C) | Precipitation (mm) | Elevation of the sea (m) | orientation | Slope(%) | Code of unit |
|---|---|---|---|---|---|---|---|---|---|---|
| *Juniperus excels* | *Juniperus excelsa*, *Celtis caucasica*, *Amygdalus scoparia* , *Amygdalus lyciodes* | Very deep | Loamy-sandy | Very good | 8-10 | 500-550 | 1800-2200 | southern | 30-65 | 13 |
| *Juniperus excels* | *Juniperus excels* , *Celtis caucasica* , *Amygdalus scoparia* , *Amygdalus lyciodes* | Very deep | Loamy-sandy | Very good | 10-12 | 500-550 | 1800-2200 | southern | 30-65 | 14 |
| *Juniperus excels* | *Juniperus excels* , *Celtis caucasica*, *Amygdalus scoparia* , *Amygdalus lyciodes* | Very deep | Loamy-sandy | Very good | 10-12 | 500-550 | 1800-2200 | western | 30-65 | 15 |
| *Elaeagnus angustifolia* | *Pinus eldarica* , *Celtis caucasica*, *Elaeagnus angustifolia* | Very deep | Loamy-sandy | Very good | 10-12 | 500-550 | 1400-1800 | southern | 30-65 | 23 |
| *Pinus eldarica* | *Pinus eldarica* , *Celtis caucasica*, *Morus alba* | shallow-average deep | Loamy-sandy-clay | Average | 10-12 | 500-550 | 1400-1800 | western | 30-65 | 24 |

| The most suitable species | Species suitable for afforestation | Soil depth | Soil texture | Soil drainage | Temperature (°C) | Precipitation (mm) | Elevation of the sea (m) | orientation | Slope(%) | Code of unit |
|---|---|---|---|---|---|---|---|---|---|---|
| *Celtis caucasica* | *Juniperus excels , Celtis caucasica, Morus alba* | shallow | Loamy-sandy | Good | 12-14 | 350-400 | 1400-1800 | southern | 30-65 | 27 |
| *Morus alba* | *Juniperus excels, Celtis caucasica, Morus alba* | shallow | Loamy-sandy | Good | 12-14 | 350-400 | 1400-1800 | rnweste | 30-65 | 28 |
| *Elaeagnus angustifolia* | *Juniperus excels, Pinus eldarica, Elaeagnus angustifolia, Berberis crataegina* | Deep-very deep | Medium loam | Good | 12-14 | 350-400 | 1400-1800 | southern | 30-65 | 29 |
| *Morus alba* | *Juniperus excels، gnus angustifolia, Pinus eldarica, Berberis crataegina* | Deep-very deep | Medium loam | Good | 12-14 | 350-400 | 1400-1800 | southern | 20-30 | 30 |
| *Celtis caucasica* | *Juniperus excels, Pinus eldarica , Elaeagnus angustifolia, Morus alba* | shallow | Loamy-sandy | Very good | 12-14 | 350-400 | 1400-1800 | southern | 30-65 | 33 |
| *Elaeagnus angustifolia* | *Juniperus excels, Celtis caucasica ، Elaeagnus angustifolia, Morus alba* | Very deep | Medium loam | good | 12-14 | 350-400 | 1400-1800 | northern | 30-65 | 35 |
| *Morus alba* | *Amygdalus lyciodes, Berberis crataegina , Morus alba* | Very deep | Medium loam | good | 12-14 | 350-400 | 1400-1800 | southern | 30-65 | 36 |
| *Elaeagnus angustifolia* | *Elaeagnus angustifolia ، Berberis crataegina, Morus alba* | Very deep | Medium loam | Very good | 12-14 | 350-400 | 1400-1800 | western | 30-65 | 37 |
| *Elaeagnus angustifolia* | *Elaeagnus angustifolia ، Berberis crataegina, Morus alba* | Very deep | Medium loam | Very good | 12-14 | 350-400 | 1400-1800 | western | 30-65 | 39 |
| *Amygdalus lyciodes* | *Amygdalus lyciodes, Celtis caucasica, Morus alba* | shallow - average deep | Loamy-sandy-clay | Average | 12-14 | 350-400 | 1400-1800 | northern | 30-65 | 43 |
| *Amygdalus scoparia* | *Amygdalus lyciodes , Celtis caucasica, Morus alba* | shallow - average deep | Loamy-sandy-clay | Average | 12-14 | 350-400 | 1400-1800 | western | 30-65 | 44 |
| *Celtis caucasica* | *Pinus eldarica ، Juniperus excels , Amygdalus lyciodes* | shallow | Loamy-sandy | good | 12-14 | 400-450 | 1400-1800 | southern | 30-65 | 45 |
| *Amygdalus scoparia* | *Pinus eldarica ، Elaeagnus angustifolia , Celtis caucasica ، Morus alba , Amygdalus scoparia* | Deep | Medium loam | good | 12-14 | 400-450 | 1400-1800 | northern | 30-65 | 48 |
| *Amygdalus scoparia* | *Pinus eldarica ، Elaeagnus angustifolia, Morus alba, Amygdalus scoparia* | Deep | Medium loam | good | 12-14 | 400-450 | 1400-1800 | western | 30-65 | 49 |
| *Celtis caucasica* | *Amygdalus lyciodes , Celtis caucasica ، Juniperus excels, Amygdalus scoparia* | Very shallow | Loamy-sandy | week | 12-14 | 400-450 | 1400-1800 | northern | 30-65 | 51 |
| *Celtis caucasica* | *Amygdalus lyciodes , Celtis caucasica ، Juniperus excels* | Very shallow | Loamy-sandy | week | 12-14 | 400-450 | 1400-1800 | northern | 30-65 | 52 |
| *Elaeagnus angustifolia* | *Pinus eldarica, Elaeagnus angustifolia ، Morus alba, Berberis crataegina* | Very deep | Loamy-sandy | Very good | 12-14 | 400-450 | 1400-1800 | southern | 30-65 | 54 |
| *Pinus eldarica* | *Pinus eldarica ، Morus alba , Berberis crataegina* | shallow - average deep | Loamy-sandy-clay | Average | 12-14 | 400-450 | 1400-1800 | western | 30-65 | 55 |
| *Pinus eldarica* | *Pinus eldarica ، Morus alba, Berberis crataegina* | shallow - average deep | Loamy-sandy-clay | Average | 12-14 | 400-450 | 1400-1800 | western | 30-65 | 56 |
| *Pinus eldarica* | *Pinus eldarica ، Morus alba, Berberis crataegina* | shallow - average deep | Loamy-sandy-clay | Average | 12-14 | 400-450 | 1400-1800 | western | 30-65 | 57 |
| *Pinus eldarica* | *Pinus eldarica ، Morus alba, Berberis crataegina* | shallow - average deep | Loamy-sandy-clay | Average | 12-14 | 400-450 | 1400-1800 | western | 30-65 | 58 |

## Discussion

Forest is considered as one of the most important and most attractive recreation resources in nature which is the destination of most of the nature tourists (Mahmoudi *et al.,* 2012).To avoid the natural resources and the environment waste, land use planning is of high importance; so that, less investment, higher sustain potential is of the consequences of such an activity. (Babaie Kafaky *et al.,* 2009), evaluated the ecologic potential of Zagros forest in order to find out the reasons of ecosystem degradation. Results showed that in more than 70% of the study area, current use is not based on ecological criteria caused severe degradation. Also, (Abdelkawy *et al.,* 2010), applied MCDM along with GIS to find out suitable lands for agriculture in arid and semi-arid. (Lathrop *et al.,* 1998), found the GIS out as an applicable tool in environmental assessment. Acceleration, high accuracy and increase the production and perfect data analysis is of the properties of the considered technology. (Eldrandaly *et al.,* 2004), declared that Problems involving the processing of spatial data such as industrial site selection and land use allocation are multi-facetted challenges. Not only, they often involve numerous technical requirements, but may also contain economical, social, environmental and political dimensions that may have conflicting values. Solutions for these problems involve highly complex spatial data analysis processes and frequently require advanced means to address physical potential conditions, while considering the multiple socio-economic variables. Geographic Information Systems (GIS) and Multi-Criteria Decision-Making techniques (MCDM) are two common tools employed to solve these problems. It is evident that developments in theoretical concepts of ecology are a source for stimulating interaction between ecology and statistics (Doledec *et al.,* 1996). Various factors were studied which the most crucial environmental factors in land use planning for the present study purpose. So that, by change of these properties, region potential changes, too. (Dengiz *et al.,* 2010), also applied the similar factor in forest development assessment of western Ilimak and Central Black Sea. Factors weight was determined using Expert Choice software which extremely improve the results accuracy. Group AHP also pave the way to achieve the criteria weight with less error. (Patil *et al.,* 2003), illustrated that different indicators typically convey different comparative messages and there is no unique way to rank the objects while taking all indicators into account. a conventional solution is to assign a composite numerical score to each object by combining the indicator information in some fashion. Each such composite involves judgments (often controversial) about substitute-potential among indicators. According to AHP results, elevation of the sea factor showed the highest weight in the studied area. Elevation affects on the precipitation and temperature factors. Because, increasing the elevation in the region, site factors weakens, access ways decreases, and water supply and support operations confronts with problems. (Dangkhoi *et al.,* 2010) presented elevation of the sea and slope as the highest total weight in his study in Vietnam. It also worth to mention that (Hasmadi, 2009), illustrated that slope plays so important role in Malaysia. Besides, (Jozi *et al.,* 2010), in Varjin, presented the highest weight for slope factor; whereas, slope factor in the present study showed the lowest weight. Therefore, it is evident that effect of different factors in different area changes. However, the present study applied SAW method, based on Compensate model, where the total weight calculated according to all criteria weight, which improve the assessment accuracy. To this aim, 4 groups were proposed for forest development in the area. (Dengiz *et al.,* 2010), divided the studied area in his study into three groups which depends on the ecosystem diversity. Totally, 798 ha of the area recognized suitable of which 101 ha located at 1400-1800 m height and the rest at the height less than 1800 m. 475 of the developable lands covered by Loamy-sandy soil and 70% of soil drainage was good and very good. Sometimes, one non-indigenous plant species competitively overruns an entire ecosystem (Pimental *et al.,* 2000). (Shaban *et al.,* 2008), studied the suitable species for green spaces development. In this regard, they essentially declared that the sensibility of *Celtis caucasica* to the soil is considerably low. Thereupon, its preference for units 6, 10, 17, 20 and 21 was identified for low depth of soil. Amongst the presented species, *Morus alba*, were determined resistant against any kind of soil applied to create shades, carminative, as well as soil erosion monitoring. In addition, high leaves density of *Morus alba* play crucial role in weather and noise pollution. (Malak Qasemi, 2004), also showed that *Morus alba* is suitable for semi-arid regions. The presented species was found out more appropriate for 7, 9 and 12 units. Regarding *Pinus eldarica,* due to resistance against cold and arid weather was determined suitable. So, for 5, 23, 24, 25, and 26 units where the precipitation level exceeds 400 mm, such a species was detected more suitable. *Berberis crataegina,* resistant against cold weather could be cultivated along with *Juniperus Polycarpos*. *Elaeagnus angustifolia* also is an indigenous plant extremely resistant against arid weather and to some extent to the salty taste. This is why, this species could be cultivated in integration with *Pinus eldarica* and was detected suitable for 4, 8, 13 and 14 units. *Juniperus Polycarpos* which is an indigenous plant, found out at southern parts of the region at 1700-3000 m height, and therefore suitable for the homogenous units located at the heights more than 1800 m. *Amygdalus lyciodes* has shown the similar properties also. During planning for afforestation, it is more suggested that *Juniperus Polycarpos and Pinus eldarica* to be cultivated with *Berberis crataegina and Elaeagnus angustifolia*, in order to avoid of probable fire, as well as improve the tourism attraction. (Malak Qasemi, 2004) has declared the similar suggestion at Sorkhe Hesar forest Park insisting on cultivation of Purple and Bray.

**References**

**Abd el-kawy O, Ismail H, ROD J.** 2010. Suliman, A, A Developed GIS-based Land Evaluation Model for Agricultural Land Suitability Assessments in Arid and Semi-Arid Regions, Research Journal of Agriculture and Biological Sciences **5**, 589-599.

**Asgharpour M.** 2002. Multi Criteria Decision Making, University of Tehran, Tehran, 398.

**Babaie-Kafaky S, Mataji A, Ahmadi Sani N.** 2009. Ecological Capability Assessment for Multiple-Use in Forest Areas Using GIS- Based Multiple Criteria Decision Making Approach, American Journal of Environmental Sciences **5**, 714-721.

**Bobade S, Bhaskar B, Galikwad M, Raja P, Gaikwad S, Anantwar S, Patil S, Singh S, Maji, A.** 2010. A GIS-based land use suitability assessment in Seoni district Madhya Pradesh India, Tropical Ecology **51**, 41-54.

**Dangkhoi, Murayama.** 2010. Delineation of Suitable Cropland Areas Using a GIS Based Multi-criteria decision Approach in the Tam Dao National Park Region, Vietnam, Sustainability **2**, 2024 – 2043.

**Dengiz O, Gol C, Sarioglu F, Edis S.** 2010. Parametric approach to land evaluation for forest plantation: A methodological study using GIS model, African Journal of Agricultural Research **5**, 1482 – 1496.

**Doledec S, Chessel D, Ter Braak F, Champely S.** 1996. Matching species traits to environmental variables: a new three-table ordination method, Environmental and ecological statistics **3**, 143-166.

**Eldrandaly K, Eldin N, Sui D, Shouman M, Nawara G.** 2004. Integrating GIS and MCDM Using COM Technology, the International Arab Journal of Information Technology **2**, 163-166.

**Ghodsipoor SH.** 2006. Introduction of multi criteria decisions and Analysis Hierarchical Process (AHP). Amir Kabir University Publications, 220.

**Jaimes NBP, Sendra, JB, Delgado MG, Plata RF, Némiga XA, Solís LRM.** 2012. Determination of Optimal Zones for Forest Plantations in the State of Mexico Using Multi-Criteria Spatial Analysis and GIS, Journal of Geographic Information System **4**, 204-218.

**Jiang fan, D.** 2007. Analysis of the Biodiversity Restoration of Different Forest Types in Maoer Mountainous Region **12**, 77-82.

**Javanmiri Pour M, Rasouli M, Soofi Mariv H, Avatefi Hemat M, Shahmoradi M.** 2013. Wild pistachio tree (*Pistacia mutica*) in the Qalajeh forest region of western Iran, Journal of Forestry Research **24**, 611-614.

**Jozi A, Zaredar N, Rezaeian S.** 2010. Evaluation of Ecological Capability using Spatial Multi Criteria Evaluation Method (SMCE) (Case study: Implementation of Indoor Recreation in Varjin Protected Area-Iran), International Journal of Environmental Science and Development **1**, 273-277.

**Jozi A, Moradi Majd N, Rezaian S, Jesmani Tafti N.** 2011. Evaluation of Ecological capability of Amygdalus Scoparia Habitat Condition in Bolhasan Dezfol of Iran Zone by Using of MCDA Method, 2nd International Conference on Environmental Engineering and Applications (IPCBEE), IACSIT Press, Singapore**17**, 164-167.

**Karimi H.** 2002. Glossary of plant in Iran, flowers and household plants, 2 th edition, Parcham publishment, Tehran, 516.

**Hasmadi I.** 2009. Developing Policy for Suitable Harvest Zone using Multi Criteria Evaluation and GIS-Based Decision Support System, International Journal of Economics and Finance **1**, 273-277.

**Lathrop G, Bognar A.** 1998. Applying GIS and landscape ecological principles to evaluate land conservation alternatives, Landscape and Urban Planning **41**, 27-41.

**Makhdoum M.** 1999. Fundamental of land use planning, Tehran University, Tehran, 289.

**Malak ghasemi A, Babai Kafaki S, Adeli Pish Bijari, E.** 2004. The Assignment of Land-Use Planning Principles and GIS applications in Afforestation and Green Areas' Development (A Case Study in Tehran's Sorkhe-Hesar Forest Park), Journal of Agricultural Sciences, Islamic Azad University, science and research branch, 111.

**Mahmoudi B, Sharifi N, Maleknia R, Ahmadeian R, Haghsetan A.** 2012. Ecological Based Planning of Forest Outdoor Recreation Case Study: Traditional Span of Mandj in Lordegan Forests-Iran, Research Journal of Environmental and Earth Sciences **4**, 680-687.

**Malczewski J.** 1999. GIS and Multicriteria Decision Analysis, John Wiley & Sons publishment, USA, 392.

**Martin D, Saha K.** 2009. Land evaluation by integrating remote sensing and GIS for cropping system analysis in a watershed, CURRENT SCIENCE **96**, 569-575.

**Mozafarian V.** 2004. Trees and shrubs of Iran, Farhang moaser publishment, Tehran, 1003 P.

**Nguyen V.** 2008. Use of GIS Modelling in Assessment of Forestry Land's Potential in Thua Thien Hue Province of Central Vietnam, 220.

**Patil GP, Taillie C.** 2003. Multiple indicators, partially ordered sets and linear extensions: Multi criterion ranking and prioritization, Environmental and Ecological Statistics **11**, 199-228.

**Pimentel D, Lach L, Zuniga R, Morrison D.** 2000. Environmental and Economic Costs of Nonindigenous Species in the United States, BioScience **50**, 53-65.

**Sabeti H.** 1976. Trees and shrubs of Iran, Ministry of Agriculture and natural resources, 874.

**Shaban M, Khajeodin J, Panahpoor E.** 2010. The Investigation of Drought Resistance in Wood Species for Isfahan Greenery Development, Journal of Research in Agricultural Science **5**, 57-67.