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The Landscapes of Mountains in the Northeast of Tunisia: Evaluation Essay of Landscape Potential of Djebel Zaghouan

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Abstract:

The delegation of Zaghouan, which is located in the northeast of Tunisia, is characterized by a very specific natural landscape, the scenery of the mountains. Through a spatial analysis of land use map of the governorate in a scale of 1/400 000, a landscaped characterization of the mountains of the region was established by the synchronization of the spatial analysis with the method of quotation of NEURAY. The results of the spatial analysis, using the software ArcMap 9.3 showed that Zaghouan is a zone characterized by varied

and uneven reliefs; we notice alternations of mountains and plains or trays. These hilly landscapes are covered by an important forest vegetation which occupies 64 000 ha that is 123.06 % of the total surface of the governorate. The summit of Djebel Zaghouan reaches 1300 m of height; it is mainly covered by Holm oaks. The method of quotation showed us that the landscapes of Djebel Zaghouan are very rich, in spite of the anthropological action exercised near the mountain, the landscaped value can achieve for certain sights 79.75, what reflects the importance of the landscaped wealth in this zone. To browse the landscape of natural territories in the region revealed the importance of the mountain's landscapes, but we managed to show the leading part of Djebel Zaghouan in the foundation of a typical landscape in this governorate.

Key words: landscape of mountains, Djebel Zaghouan, reliefs, vegetation foresters, anthropological action.

1. Introduction

During millenniums, mountains constituted a reservoir of the resources so precious as the water, the energy, the agriculture, the forest and the biological diversity. They represent important centers of culture and places of relaxation (Saadaoui, on 2013). The fragility of the mountain ecosystems, the interannual variability associated with a Mediterranean climate and the presence of a rural population in the mountains are the key factors in shaping landscapes observed But also marked by strong generative natural and anthropological constraints of competitions, conflicts and risks (Donadieu and Rejeb, on 2011). These zones are essentially for forest and pastoral vocation. The Tunisian mountains cover about 2 million hectares, by considering the grounds the height of which exceeds 300 m (Abid, on 1985). Zaghouan, region established on the hillside of Djebel Zaghouan, is characterized by the presence of the remarkable mountainous links, dense

vegetation cover. Djebel Zaghouan, is an important potential in terms of biodiversity and provides a remarkable opportunity for the development of truly sustainable development Governorate. This reflection leads us to characterize the natural landscapes of this region, and to begin a landscaped reading which has for objectives to put in landscape of certain sites of Djebel Zaghouan and to establish a link of multidisciplinary between the human action and the nature.

2. Materials and Methods

2.1. Site of study

The governorate of Zaghouan covers a surface of 2775 Km2, which is 1.8 % of the national territory. The region benefits from a wide agricultural surface (282 thousand ha among which 185 thousand farmlands and 87 of the routes and the forests (APII, on 2014), the city was built on a hill connected with Djebel Zaghouan where several sources (springs) of water still carried the imprint of Romains.

Djebel Zaghouan, it is a mountain situated in the Northeast part of the Tunisian ridge, it is about a natural site endowed with a remarkable biological, cultural and archaeological value, fitted out recently in natural reserve. This mountain is situated in 50 km from the Capital Tunis, It extends over a space nine kilometres long and three wide. Its height peaks in 1300 meters at the top of Ras El Gassâa and its surface is estimated at 20 km2.

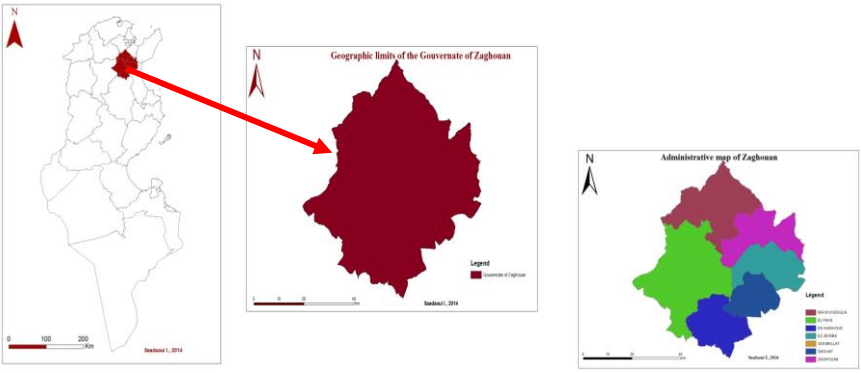

Figure.1. Geographical situation and administrative map of the governorate of Zaghouan

2.2. Methods

To characterize the landscape of the region and its reliefs, we resort to use GIS software (ARC GIS v 9.3), some thematic maps on the scale of 1/400 000, sections of the topographic map in scale 1 / 50,000 of weather, agricultural statistics, and statistics MIT: ONM.

2.3. Characterisation of forests landscapes through Cartography

The approach to characterize the landscape of the mountains of Zaghouan hinges on the establishment of a database of forest data to a data processing. This requires a compilation of these data using spatial analysis techniques. Through the Arc Gis we created thematic maps useful to characterize the landscape of the mountains of the study area, and with their database we tried to analyze and evaluate explicitly natural settings Zaghouan.

By means of software SIG; ARC MAP V 9.3, we realized certain thematic maps in the scale of 1/400 000:

-Map of distribution of bioclimatic zones.

-Map of reliefs in the governorate of Zaghouan.

-Map of distribution of forests in the region of Zaghouan.

And with the aim of valuing this landscape, we resorted to the method of quotation of Neuray.

Method of reading of the landscapes: quotation of Neuray.

The application of the method of quotation of Neuray allows us to estimate the landscape of mountains at the governorate of Zaghouan and to follow its evolution which results from natural and anthropological interactions.

With the aim of the determination of the landscaped value by the method of quotation we made an exit in the zone of study (Djebel Zaghouan). We chose three points of observation.

The geographic coordinates N and E taken by the GPS for each observation point are converted into metric coordinates with the application of "GEOCALC" and then projected on the digital topographic map of the study area to calculate the length of the exact sight.

The method of quotation supplies only landscape values; it bases on an analysis of the sights taken in the perceptible places. It gives at the same time a global value of the landscape and an evaluation separated from the various important elements. The method takes into account the principle of RECIPROCITY (if I see I am seen) (Toussaint, 2009).

In every sight we determine several data:

· The length, the orientation and the width of the view;
· The vertical dimensions of the view;
· The factors of valuation;
· The value of the base of the view.

The basic value of the sight is calculated according to the following formula: V = L x R x S. This basic value of the view represents a current situation of the landscape perceived from the sight (table1).

2.4. Situation and landscaped groupings of the zone of study

The perimeter of study, Djebel Zaghouan, who includes the forest and outer-urban zone, occupies a sector included in a quadrangle in the following address and coordinates: X: 58 ' 10" and Y: 4' 023"

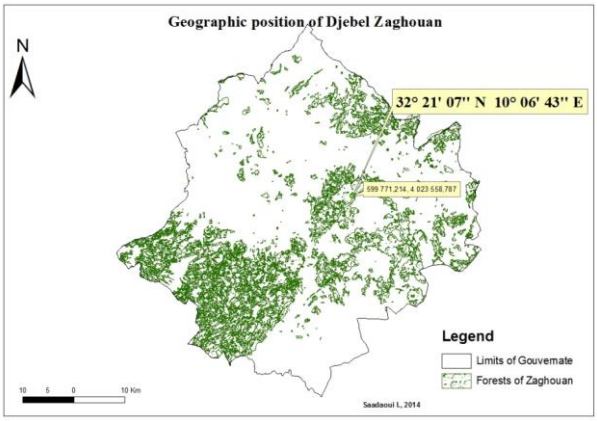

Figure.2. Geographic position of Djebel Zaghouan

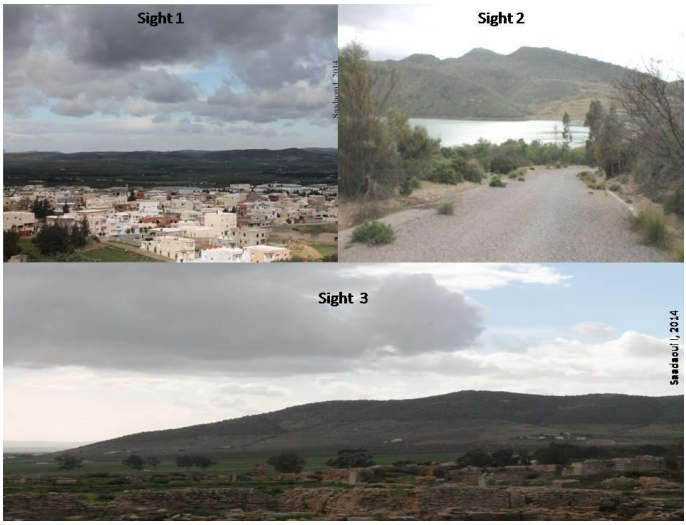

Figure.3. The sites of observation of the landscape of mountains in the Governorate of Zaghouan

Table.1. Characteristics of sights

Localisation of observation sites / Characteristics		Zaghouan		
		Station 1	Station 2	Station 3
Direction of the sight		340° North	180° North	236 Southwest
Length of the sight (l) (he)		80	172	340
Visual angle of vertical dimensions				
	α	-30	-25	-10
(°C)	ß	2	5	5
	Γ	30	30	40
Perceived unevenness (D) (m)		00	14.9	8

3. Results

3.1. The landscape of the governorate through the climatology

The governorate of Zaghouan is situated in the northeast of Tunisia (figure 1); crossed by the Tunisian ridge which determines two bioclimatic floors:

- The subhumide in the North and the northeast with an annual average rainfall from 400 to 500 mm.

- The semi-arid lower in the South and South East in average annual rainfall less than 250 mm and up to 400mm.

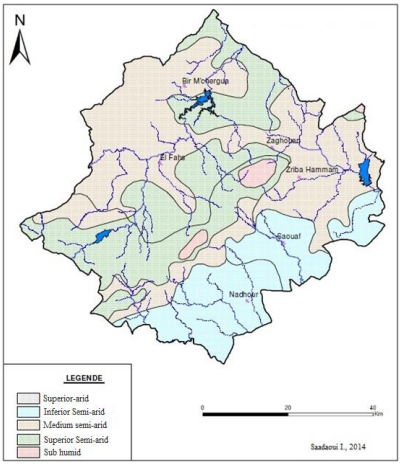

Figure.4. Map of distribution of the bioclimatic floors of the governorate of Zaghouan

In a general way, the rainfall is characterized by a big irregularity and often appears in the form of showers.
The East and the southeast of the governorate, (a part of the delegations of Zaghouan, Zriba, Saouaf and Nadhour) undergo the influence of the maritime coast of the governorate of Sousse and Nabeul and offer a softer climate in winter, moderated in summer and in spring.

3.2. The landscape of the governorate through reliefs

The governorate of Zaghouan has a situation on horseback between high Tell and Tunisian ridge and is characterized by varied and damaged reliefs presenting alternations of mountains and plains or trays (figure 3).

The data base of the reliefs map shows that the governorate includes four natural groups namely:

A zone of the North: it is established by the plains of Fahs and of Sminja crossed by main Oued of the governorate: Oued Kebir-Miliane the main tributaries of which are:

- Oued Menjara and Oued Abaya
- Oued Maleh
- Oued Bou Dhebben.

This river system constitutes the main part of the strategy of mobilization of surface waters. This zone is reserved for the big cultures, covers approximately 50 000 ha, that is 18 % of the total surface of the governorate.

A central zone: formed by a section of the Tunisian ridge including mainly Djebels Fkirine 985 meters in height, Bent Saîdane 818 meters in height and the big Peak of Zaghouan 1295 meters in height: Djebel Zaghouan, the second summit in Tunisia after Chaambi in Kasserine.

This zone of mountain relief, including the biggest forest reserve, cover approximately 60 000 ha that is 21 % of the total surface.

An Eastern Zone: it is an alternation of plains and hill sides, we quote in particular the plains of Zaghouan, Wadis Erribeh, Bou Achir and the hillsides of Jeradou and Ain Battria This zone with mixed vocation (big cultures, olive trees, fodder reserves on foot), covers approximately 90 000 ha that is 32 % of the total surface of the region.

A South and Southeast zone: it includes especially pastoral zones and plains with secondary cereal cover 72 000 ha that represents 25.5 % of the total region surface. This zone is considered as the most sensitive scene the nature of its ground and its plant place setting constituted in scrubland and shrub.

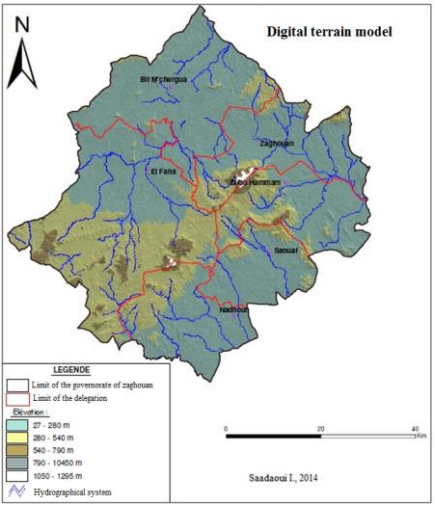

Figure.5. Map of reliefs in the governorate of Zaghouan

3.3. The forest landscape in the governorate of Zaghouan

From the data base of the map of distribution of forests in the region of Zaghouan (figure 4), the data of the Ministry of agriculture, the forest resources are distributed as follows:

- 35000 ha of forests, among which 9000 ha are improved;

- 11000 ha of improved pastoral ground private submitted to the forest regime;
- 18000 ha of Pastoral ground submitted to the forest regime.

It is the Holm oak which prevails on this mountain range, in particular around the summit and on the slopes of the hillside in the North. But we also find, pines of Aleppo, carob trees and wild olive trees abundances. We also find a rich variety of aromatic plants as the thyme or the rosemary.

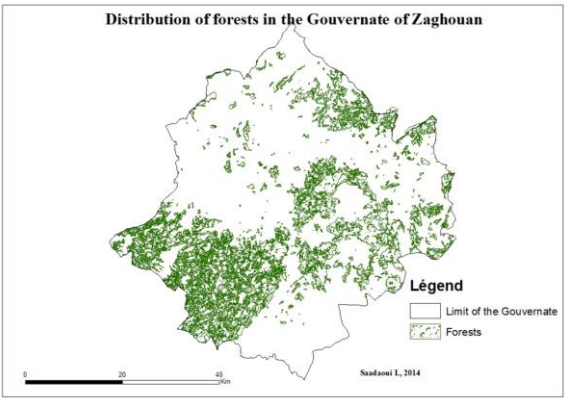

Figure.6. The map of distribution of forests in the region of Zaghouan

3.4. Valuation of the forest landscapes of Djebel Zaghouan by The method of Quotation

After the characterization of the various plans of observation (figure 5) in every sight we attribute a number of points to the factors of valuation according to their distributions in the site (table 2).

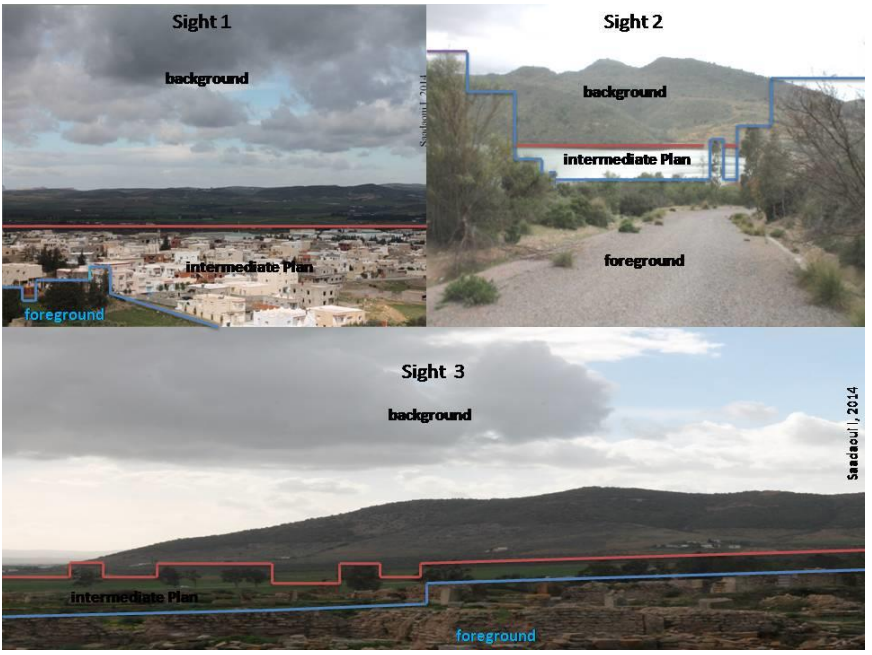

Figure.7. Distribution of the various plans in the observation sites.

The quantification of the factors of valuation gives us the following results.

Table.2. Factors of valuation

Factors of valuation	Site 1	Site 2	Site 3
Water	-	6	-
Rocks	-	6	3.5
Open space	3	-	4
Successive plans	2	6	6
Centring of view	6	6	3
Ridge line	4	4	6
Accentuation relief	6	6	6
Communication route	-	6	-
Integrity	1	4,5	4.5
T	22	44.5	33
S	3.2	5.45	4.3

After projecting the metric coordinates in the sites of observation on the topographic map of the region (figure 6,

figure 7 and figure 8), and calculating the length of the sight. We calculated the basic value of the sights (table 3).

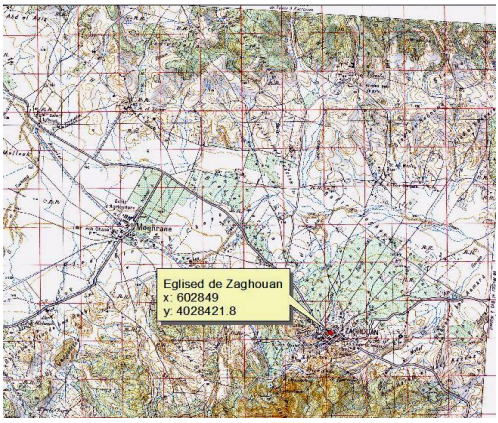

Figure.8. Metric coordinates of 1st site of observation on the topographic map of the region

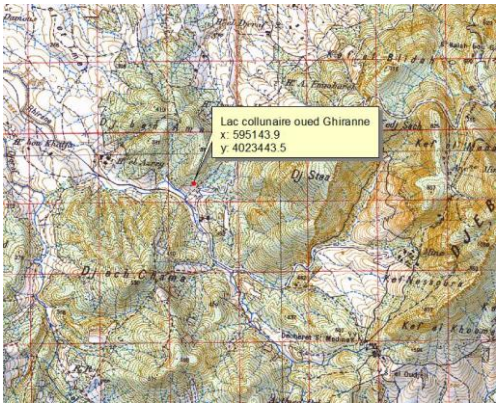

Figure.9. Metric coordinates of 2nd site of observation on the topographic map of the region

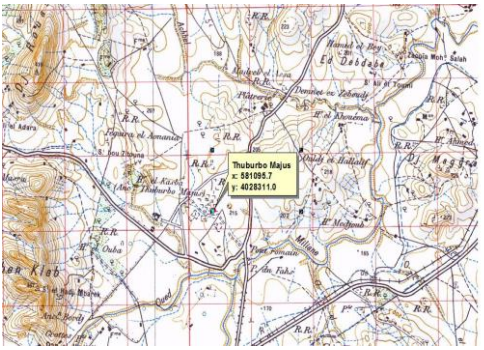

Figure.10. Metric coordinates of 3d site of observation on the topographic map of the region

Table.3. Calculation of the basic value of the various observed sites

	L: Length of sight	**R Vertical dimension of the view**	**S Factors of valuation**
Site 1	4,38	1,22	3,2
Site 2	11,17	1,31	5,45
Site 3	12,65	1,004	4,3

The results of the calculations of the values of four views for every site are recorded on the table 2. It include the basic value of the view (V)

Table.3. Value of the view

Localisation of observation sites / Value of the views	DjebelZaghouan		
	Station 1	Station 2	Station 3
Direction of the sight	North	North	Southwest
Valueof the view V= L * R * S	17.09	79.74	54.61

The second station presents the highest value, V = 79.74, this value is due to a natural landscape without any human intervention, we notice that the more the anthropological action increases the more the value of the view decreases.

4. Discussion

The spatial analysis shows that Zaghouan is characterized by very rugged reliefs, Djebels and hills dominating the landscape and the river system are very hierarchical. The climate of the region belongs to the upper level of the semi-arid with torrential rains that are causing an accelerated streaming.

The forests of the region divide up throughout the chains of the mountains of the region; it is especially characterized by the presence of Holm oaks.

The results of the landscaped reading inform us about a strong landscaped wealth in the mountains of the governorate of Zaghouan.

The landscaped reading shows us that these natural landscapes underwent depreciation by the presence of the artificial elements.This increased devaluation of the visual environment is the result of the implementation of disorderly artificial elements such as electricity pylons and anarchic constructions that have degraded the landscape was originally ruralized and well-structured that was easily grasped visually (Hau, 1999; Hameg 2005).

The highest recorded values are obtained due to the absence of all artificial elements and the presence of meaningful elements that blend into the landscape (like water, vegetation). The work we have done is in itself a new experience and an example to follow in the field of space management by all those who are in charge of policy planning.

Indeed, the quantitative estimation of the landscaped groupings of the Djebel Zaghouan answers precise and practicable questions on a possible valuation of the fields of vision and on landscaped sequences from east to west of the governorate. The strong values of the observed sites can help to direct the decisions of presence of the new projects to these zones.

Conclusion

The present study allows confronting specialization thanks to the use of software SIG, and the reading of the landscapes thanks to the method of quotation of Toussaint (2009, modified). The results identify the landscape of the mountains of the governorate of Zaghouan. The characterization of this territory shows the following essential facts:

- The mountains that support a rich landscape of forests are host oaks which have the dominant occupation of the mountain ranges of the governorate.

- Djebel Zaghouan is a rich natural area, which is facing several constraints (ecological and human), these natural areas should be protected against human actions.

This work allows the reflection on the development of natural resources of Eastern Tunisia. In addition it is essential to think about sustainable projects that streamline the idea of landscape sustainability and sustainable development in the mountainous regions.

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