EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 4/ July 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Characterization of Landscapes in the Central-West of Tunisia: Wadis of Feriana in keeping with the Landscape of the Mountains

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Abstract:

The delegation of Feriana, located at the south of the governorship of Kasserine in the central west of Tunisia, is characterized by the presence of a series of mountainous links and an important drain of the wadis. The spatial analysis, through the analyses of the cards with the help of a software SIG, data weather and data of the Ministry of agriculture, makes it possible to characterize the landscape of the mountains and to reveal the importance of the water resources in the area. The climate of Feriana is

a Mediterranean climate with continental aspect marked by the irregularity of rainfall and its contrasted seasons. Thus the study shows that the geographical and climatic factors work the landscapes of this area. The mountains are part of the Southern zone of Djebel Chaambi, and occupy all the Northern zone of the delegation (Common of Bouchebka). These rugged reliefs are covered by an important forest vegetation that occupies 20 651 ha which is 13.1% of the total forest surface of the Governorship of Kasserine. The wadis are 43 wadis that the most important are "Bouhaya Wadi" and "BouChebka Wadi". The majority of the wadis are located especially on the mountainous links (Djebel Bouchebkha and Djebel Feriana), creating a specific landscape of the mountains of the area. The landscape analysis of the territories of the area of Feriana revealed the importance of the landscapes of the mountains on the ecological plan and the principal role that they play of in the construction of atypical landscape of the area of Feriana.

Key words: Landscape of the mountains, water resources, wadis, Feriana.

1. Introduction

The landscape had become the resident society products (Donadieu and Rejeb, 2009) they are part of the ecosystem (Toussaint, 2003).The word which, at the 4th century, for the first time in the world, took the direction of "landscape", "the mounts and water". It had been used during centuries without aesthetic connotation, with the direction of "water of the mountain", primarily by hydraulic engineers. These mountain waters were also the haunt of spirits of the wilderness (Berque, 2009). The area of Feriana located in central west of Tunisia is characterized by important forest formations as well as a drain of as much of importance presenting 43 wadis. It is starting from the mountains that the wadis occur (MEDD, 2006). The landscapes of mountains constitute a natural heritage and cultural vulnerable (Quétier and al., 2010). The wadis and the hydraulic resources also played a significant role in the

dynamics of the landscapes. From analyses representative of some natural situations, this synthesis will focus on what could represent the landscapes and their insertions in various territorial typologies of occupation (Rejeb, 2011). We are interested in this research to prove the interrelationship between the wadis and the mountains which create a specific landscape of this zone.

2. Materials And Methods

2.1. Presentation of the study site

The region of Feriana is at the western south of the Governorship of Kasserine between 35°9' and 35°15' of Northern latitude and between 8°38' and 8°45' of longitude. The delegation covers a surface of 91 200 ha (11% of the total surface area of the Governorship of Kasserine). The forests occupy a surface of 20651 ha (Atlas of the governorship of Kasserine, 2012). The delegation receives precipitations from 400 to 450 mm/yr unequally distributed with one dry summer season. The annual average temperature is of 17.5 °C, the region is characterized by instability of the weather (Seibert and Gharbi, 2001). The delegation is characterized by the abundance of the water resources.

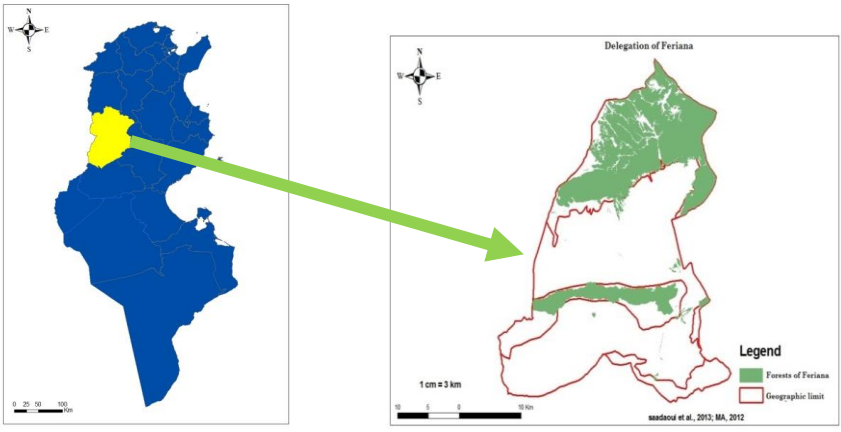

Fig.1. Localization of the site of study

2.2. Materials

In order to characterise the relation among the wadis of the area and its reliefs, we have recourse to a computer software SIG (ARC GIS v 9.3), some thematic maps on the scale 1/250 000, of the cuts of the topographic map on the scale 1/50 000 of the statistics weather, agricultural, and statistics of the M.I.T: ONM.

2.3. Methods

2.3.1. Weather data processing

From the weather data of the station of Feriana we could carry out the ombrothermic diagram of the area, and the diagram of the monthly rainfall values and their contribution (in %) in total annual rainfall.

2.3.2. Cartographic data processing

Using the computer software SIG (ARC MAP v 9.3) we carried out certain cards sets of themes on the scale 1/250 000:

- Map of distribution of the bio-climatic stages.
- Map of localization of the mountains in the delegation of Feriana.
- Map of localization of the forests of Feriana.
- Map of localization of the forests according to the bio-climatic stages of the area of Feriana.
- Map of distribution of the wadis and their effluents in the area of Feriana.
- Map of distribution of the wadis on the mountainous regions of Feriana.

3. Results

3.1. Climate

3.1.1. Rainfall

Figure 2 shows that the kind of climate is AWSS (decreasing rainfall in the order fall, autumn, spring, winter, summer) that

one finds cold but not very wet winters and hot and dry summers.

Delegation of Feriana: a continental Mediterranean region trend, where the maximum rainfall tends to move toward the fall to the summer and minimum in the summer to the winter.

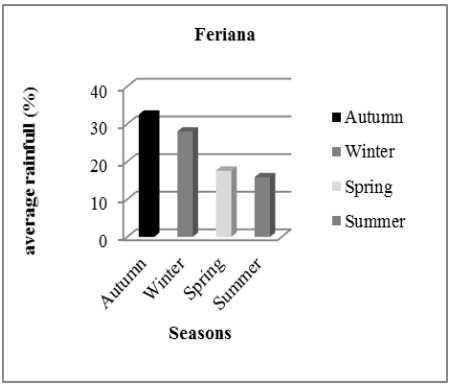

Fig.2. Average of seasonal rainfall and their contribution (in %) at an annual rainfall total

Figure 3 shows that the daily maximum rains of the summer occur generally in June and in August.

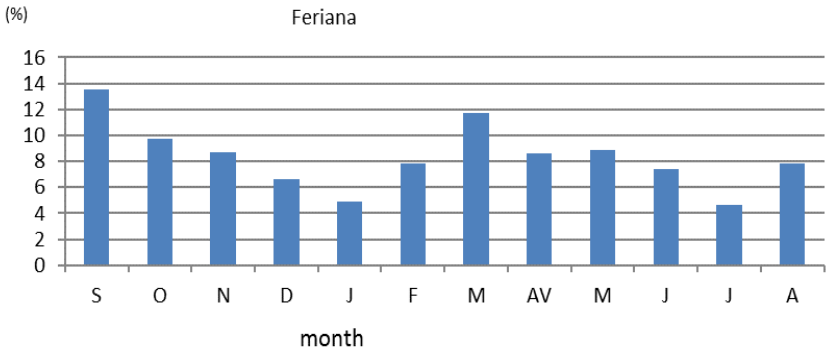

Fig.3. Monthly rainfall values and their contribution (in %) on the whole annual rainfall

3.1.2. Temperature

Table1. Monthly rainfall values and their contribution (in %) in total annual rainfall

Station	annual average	monthly average		monthly average		thermal amplitude		
		Janv.	Juill.	Min. Jan.	Min. July	Annual	Jan	July
Feriana	16.3	7.3	25.9	1.2	34.0	18.6	11.1	18.1
Kasserine	16.4	7.2	26.2	1.9	35.0	18.0	10.8	17.4
Thala	15.3	5.9	26.1	1.9	33.4	20.2	8.3	16.6

The annual average temperature lies between 15 and 18°c. The annual thermal amplitude is high (18.5 and 20°c). The minima's of January are relatively low with 2°c, while the maximal's of July are close to 34°-37°c.

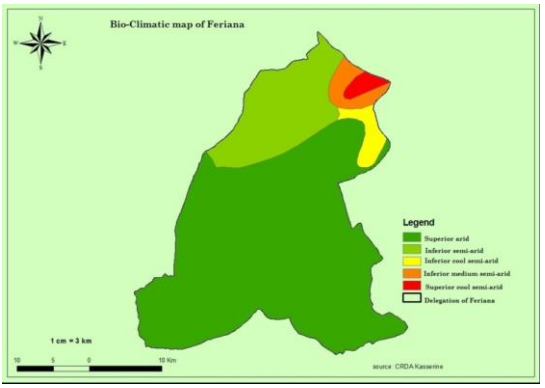

Fig. 4. Bioclimatic map of Feriana

From the data we summarized the bio-climatic characteristics in table 2:

Table 2. Bioclimatic feature

Station	Bioclimatic	sub-bioclimatic	Variant	Q
Feriana	Arid	Superior	cool winter	17

3.1.3. Ombrothermic Diagram

The Ombrothermic diagram shows that the climate is characterized by hot, dry summers and semi-arid mild winters, transition among arid floors in the southwest and semi-arid in the West. During the last decade, drought spreads throughout the year.

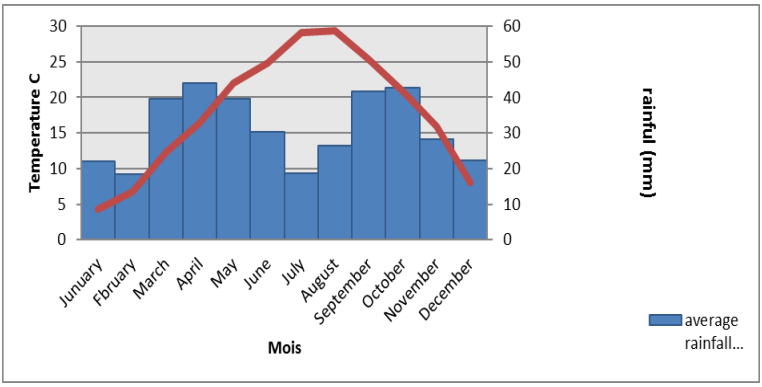

Fig.5. Ombrothermic diagram during the last decade (1999-2010).

3.2. Landscape of mountains

The analysis of the location map shows mountains which seem to occupy the entire north of the delegation (Bouchebkha) and the central zone (Feriana and Thélepte).

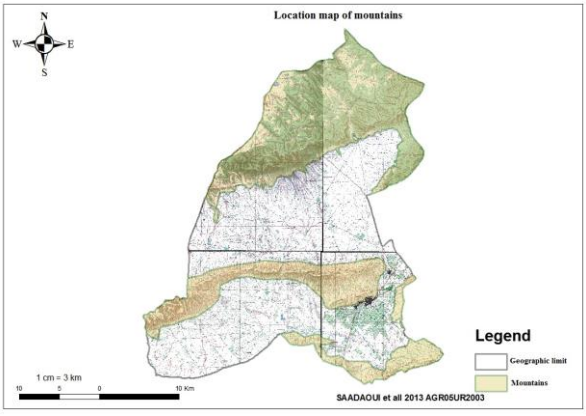

Fig. 6. Location map of mountains

3.2.1. Djebel Feriana

- **Geological outline**

Djebel Feriana corresponds to a dis-symmetrical anticlinal structure of axial plan EW slightly plunged towards the south with a rectified northern side and a southern side with weak dip. It is overall length is of approximately 4 km and its aperture is about 3°. It belongs to a series of outcrops in the east and the north-west of the region of Feriana. They are links anticlines separated by synclinal basins directed appreciably EW.

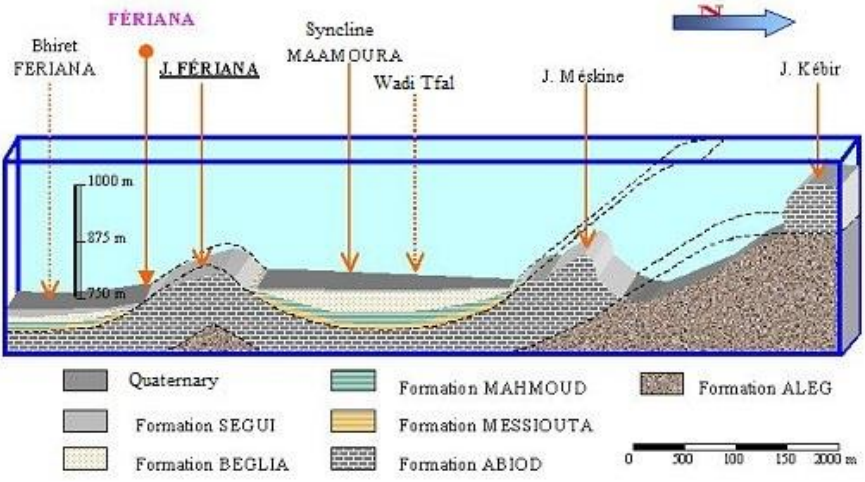

Fig.7. Block diagram showing the three-dimensional fitting of the geological formations on the level of the area of Feriana (OTC)

- **Geographical location**

Feriana is in the western part of central Tunisia to 745 m of altitude. The solid mass of Djebel Feriana is located in central Tunisia. It occupies the southern part of the sheet of Feriana (n°91) and the northern part of the sheet (n°100) of the Soulah wadi.

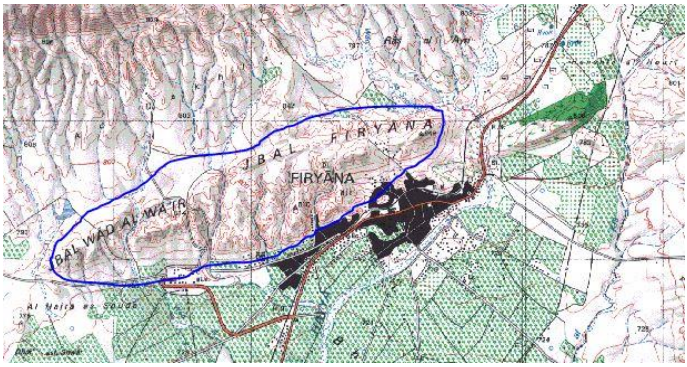

Figure.8. Extract of the topographic map of Feriana and localization of sector of studies (OTC)

3.2.2. Djebel Dernaya (Bouchebkha)

Figure 9 shows a portion of the sub-region of high steppes. The layers bordering the altitude 700 m, confined among the mountains of Dernaya and Bouhayia, Djebels Sidi Aich, Djebel Majoura kharrouba to the east, and the Algerian border in the west.

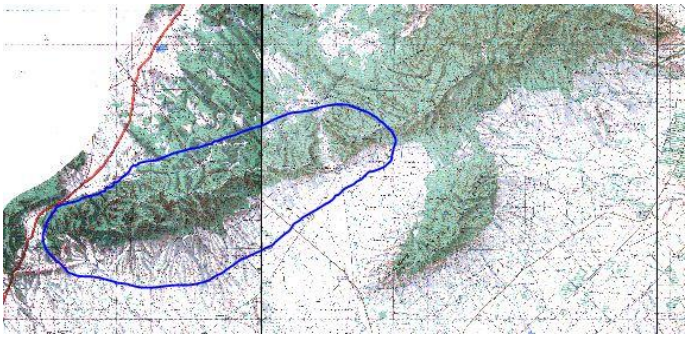

Fig.9. Extract from the topographic map of Bouchebkha (1/50 000) and localization of the sector of study.

3.3. Forests

The analysis of the data base of the map of localization of the forests shows that the area presents 20,651 ha of forests, this superficies represent 22% of the delegation's area and 13.1% of the total area of the forest zone of the governorship.

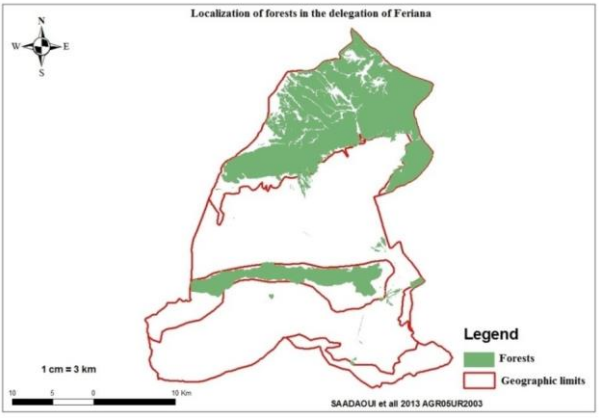

Fig.10. Localization of the forests in the study site

3.3.1. Distribution of the forests according to the bioclimatic stages

The map of distribution of the forests shows that most of the forest zones are localised on the semi-arid floor and on altitudes from approximately 800 mr.

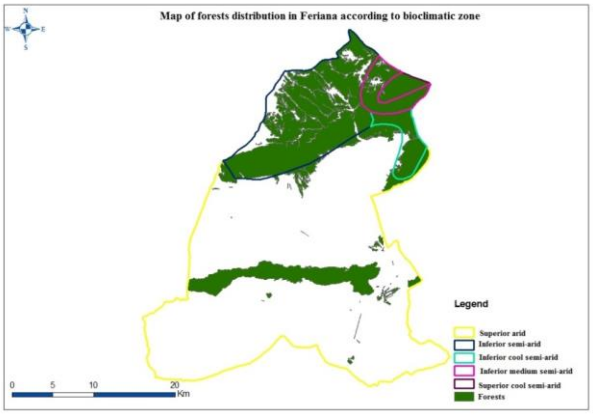

Fig.11. Distribution of the forests according to the bio-climatic stages

3.4. Wadis and landscape of the area

Figure 12 shows that Feriana has an hydrographic system which is constituted by 41 wadis.

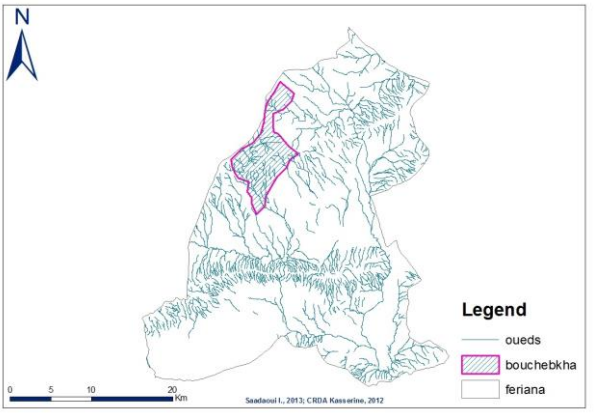

Fig.12. Map of the wadis in the delegation of Feriana

From the data of the map of wadis, was performed as shows the following table:

Table.4. The most important wadis to the delegation of Feriana

Wadis	Length	% Relative to the total length wadi
Wadi BOUHAYA	224414m	18
Wadi Es SABOUN	144362m	11,5
Wadi BOUCHEBKHA	41033m	3,3
Wadi ELKIS	57109m	4,6
Wadi EDAM	35138m	2,8

Figure 13 shows the distribution of wadis in the mountainous regions of Feriana:

Presence of Bouchebka's wadis / Djebel Bouchebka and Bouhaya's wadis /Djebel Feriana. The waters of the wadis that are located at Djebel Bouchebka and are collected through 4 hill lakes.

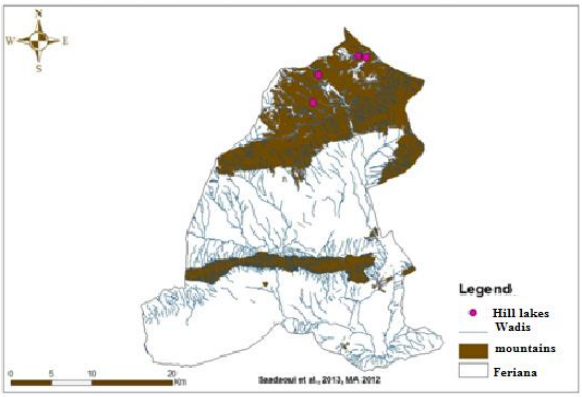

Fig.13. Distribution of wadis in the mountainous regions of Feriana

4. Discussion

The results of the work carried out in this article allow us to reveal the natural character of the landscape in the study area. The climatic study allows us to see the major character of the rainfall to the area of Feriana in the extreme irregularity. The variability of precipitations is accentuated even on a monthly scale. The rains of summer are primarily storms that often fall at the end of summer. So the summer drought remains much accentuated. The Ombrothermic diagram shows us that the period of drought may be spread out along the year. This difficult climatic character is accentuated by a presence of high altitudes and broken reliefs.

The spatial analysis shows that these mountains are characterized by the presence of a system of wadis, such as wadi Bouhaya and wadi Bouchebka that are considered the most important among the hydraulic resources of surface in the governorship of kasserine. These wadis, in keeping with the mountains, offer a typical landscape to the area.

5. Conclusion

This study made it possible to confront spatial analysis thanks to the use of software SIG and the weather data; one thus could reveal the great landscape units of the area of study made up mainly of a landscape of the mountains and landscape of the wadis.

The factor of mountain relief associated with the difficult climate with the delegation is confirmed in the Aspect of the Natural Vegetation (Secondary Forests and Esparto). Despite the wealth of natural resources in the region, it remains a marginalized area. Failures of government policies are the cause of environmental degradation. Government interventions should encourage individuals to increase the use of environmental goods. They can be conducted at the macro level or across a sector. To remedy these deficiencies, the public authorities have an important role to play in the implementation of environmental policy role. They must promote the sustainable development by incorporating optimal management of natural resources and environmental protection (Mamadon, 2003).

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