

THE MOST IMPORTANT CLIMATIC ELEMENTS AFFECTING THE COMFORT OF TOURISTS IN THE AURES MOUNTAINS CASE OF BATNA REGION (EAST ALGERIA)

Sabrina Meridja

*Department of Architectura, University of Algiers 1, 02 Didouche Mourad Street
Algiers, Algeria.*

Louardi Kherrou¹

*Department of Geography and Territorial Planning, Houari Boumediene Sciences
and Technology University, Algiers, Algeria.*

Lyes Belaid

*Department of Geography and Territorial Planning, Houari Boumediene Sciences
and Technology University, Algiers, Algeria.*

Received 22 April 2020; Accepted 17 May 2020; Published 29 July 2020

ABSTRACT

The aim of this study is the quantitative analysis of the tourist sites selection of the study area located in the Aures Mountains, eastern Algeria. Climate is one of the most important natural factors that affect humans' physical and psychological wellbeing and their activity and mobility, the climate itself is a significant tourist attraction in many countries around the world, and also a specific factor in the opportunity to enjoy other sources of tourism (natural - historical - social). We can therefore say that climate with all its many components is either a source or a limiting factor for tourism. This research is based on an analytical approach that relies both on field studies and data collection, followed by a practical analytical approach by accessing data obtained from air stations in the area for the 1980 - 2018 period. To improve the results, a comparative analysis is included, by comparing the most popular climatic preferences for tourist-investment in the different state regions. The researchers relied on the percentage index for statistical measures using the comfort proof equation, taking the elements of temperature and humidity.

KEYWORDS: Aures, Batna, Climate impact, Human comfort, Human activity, Tourist activity, Traces of rest.

INTRODUCTION

Weather and climate have an important influence on the global tourism sector. For tourists, weather and climate are intrinsic components of the vacation

¹Correspondence to: Louardi Kherrou, Houari Boumediene Sciences and Technology University, Department of Geography and Territorial Planning, BP 32, El Alia, Bab Ezzouar, 16111, Algiers, Algeria, Tel: 213(00)53637325 or 213(00)795471809; E-mail: louardi.kherrou@yahoo.fr

experience. They can act as a central motivator in an individual's choice of holiday destinations and timing of travel, and can also be a salient factor in tourism spending and holiday satisfaction (Scott et al., 2008). Climate in all its elements is one of the most important natural factors affecting human physical and psychological comfort, activity and direction of movement. The climate itself is an important tourism element, it is one of the main tourist attractions in many countries of the world, and it is a determining factor for the possibility of taking advantage of other tourism sources (Natural, historical and social). Therefore, we can say that the climate with its multiple elements is an attractive factor and a source that helps or limits the tourism movement (Nurhazani et al., 2019). The temperate climate is an important factor in international and national tourist attractions. In addition, the climate can be favourable to the inhabitants of the cold zones in winter and to the summer climate of the inhabitants of the hot zones in summer (Besancenot, 1985). Maintaining winter tourism, if not improved, is a major goal for all tourism actors, according to the recent slogan of the French National Cable Car Association and the trade union chamber of the ski lifts operators: "All skiing may end, but without skiing, everything is over", attesting to the importance of skiing activity in the operation and restructuring of the regions (Didier, 2010).

The impact of solar radiation, moisture and snow on humans' physical and psychological health is well known, and numerous studies have been carried out to demonstrate such a connection to human activity. Tourists often prefer moderate temperatures coupled with low humidity, a situation in which some researchers, including the American geographer Ellsworth Huntington (1916), confirmed the effect of climate on human activity, with some important results that can be applied to the tourism sector, including: Humans are most physically active if the temperature is between 15-18°C and most mentally active if the outside temperature reaches 37°C with some frost at night, while high humidity enhances the human activity if the weather is cold, if it is warm, then they are both lazy and less active (Fathi, 1980). One of the topics that global studies focused on during the first and second decade of the new millennium is the study of human comfort, because the developed world's countries rely on the human comfort to achieve human creativity (Intissar, 2018). Besides the geographical location, topography, landscape, vegetation and wildlife, all factors influencing tourism decision-making, weather and climate determine the attraction of a given tourism region (Tzu-Ping, 2008).

Based on this reference, a quantitative assessment of climatic features of one of the eastern Algerian mountainous states has been conducted to determine the climatic conditions for human comfort, based on data from different weather stations in the province of Batna in order to compile touristic sites.

DESCRIPTION OF THE STUDY AREA

The focus of the study is the land of Batna province, in the heart of the Aures (**Figure 1**). The State territory is largely a part of the natural group in the Tellian and Saharan atlas, which is the state's natural advantage, and also regulates the distribution of economic activities and characterizes human life. Its geographical position gives it special topographical features which directly affect

the human and cultural components, including the nature of population activity and its geographical distribution.

It is about 200 km north-south and similar east-west, which gave it different geographical environments, starting in the northeast to the southwest with sabkhat the most famous of which are the Shatt al-Hodna, then the highlands, and to the south of the Ain Touta-Fesdis corridor arriving to the border with Biskra province extends the majestic Aures Mountains and its natural landscapes, especially the depressions and straits. This great extension has natural tourism components that made it a tourist advantage both nationally and internationally.



Figure 1. Location of the Batna region on the Aures mountain range in east Algeria.

Batna is located between 4° and 7° east longitude and 35° and 36° north latitude (Louardi et al., 2018), this huge site played an important role in defining both the quality of the dominant climate and the form of vegetation with tourist attractions. It sits in a natural mountain environment, cool in winter and mild in summer and under normal weather conditions. The region's climate is generally considered semi-arid, but in mountain and forest areas over 1200 m above sea level, the climate is quasi-humid, as shown in **Figure 2**. The climate in the study area is impacted by several factors: its location between the 35° and 36° N wide circles, its distance from marine influences, which makes it subject to two different climates as mentioned above. The state's climate is cool in winter, where the temperature drops to an average of 3°C. In fall, most rain is in the form of snow with 50 freezing days. In summer, the climate is semi-arid, with an average temperature of 28°C. The region is subject to dry Sirocco winds from the South; while in spring and autumn it has a mild climate, which can be considered ideal for tourism (Souiher, 2001).

The study area is distinguished by high mountains, interrupted by highlands, thick forests and picturesque landscapes, home to a native Amazigh population. Batna province occupies an area of 12038.76 km², it currently comprises 61 municipalities in 21 districts, and it also includes a natural and cultural museum. It became necessary to undertake a development of economic and infrastructural sectors in this area to revive tourism activity, while the current status of the Algerian tourism planning is not included in the list of poles of tourism excellence

Meridja, Kherrouj & Belaid

established in Law 10-02 of 29 June 2010, including the ratification of the National Development Plan.

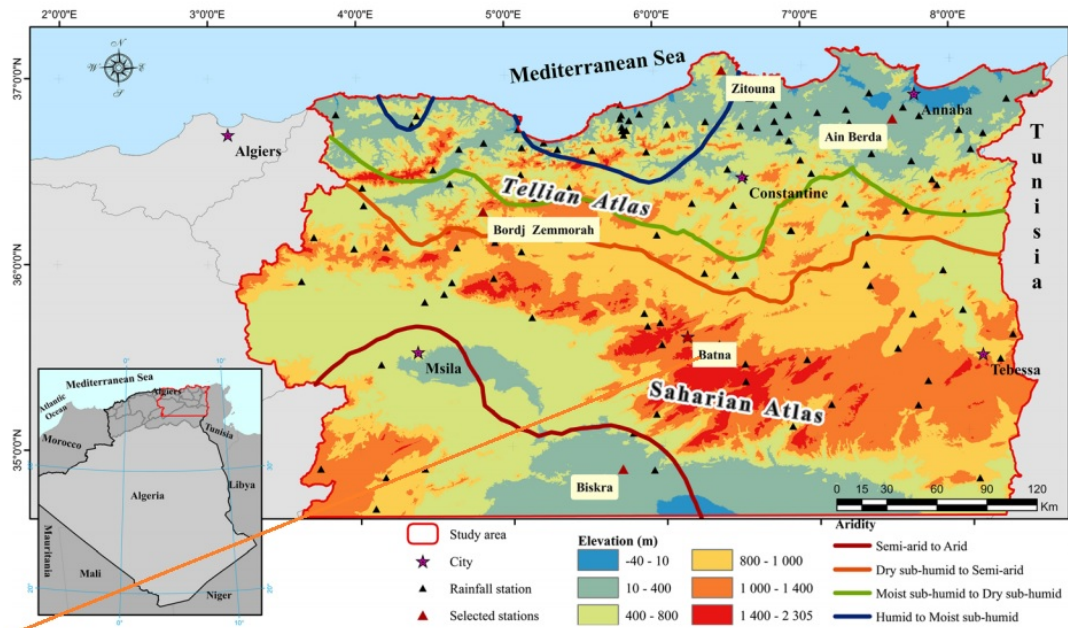


Figure 2. The location of the study area within the main climatic zones in east Algeria (Abdelaaziz et al., 2018).

METHODOLOGY

This analytical approach is based on the following techniques:

A- Theoretical approach: The researcher used a set of references to gather information on the research topic.

B - Method of analysis: Data collected from regional air stations for the period 1980 to 2018 were processed.

C - Comparative approach: Compare the most famous climate preference for tourism investment across different states.

D - Statistical measures used: Researchers relied on the index of percentages using the comfort index from Thom taking into account the temperature and humidity parameters (Tawhida et al, 2013).

RESULTS AND DISCUSSION

The main climate elements affecting the construction of the Batna State tourism industry are the following:

Temperature

The average temperatures in Batna state per month, as shown in **Table 1**, indicate that they differ from one place to another and one season to another because of the location and elevation effect. Altitude is important for the warmth of summer temperatures and their drop in winter. It can be seen that the average monthly temperature in the Aures Nammasha basin is about 3.8°C in the zeqqaq

region, 7.5°C in the Aris region in winter, up to 25°C. C in summer, while in the basin of el hodna, the average temperature is 10.8 in winter in the region of Barika and reaches 29.5°C in summer. In general, the Batna region is characterized by high temperatures in summer and low temperatures in winter.

Table 1. Batna average temperatures for 1980-2018 (Louardi, 2018).

Zone	El-Hodna basin			Nemamcha basin					Average
Station	Boutaleb	Merouna	Barika	Oued Chaâba	Zeqqaq	Arris	Batna	Foum Etoub	
Level (M)	1225	1060	456	1273	1650	1100	1040	1110	
In Winter	4.8	7.3	10.8	6.3	3.8	7.5	7.0	6.2	6.7
In Spring	11.3	13.4	16.8	12.2	10.5	14.2	13.8	12.2	13.5
In Summer	23.5	24.6	29.5	23.8	21.8	25.2	25.5	24	24.7
In Autumn	13.67	16.83	19.67	14.83	13.33	16.17	17.00	15.17	15.8

Source: Air Monitoring Station Ain Sokhna, Batna- February 2019

The seasonal variation of the thermal component in the temperate regions of the study area results in a natural sound of the mountain which affects tourist activity. The physical aspect of the climate also defines the possible tourist activities at a given location.

Relative humidity

It appears from **Table 2** where we measured at three different stations (Batna, Aris and Braika), that the humidity increases in the mountainous regions of Batna in winter due both to the altitude and the surrounding forest coverage on all sides, from Balzmah Forest in the north to Ish Ali Forest in the south, where the humidity reaches 75% during winter and 32% in summer. In Aris region, a mountainous region at about 2121 m above sea level with dense forests in the Eshmol and Zalatu mountains, humidity reaches 70% in winter and 31% in summer, as shown in the same table. Semi-arid areas such as Barika have a humidity of 69%, which is of course due to their proximity to brood, producing a healthy climate and a soothing atmosphere.

Table 2. Annual average relative humidity in Batna of largest stations during 1980-2018.

Seasons	In Winter			In Spring			In Summer			In Autumn			Average
	Dec.	Jan.	Feb.	Mar.	Ap.	May	Jun.	Jul.	Au.	Sep.	Oct.	Nov.	
Batna	75	75	74	63	55	65	41	32	44	67	64	49	59
Arris	70	69	64	57	50	44	38	31	36	48	58	57	52
Barika	62	67	69	48	46	54	31	26	34	45	54	58	50

Source: Air Monitoring Station Ain Sokhna, Batna- February 2019.

Meridja, Kherrou & Belaid

Table 2 above shows that the relative humidity levels vary between the different regions of Batna, in particular between the el houdna basin, the highlands and Aris, as well as between the seasons of the year. In other words, the relative humidity using average temperatures contributes to the interpretation of the seasonality of tourism in Batna.

Determination of months of rest in the Batna Province

To determine this, the Rest index of Thom: (Comfort Index temperature - humidity was applied, and researchers selected thom's equation and they analysed the elements of temperature and humidity and its impact on the human well-being, Thom; in 1970; established a relationship to determine human comfort under certain climatic conditions based on temperature and relative humidity, as follows:

Rest index of Thom: $THI = T_x - [(0.55 - 0.0055 U \%) (T_x - 14.5)]$ (Mustapha, 1996)

THI: Thermo-hygrometric complex in °C.

T_x: maximum temperature in °C.

U%: Relative humidity in % at the time of the thermal maximum.

ANALYSIS OF TABLE 03 RESULTS

From **Table 3** and **Table 1** we conclude that the tourist discomfort is in areas higher than 1100m. In spring, tourists feel very comfortable in all areas ranging from 1000 to 1060m in Merouna, Batna and Foum Toub, while they feel a kind of warmth in the Barika, southwest of Batna.

Table 3. The evidence of Thom rest condom in Batna State.

Seasons	Temperature rate	Moisture rate	Rest index	Symbol	Sensation to the climate
Winter	6.7	69.5	9.6	C	Discomfort from cold weather
Spring	13.5	53.5	13.8	P	Susceptibility from heat
Summer	24.7	34.7	22.8	P+	Total comfort
Autumn	15.8	55.5	15.4	P-	Susceptibility from cold weather

Source: Calculated by the authors based on the station data shown in table (01)

CONCLUSION

It is clear from the above analysis that the most important climatic stations in the province of Batna are in an ideal heat range, suitable for all leisure activities and all ages during most seasons of the year despite the high relative humidity in winter, and the low temperature mentioned above, which facilitates the movement of tourists, even in the region of Barika, where the temperature is high in summer with a low humidity, whose thermal range is suitable for most mountain-related

tourism activities, with the exception of swimming activities, which is only available in towns belonging to the El hodna basin.

It is also evident that the sensation of cold comfort, which is expressed by the continental climate and is best suited to the movement of tourism for most of the year, while the areas adjacent to the desert and located on the flanks from the Aures massif, for example: Ghoffi, Ghassira and Tkot located to the south-east of the state and covered areas such as Nkaus. These regions have a fairly high temperature and are qualified for tourist attractions in winter, while the rest of the regions enjoy a favourable climate for winter tourism movement favouring snowfall and summer tourism requiring a refreshing breeze which generates different climatic beaches favouring seasonal tourist traffic.

REFERENCES

- Ayana, F.M.A. (1984). Economic Geography - Dar Al-Nahda Al-Arabiya, Lebanon 60.
- Besancenot, J. (1985). Climate and summer tourism on the coasts of the Iberian Peninsula. *Geographic Journal of the Pyrenees and the South-West, Toulouse* 56: 431.
- Kebiche, M. (2018). Climate, health and tourism: Application to a Mediterranean climate semi-continental attenuated: The region of Sétif (Algeria). *Work of the Institute Geographical area of Reims* 24: 93-94.
- Kherrou, L., Rezzaz, M.A. & Hattab, S. (2018). Rehabilitation of geographical areas for a tourist development the case of Batna region's mountains (Algeria). *GeoJournal of Tourism and Geosites Year XI* 22(2): 458.
- Kherrou, L. (2018). Planning and development of tourist types suitable for the province of Batna, doctoral thesis, university of sciences and technologies Houari Boumediene 220.
- Khyun, M.I.S. (2018). Human Comfort Index for Selecting Tourist Sites in Northern Iraq. *Journal of Arts* 123: 241.
- Lin, T. & Matzarakis, A. (2008). Tourism climate and thermal comfort in Sun Moon Lake, Taiwan. *International Journal of Biometeorology* 52: 281.
- Merabti, A., Meddi, M., Martins, D.S. & Pereira, L. (2018). Comparing SPI and RDI Applied at Local Scale as Influenced by Climate. *Water Resour Manage* 32: 1071-1085.
- Nouari, S. (1994). The effect of geographical factors on rural transformations in the State of Batna - PhD Thesis from Houari Boumediene University – Algeria, pp: 28-33.
- Richard, D., George-Marcelpoil, E. & Boudières, V. (2010). Climate change and development of mountain territories: What knowledge for which courses of action? *Journal of Alpine Research* 7.
- Scott, D., Gössling, S., & de Freitas, C.R. (2008). Preferred climates for tourism: Case studies from Canada, New Zealand and Sweden. *Climate Research* 38: 61-73.
- Shariff, N.M., Abidin, A.Z. & Mohamed, A.E. (2019), New critical indicators of climate variability and change in Malaysia. *GeoJournal of Tourism and Geosites* 24(1):40.
- Shariff, N.M., Abidin, A.Z. & Mohamed, A.E. (2019). Tourism event: Perceptions on the Zealand and Sweden, *Climate Research* 38: 61.
- Tawhida, A. & Yousif (2013) Application of Thom's Thermal Discomfort Index in Khartoum State, Sudan. *Journal of Forest Products & Industries* 2(5): 36-38.