Int. J. Environ. Res., 10(4):601-612, Autumn 2016
ISSN: 1735-6865

Assessment of Tourism Climate Opportunities and Threats for Villages Located in the Northern Coasts of Iran

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Received 16 June 2016; Revised 20 Sep. 2016; Accepted 29 Sep. 2016

ABSTRACT: Identifying environmental potentials has a crucial role in the construction and spatial planning of our country, especially in the countryside. This article attempts to examine the climate characteristics of the tourism villages located at the northern coast of Iran, which is the south of Caspian Sea, in order to expand and develop the tourism industry. In this study, for the first time, terms of climate comfort and climate tourism in 6 tourism villages of 3 provinces of Golestan, Gilan, and Mazandaran were analyzed through physiologically equivalent temperature (PET) and climate-tourism-information-scheme (CTIS) by using data from 1994-2014. Results from PET showed that among the 6 studied villages in Mazandaran, Kandolus and Javaher Deh had the most days of thermal comfort with values of 51.6% and 51%, respectively in the entire period of the study while the least thermal comfort was 35.3% which belonged to Zeyarat in Golestan. The results also showed that based on PET, late fall to mid-winter held the maximum climate comfort conditions observed in the villages of the 3 provinces. Furthermore, it was found that the most important climate comfort deterrent factor in villages of Gilan and Golestan was hot class and for Mazandaran, bioclimatic warmth. However, based on CTIS, windy, foggy, and cold stress were not known as comfort limiting factors in the entire study area. Sultry and heat stress were introduced as tourism limiting factors in the summer and spring. On the other hand, the maximum comfort was in the autumn based on thermal comfort.

Key words: Tourism climate, Rural tourism, Bioclimatic, Northern Iran, Physiologically equivalent temperature, CTIS index

INTRODUCTION

Tourism industry has an influential economic role in the destination and tourist country (Haque and Khan, 2013). Tourism makes wealth and can have an important role in the success of development goals of the millennium such as eradication of poverty, gender equality, environmental sustainability, and global partnership (Saarinen et al., 2013). This industry is the main factor in globalization consisting of billions of connections between guest/host and merging most places into a global tourism network (Weaver and Lawton 2007). That is why a lot of attention is paid to the planning and development of this industry in different countries and regions (Farid, 2015; Guo and Sun, 2016; Liu and Chou 2016). Planners and economists who worked for organizations such as the UN, World Bank and the Organization for Economic Co-operation and Development conducted studies on tourism as a developmental tool (Sharpley and Telfer, 2002).

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Tourism development is influenced by various factors and components. Climate is a major factor in the development of the tourism industry that can be considered as a valuable asset in tourism on a global scale (Amelung and Viner, 2006; Scott et al., 2008; Trawöger, 2014; Yazdanpanah et al., 2016). The effect of climate on tourism can be either positive or negative (Becken, 2013). For the tourist, the weather is an inherent part of the holiday experience (Goh, 2012) and plays a significant role in tourism demand, the development of tourism patterns (Asgary et al., 2011), destination selection, time of travel and can also influence performing or not performing tourist activities; for example, snow skating tourism (Michailidou et al., 2016; Akbarian Ronizi and Rezvani, 2016). Numerous studies have examined the relationship between tourism and weather (Lise and Tol, 2002; Nicholls, 2006; Gossling et al., 2006; Scott and Lemieux, 2010; Pham et al., 2010; Scott, 2011; Morrison and Pickering, 2013; Amelung and Nicholls,

2014; Liu, 2016; Paquin et al., 2016). These studies have been conducted by researchers of climatology and tourism geography. Changes and challenges of the past have brought about the importance of considering atmospheric conditions in investigating the tourism potential in order to develop tourism (Pearce 1981; De freitas, 1990; Perry 1992; Martín,2005).There is a general consensus in the tourism literature that the destination image is a key concept in the selection; that is, reviewing destination images can provide information about vegetation, climate and natural features (Hu and Ritchie 1993; Galarza et al., 2002; Pike, 2002). In general, climate has a prominent role in tourism purposes and can influence tourism. Climate variability causes seasonal tourism and determines the time of travel. The fact that seasonal tourism is so acute and must be dealt with carefully is well known in tourism demand. Tourism researchers study seasonal distribution of tourism demand by analyzing indicators of tourism demand models (Goh, 2012).

Mendizabal et al. (2014) define climate change adaptation measures as changes to decision-making in order to increase the resilience, or reduce the vulnerability, in the face of future projected climate change. Nowadays, climate change is considered as an effective factor in the future development of tourism system within different regions and causes a high level of uncertainty specially at the regional or local scale. Regarding this uncertainty, attempts can be made to remove disruption in tourism and rebuild capacity by making social and economic local systems flexible (Wyss et al., 2014).

Iran's tourism industry has a great potential for development. According to the World Tourism Organization, Iran is ranked 10th in terms of archeology and historical attraction and ranked 5th in terms of natural attractions (Ghanian et al., 2014; Yazdanpanah et al., 2016). However, tourism has not been able to play an influential role in Iran's economy. Due to the country's economic dependence on oil, attention and investment is required to develop tourism and to abandon its single-product economy. Some of Iran's potential tourism developments are rural areas due to major cultural, historical, natural and structural attractions, not to mention the various patterns of tourism seen within the country (Rezvani, 2008).

Among these, rural areas located in northern Iran, Mazandaran, Golestan and Gilan are the most important tourist attractions due to climate differences. Different patterns of tourism such as ecotourism, religious tourism, cultural tourism, swim tourism, historical tourism, and agricultural tourism are formed because of other attractions like location, green jungles, rivers, springs, waterfalls, natural attractions, and monuments which attract many tourists during different seasons (Ghadami,2008; Jomehpour and Keyoumarse, 2012; Khajehshahkoyee et al.,2013; Motiei Langrodi and Heydari, 2013). Regarding the potentials in the last decade, tourism development is being considered as a strategy for sustainable development in rural areas. Rural tourism is a diversified industry (Leco et al., 2013) and any kind of planning and policy making in tourism development necessitates identifying factors affecting this industry. As mentioned above, climate is an important factor; therefore, evaluating the potential of rural tourism climate in this geographical area seems necessary, which is the purpose of the current study.

Villages studied in this research are 6 villages located in Iran's northern coast which are visited by thousands of tourists throughout the year for leisure and entertainment (Fig.1). These villages are: A) Qaleh Rudkhan: one of the mountainous villages of Gillan with good weather that attracts a lot of tourists in different seasons because of its climate, mountains, forests, and also because of Qale Rudkhan (belonging to Seljuk period); B) Agh Uler: this historical and summer village is in the west of Tallest (Gilan). Good weather, deep valleys, vast and green meadows, high mountains, clear springs of mineral water and monuments such as ancient cemetery and Zarqam-Alsaltaneh's castle are the tourist attractions of this village; C) Qaleh Qafeh: a mountainous village with a traditional setting in Golestan (Meenudasht); according to the cultural heritage organization, the complex and traditional texture of this village makes it an excellent rural setting in Golestan and it is 100 years old, which makes it a tourist attraction. This village has numerous tourist attractions consisting of caves, waterfalls, fountains and beautiful and exquisite forests; D) Zeyarat: this village is located in Golestan, the capital of Gorgan, in the foothills of northern slopes of the Alborz Mountains and the surrounding forest is covered with specific foothill climates making it a specific tourist attraction for Eco tourists (Jomehpour and Keyoumarse, 2012). The village is surrounded by Nahar Khoran jungles, and Adim, Mazoo kesh, Kamarsar heights from the north and by waterfalls and mountains covered with forest from the south. It is worth mentioning that the presence of the holy shrine of Abdollah has been the reason for calling it Zeyarat. Attractions of this village are natural landscapes, suitable mountaineering locations, various agricultural products, diary, fruit trees, waterfalls, and hot water spring with health benefits which has been selected as one of the top 20 mineral water springs of Iran(Khajehshahkoyee et al., 2013); E) Javaher Deh: located 27 km from Ramsar on the slopes of high Samasoos Mountains among meadows and grasslands. Labasar with famous health springs and

Samasoos mount with permanent refrigerators are the attractions of this village. The village streams having beautiful waterfalls, vast forest park near the river in the valley that is close to Safarood and a river with carbonated mineral water are the attractions of this village. Additionally, there are monuments like Adineh Mosque that used to be a Zoroastrian fire temple and Gabri graves scattered in the area which are other attractions of the village; F) Kandeloos: located in south east of Noshahr in one of the beautiful valleys in the Alborz Mountains. According to archaeologists, the historical background of this village dates back to the third millennium BC. The village has witnessed various civilizations in different historical periods and has signs of BC civilization and Iran's pre-Islamic and post-Islamic civilizations. Pleasant weather and mineral water springs give it a special charm and glory. In addition to the natural attractions, two museums of anthropology and medicinal herbs were also effective in its reputation and attracting tourists' attention.

MATERIALS & METHODS

In order to achieve this goal, daily, long-term climate data of precipitation, sunshine hours, cloud cover, fog, wind speed, relative humidity and air temperature were used for the period of 1994 to 2014. These data were obtained from Iranian Meteorological Organization. As mentioned above, PET was used in this study to quantify the bioclimatic conditions of the studied areas. PET was developed by Höppe (1999) as a global benchmark for assessing the thermal environment. It was obtained from the energy balance equation of human body and can be interpreted as the air temperature of a room in which the human body experiences the same level of thermal stress resulting in the same skin temperature and core temperature of the human body as in the real outdoor environment.

In this study, the RayMan model whose description is available in Matzarakis et al. (2007, 2010) was used to determine PET values. One of the important features of this model is simulating the short- and long-wave radiation flux densities from the three-dimensional surroundings in simple and complex environments. The final output of the model is the mean radiant temperature of the environment, which is among the most important components in calculating PET. The variables needed for RayMan to calculate PET included the following:

– Topographical variables, including latitude, longitude and altitude of the desired area;

– Meteorological variables, including dry air temperature in degrees Celsius, relative humidity in percentage or vapor pressure in hectopascal, wind speed in meters per second and cloudiness in octas. Also, individual variables such as height, weight, age and gender are physiological characteristics necessary in the model;

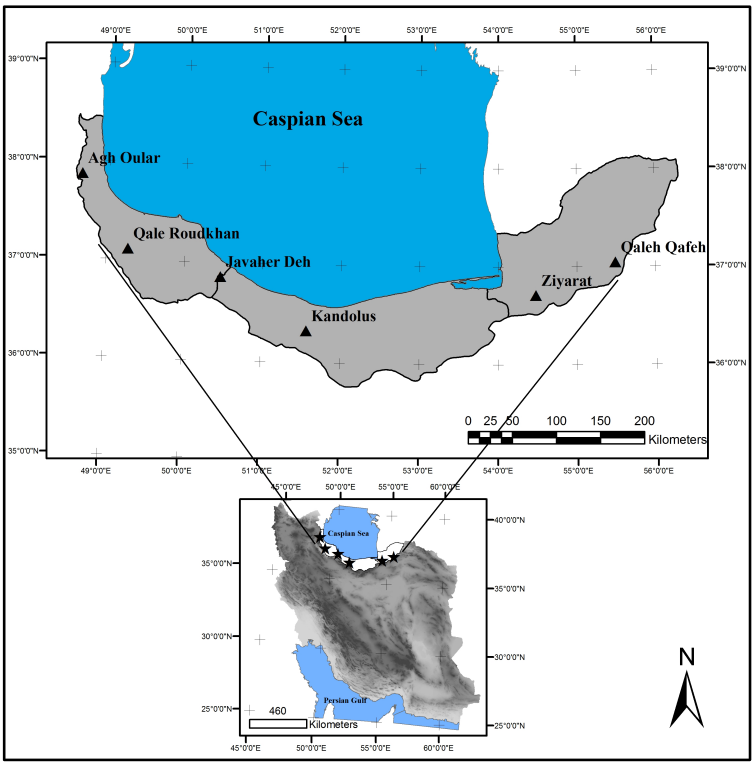

Fig.1. Case study area

– Variables that are related to the type of clothing (in clo) and activities (in watt per square meter).
In Table 1, the threshold values of PET are presented based on varying degrees of thermal stress and human thermal perception.

There are some studies that calibrated the thermal classes of PET or other bioclimatic indices for their specific climate, such as Lin and Matzarakis (2008) for Taiwan, Yahia and Johansson (2013) for Damascus, and Syria or Kovács et al. (2016) for Hungary and Roshan et al. (2017) for Iran.

It should be noted that the aim of the present work is not to define and use new thermal zones for Iranian sites. We used the conventional PET classes in this paper generalized for our case study, therefore its application should be considered only as an indicator at this stage of the research as Roshan et al.(2016) used PET as an indicator. Therefore the present study can be the base of a subsequent work where we use calibrated PET classes.

Climate-tourism-information-scheme (CTIS)

The CTIS (Matzarakis, 2007a; Lin and Matzarakis, 2008; Zaninovic and Matzarakis, 2009) intends to integrate and simplify climate information for tourism. It contains detailed climate information which can be used by tourists to anticipate thermal comfort as well as aesthetical and physical conditions when planning their vacations. CTIS provides all-seasonal frequency classes and frequencies of extreme weather events on a 10-day or monthly time scale (Matzarakis, 2007).

The CTIS is presented using frequencies of each factor under specific criteria for each 10-day interval, as shown for our case study for the period 1994–2014 in Figs. 4 to 9. The CTIS diagram includes the selected factors and criteria for the thermal, aesthetic and physical components of weather which are important for tourists as follows:

Thermal components:
1. Thermal stress (PET>35°C)
2. Cold stress (PET<0°C).
3. Thermally acceptable (PET between 18 and 29 °C)
Aesthetic components
4. Cloudiness (cloud cover<5 octas)
5. Fog (relative humidity>93 %)
Physical factors:
6. Wind (wind speed>8 m/s).
7. Long rain (precipitation>5 mm)
8. Dry days (precipitation<1 mm)
9. Sultriness (vapor pressure>18 hPa)

Information for each component is presented as the percentage of its occurrence in 10-day periods. To add to the CTIS diagrams and make the information provided easier to understand, the comprehensive "Climate Index for Tourism" (De Freitas et al., 2008) is incorporated into the scheme. The probability of CTIS scale is expressed in seven climate classes from "very poor" to "ideal", which gives about 14% of probability to each class. For parameters 1, 2, 5, 6, 7, 9, greater probability means less favorable conditions, while for parameters 3, 4, 8, greater probability means more favorable conditions (Zaninović and Matzarakis, 2009).

RESULTS & DISCUSSIONS

In this research, the first part of the findings focuses on the frequency percentages of various classes of thermal comfort PET such that the output for each station is presented in monthly frequency in Fig.2. and regardless of the monthly frequency, results of the whole period of the study are presented in Fig.3.

As mentioned before, for Golestan province, two tourist villages of Zeyarat and Qaleh Qafeh were selected. Results of this part of the study for Zeyarat show that based on thermal comfort, maximum frequencies of 21.04%, 19.10% and 17.49% belong to January, December and February, respectively and in

Table 1. Ranges of the physiologically equivalent temperature (PET) for different grades of thermal perception (Matzarakis and Mayer 1996)

PET (°C)	Thermal perception for PET	Level of thermal stress (PET)
<4	Very cold	Extreme cold stress
4-8	Cold	Strong cold stress
8-13	Cool	Moderate cold stress
13-18	Slightly cool	Slight cold stress
18-23	Comfortable	No thermal stress
23-29	Slightly warm	Slight heat stress
29-35	Warm	Moderate heat stress
35-41	Hot	Strong heat stress
>41	Very hot	Extreme heat stress

August and even July, thermal comfort is not observed, and in September and June, less than one percent of comfort conditions is observed. In this station, based on Fig. 2 and 3, no occurrence of cool to very cold levels is seen and with the exception of January, February and December, there is no experience of the slightly cool condition. On the other hand, the most important deterrent factor of comfort in this village is hot condition that is seen in August with 18.26% and in July with 16.6%, the maximum amount is experienced compared to the other months of the year. Like Zeyarat, in Qaleh Qafeh, too, maximum comfort frequencies of 21.5%, 20% and 18.4% belong to January, December, and February, respectively and from June to September, there is no experience of comfort conditions. In this village, there is no experience of cool to very cold thermal event, while monthly data distribution shows that from the late autumn to the late winter, slightly cool thermal event happens in this area. In this village, similar to Zeyarat, the hot condition has been the deterrent factor of comfort because in comparison to extreme conditions with 19.4%, the extreme maximum frequency belongs to this class (Fig.3). However, on the basis of time distribution, June with 20.18% and July with 19.97% have the maximum bioclimatic experience of this class.

In Mazandaran, evaluation of the results for Kandolus is similar to that of Golestan with a slight difference. No experience of cool to very cold condition is seen and maximum comfort condition is at 15.5%, 15.10% and 15.08% in March, January, and December, respectively with slight changes compared to the other two villages. In this village, unlike Zeyarat and Qale Qafeh tourist villages, the most important deterrent comfort condition is for warm class such that the maximum time distribution is 18.85% and 17.57% in July and August, respectively. In Javaher Deh, the only occurrence of cold bioclimatic condition belongs to slightly cool such that the most concentration of the heat extreme happened in winter. In this village, most days with maximum heat comfort belong to December with 15.80%, March with 15.51% and January with 15.35%.

On the other hand, like Javaher Deh, warm class is the most important deterrent factor of comfort (Fig.3). So, in Javaher Deh, June, September and July with 20.39%, 19.33%, 18.53% have the maximum time distribution of warm class (Fig.2). After evaluating the two villages of Agh Uler and Qaleh Rudkhan in Gilan, it was determined that as other villages studied in Mazandaran and Golestan, the only occurrence of cold bioclimatic conditions of slightly cool level is in the late autumn and the maximum is in winter in the time distribution. In these villages, winter is the most ideal season in terms of thermal comfort, while maximum frequencies of days with comfort for Qaleh Rudkhan are 16.68%, 15.74%, and 15.54% for December, January and March, respectively but for Agh Uler, January with 20.59%, December with 18.88% and February with 18.36% have got the first to third places. In tourist villages of Gilan, hot conditions, as the most frequent, are known as the main deterrent factor condition (Fig.3) so that in both villages, June has the highest potential of this bioclimatic class. The evidence for this claim is the frequency of hot class by 24% for Qaleh Rudkhan and 28% for Agh Uler (Fig.2). All in all, regardless of the monthly scale and based on the data for the period of 1994-2014, it can be concluded that among these 6 studied villages, Javaher Deh and Kandolus with 51.6% and 51% have the most days with thermal comfort and the minimum of days of comfort with 35.3% of the entire statistic period is for Zeyarat in Golestan. On the other hand, the swing of very hot extreme condition is variable from at least 3.5% for Javaher Deh to the most 16.2% for Agh Uler, but the minimum frequency of hot bioclimatic conditions with 12.2% and the maximum with 19.4% are for Kandolus and Qaleh Qafeh. Finally, according to bioclimatic warm conditions, Javaher Deh with 17.1% showed the highest frequency and Agh Uler with 13.5 % has experienced the lowest warm conditions (Fig.3).

Climate-tourism-information-scheme

The CTIS has been developed for the assessment of weather and climate in tourism regions. In order to make the CTIS diagrams easier to understand for non-experts in climatology, the comprehensive "Climate Index for Tourism" (De Freitas et al., 2008) is incorporated into the scheme. CTIS represents frequencies, probabilities, and thresholds of tourism climatic and bioclimatic factors. In addition, CTIS is a software that can operate this relevant data from text-based files and generate highly customizable diagrams. It can easily be used and implemented for diverse applications, i.e., decision making or information about tourism industry (Matzarakis 2007b; Lin and Matzarakis 2008, Farajzadeh and Matzarakis, 2012). This method is preferred for analyzing climate stations or grid points. The analyzed bioclimatic parameters are presented in frequencies on a percentage basis. The interpretation of CTIS is described in Figs. 4 to 9 for each rural area. Each colored column describes the corresponding frequency of a parameter. A frequency of 100% indicates that each day in a month is characterized by the respective condition listed on the right hand side. A frequency of 50% corresponds to an occurrence of the indicated condition during 15 days, 10% to 3 days of the considered month, and etc. (Farajzadeh and Matzarakis, 2012).

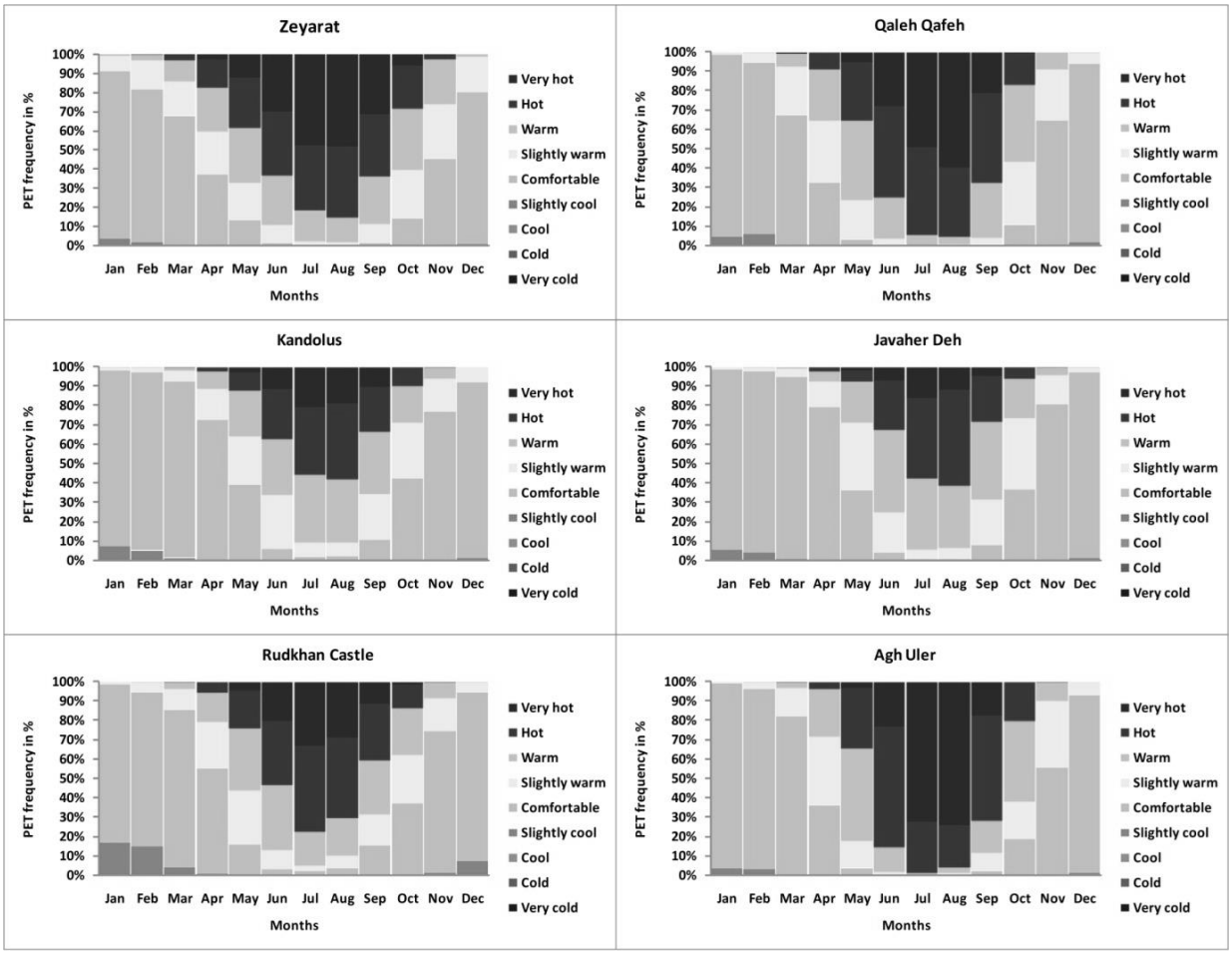

Fig.2.Monthly frequencies of PET (%) classes using daily data

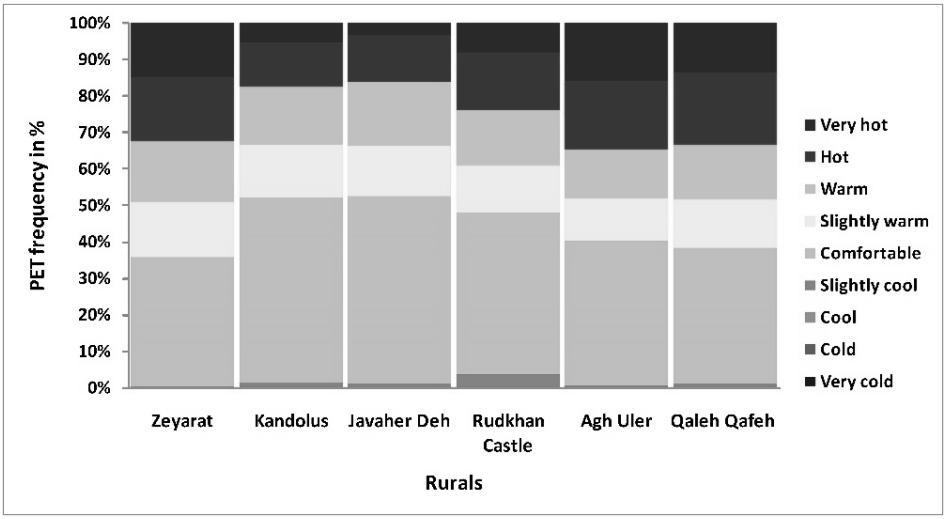

Fig.3. Frequencies of PET (%) classes using time series of 1960 to 2014

In this part of the study, results from CTIS for different villages are assessed, and first findings for two villages of Qaleh Qafeh and Zeyarat are presented. As illustrated in Fig. 4 and 5, in these villages in any period of the year, there are no limits for wind index, cold stress and even foggy conditions for tourists. For thermal comfort, as diagrams illustrate, there are no reports of thermal comfort conditions for either village in July and August though some days in most months are assigned to thermal comfort conditions. For Zeyarat, the maximum number of days with thermal condition belonged to November for 19 days; however,

Qaleh Qafeh experienced maximum thermal comfort for approximately 18 days per month in April and October. There were no reports of heat stress distribution in winter for either village and the maximum frequency of occurrence of this incident was observed in the summer. On the other hand, although throughout the year, the distribution of daylight hours is suitable, its peak is in the summer. Of important disincentives to tourism in these two villages was sultry condition whose maximum was observed in the summer. Details of CTIS illustrate that maximum sultry for Zeyarat was jointly in July and August with the average of 29 days per month which was 19 days for Qaleh Qafeh in July. Generally, according to wet day index, the maximum frequency for both cases was 4 days on average in March which is a small percentage; thus, this parameter is not considered as a disincentive to tourism in the region. On the other hand, the appropriate distribution of dry day throughout the year was significant and the maximum amount of it was in the summer. As details for Zeyarat illustrate, the maximum amount of dry day was jointly 27.6 days in July and August and for Qale Qafeh, the maximum amount of dry day in all summer months was 28.5 days on average per month (Fig. 4 and 5).

CTIS assessments for Javaher Deh and Kandolus were at some points similar to those of tourist villages in Golestan province. There were no limiting conditions of windy and cold stress for these two villages in Mazandaran. In addition, there was no limiting condition of heat stress in cold seasons, winter and autumn, which is another instance similar to that of Golestan province. In these two villages, there was no sultry situation seen in mid-autumn until late winter and similar to bioclimatic heat stress phenomenon, the maximum frequency of sultry conditions was in the summer and as the research shows, the maximum of sultry conditions for both villages was jointly in July

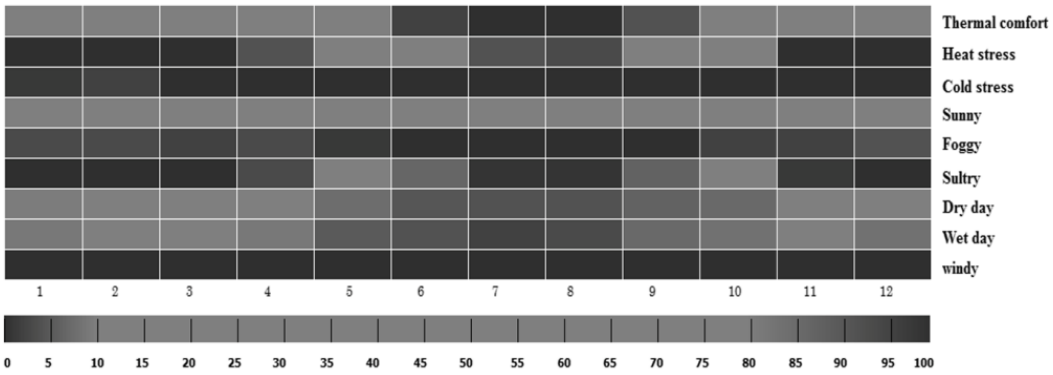

Fig.4. The assessment of the Climate Tourism/Transfer Information Scheme (CTIS) for Zeyarat from 1994 to 2014

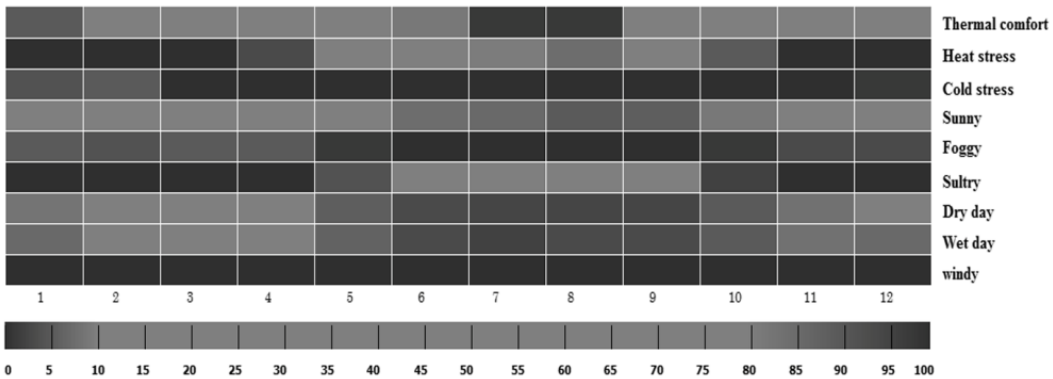

Fig.5. The assessment of the Climate Tourism/Transfer Information Scheme (CTIS) for Qaleh Qafeh from 1994 to 2014

and August with the average of 30 days per month (Fig.6 and 7). In these two villages, the maximum frequency of days with thermal comfort belonged to spring and autumn which is in the second place. However, April showed the most appropriate thermal comfort conditions for both villages. What supports this fact is the average of 18.9 days comfort in April for Kandolus and 19.8 days for Javaher Deh. In spite of this issue, the minimum days of thermal comfort are presented in the summer and winter for both these villages. Because of the small percentage of days with fogy conditions in these two villages, this factor is not considered to be an effective and important limiting parameter for tourism; however, the effectiveness of wet days is more than that of fogy ones which is because of the higher percentage of such conditions in different days of the year with the maximum temporal focus first in the autumn and later in the winter. In both villages, November showed the highest rate of wet days which is jointly on average 7 days for both villages (Fig. 6 and 7). For these two cases, although dry day distribution in different months of the year is more than at least 20 days, dry day percentage is less frequent compared to those of Golestan province villages. Nevertheless, the findings show that the minimum number of sunny days for Kandolus and Javaher Deh belonged to late winter and early spring and March showed 11.4 and 10.5 days on average for Javaher Deh and Kandolus, respectively, which is the minimum number of sunny days for these two areas.

Results for villages in Gilan province are similar to those of the other two previous provinces with slight changes. As can be seen in Fig. 8 and Fig.9, the most important limiting factors of tourism for Qaleh Rudkhan and Agh Uler are the limiting conditions of heat stress and sultry phenomena with the focal maximum in summer and spring. In July, both villages experienced heat stress conditions for approximately 28 days of the month; however, for the sultry factor, the conditions were even more unsuitable than this because in Agh

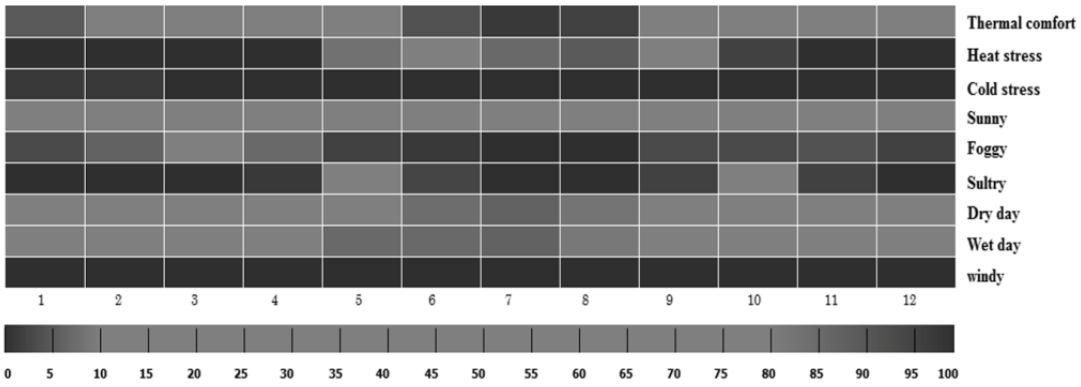

Fig.6. The assessment of the Climate Tourism/Transfer Information Scheme (CTIS) for Javaher Deh from 1994 to 2014

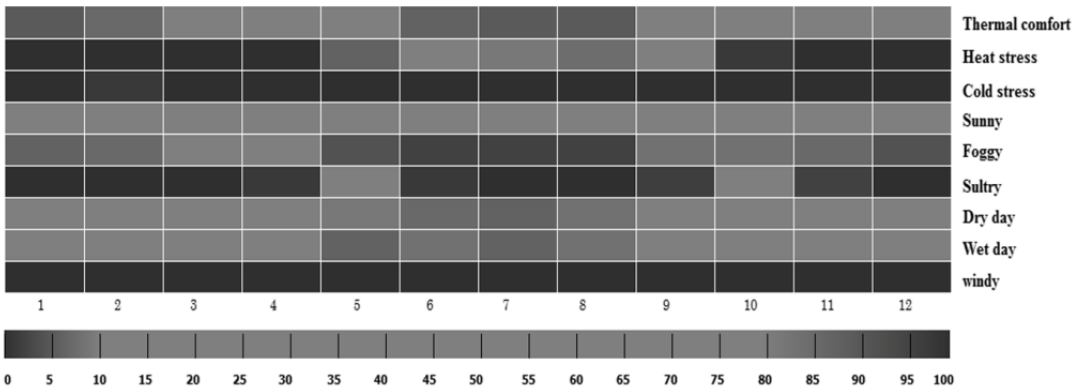

Fig.7. The assessment of the Climate Tourism/Transfer Information Scheme (CTIS) for Kandolus from 1994 to 2014

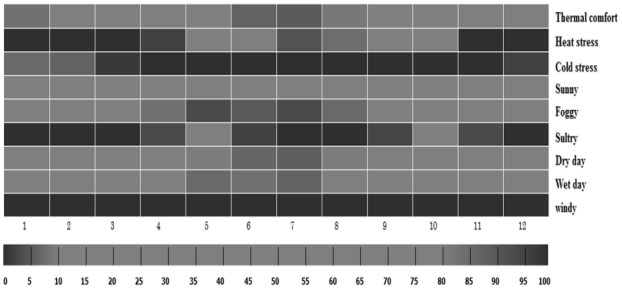

Fig.8. The assessment of the Climate Tourism/ Transfer Information Scheme (CTIS) for Qaleh Rudkhan from 1994 to 2014

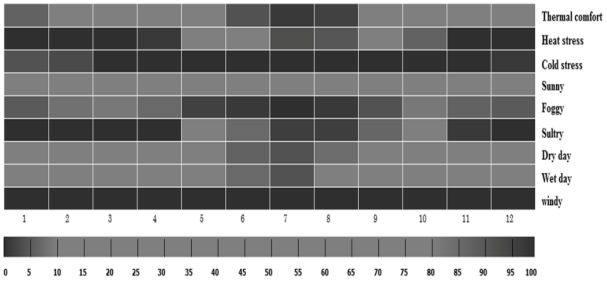

Fig. 9. The assessment of the Climate Tourism/ Transfer Information Scheme (CTIS) for Agh Uler from 1994 to 2014

Uler, in August and July jointly, 29 days of the month and for Qaleh Rudkhan, one hundred per cent of the days in August and July, the sultry condition is dominant. For tourist villages of Gilan, the increase of the number of wet days and on the other hand, the decrease of that of dry days is remarkable as compared to the two former provinces. Moreover, in autumn, the above-mentioned condition is more significant compared to other seasons of the year. Regarding sunny days, for Qlaeh Rudkhan and Agh Uler, the minimum number is 10 days in March and the maximum is 20 days in July for Qaleh Rudkhan and 23 days for Agh Uler in suitable sunny conditions. Moreover, findings of this part of research illustrate that based on thermal comfort index, autumn is the most appropriate season of the region for tourism and summer is considered the most inappropriate season of the year.

CONCLUSIONS

In this study, for the first time, regional comfort condition and tourism-climate of 6 villages situated in three Northern provinces of Iran along Caspian coast were studied by using PET and CTIS indexes. Results from PET illustrated that the most important disincentive for climate comfort of the whole area was heat stress. However, classes and thresholds are different for the area under study such that the most important disincentive climate comfort for Golestan and Gilan villages, is hot class and for Mazandaran, warm bioclimatic class. Similar to the results were the findings by (Zamanei et al., 2010; Esmaili and Ghalhari, 2014; Daneshvar et al., 2013). In all of these studies, the most important disincentive of comfort in the northern coastal parts of Iran was heat stress especially in late spring until late summer. Studies like Zamanei et al. (2010) consider the increase in the heat stress of summer in the region from a climatology perspective and believed that it depends on the increase of temperature in summer and the Caspian Sea as well as the increase of humidity in the atmosphere and the increase of sultry conditions. On the other hand, other parameters reinforcing heat stress in warm seasons in these areas include the retreat of cold westerly winds to northern latitudes, the lack of Siberian High pressure system and removing its effectiveness due to lack of cold weather in summer in these areas. In the present study, results illustrate that based on very hot, hot and warm degrees, Agh Uler with 16.2% of days, Qaleh Qafeh with 19.4% and Javaher Deh with 17.1% have the highest frequencies.

Moreover, based on the findings, it was determined that Javaher Deh and Kandolus experienced the most comfort days with 51.6% and 51%, respectively compared to other villages and Zeyarat with 35.3% of study days gained the minimum of comfort. In sum, CTIS outputs for two villages of Golestan province showed the fact that based on all factors, the most appropriate season for tourism is autumn because apart from the experience of disincentives like heat stress, cold stress, windy and even foggy conditions, the minimum number of wet day conditions were seen in this season while the maximum of days with thermal comfort given CTIS thresholds belonged to months of this season. Merely based on PET, the maximum frequencies of comfort rank for both Zeyarat and Qaleh Qafeh villages belonged to January, December and February, respectively. This lack of correspondence between PET and CTIS results is because of the difference in comfort thresholds for these two indexes and because for PET, the comfort areas are considered 18 to 23 while for CTIS, they are considered 18 to 29. Findings for two villages of Mazandaran province illustrated that, similar to two tourist villages of Golestan, parameters like windy, cold stress and foggy conditions as disincentives of tourism-climate condition are not recognized in any month of the year. In spite of the issue, the most important disincentives of tourism from a climate point of view in summer days are heat stress and sultry condition which are at a

maximum. Also, the low frequency of days with thermal comfort compared to other months of the year made this season the most inappropriate time from a tourism-climate perspective. On the other hand, difficulties of tourism-climate in spring are heat stress and sultry conditions whose frequency is not as much as that in summer although in general, they have a negative impact on the bioclimatic conditions of the region. Regarding two parameters of wet day and dry day, no significant difference could be seen between different months of the year and based on thermal comfort factors, autumn is the most appropriate season of the year in which the maximum comfort condition is gained which was in the range 18 to 23 PET which for both villages which belonged to December. Thus, regarding all limiting components in CTIS index and also PET index, the most appropriate season for tourism in these two villages is autumn. In Gilan province, also, in most cases, results were in accordance with two other provinces. The difference is that wet day and foggy indexes are a bit higher and dry day and sunny indexes are a bit lower. Moreover, heat stress focus and sultry condition were in summer and spring and cold stress and windy conditions were not considered as disincentives for tourism in the region. On the other hand, based on thermal comfort index, the most suitable season of the year for tourism is autumn and PET results introduce December as one of the most appropriate months for tourism. In line with the results of the present study, Ismailia et al. (2011), by using PET and CTIS indexes, demonstrated that the most appropriate season for tourism for cities across the southern part of Caspian Sea is autumn. However, despite these findings, Ramezani Gourab and Foroughe (2010); Delavar et al., (2012); Ramazanipour and Behzadmoghaddam(2013); Ramezani et al.,(2013) and Roshan et al.,(2016) achieved different results. They illustrated that for cities on Caspian Sea side, the most suitable season for tourism is summer and spring. The possible reason for this difference may be the methodology utilized here in that in other studies, tourism climate index (TCI) was used which is proper for summer tourism-climate and compared to CTIS, it disregards cold stresses and foggy condition. Moreover, fundamentally, TCI method is based on monthly average of climate components while in CTIS, data are considered on a daily basis. On the other hand, in the former index, bioclimate areas are used based on effective temperature index, which is a simple bioclimatic index; however, in the present study, PET, which is a physiologic index, was used.

Today, the use of composite indicators that are based on the balance of the human body, e.g. PET, is very common in thermal comfort assessments and tourism climatology. For example, Nastos and Matzarakis (2013) revealed that the trend analysis of PET extremes indicated increasing trends for both extreme heat and cold stress in the Athens University Campus, Greece for the time period of 1999–2007. Additionally, numerous other researchers used PET in their studies; for example, Rudel et al., (2007) for Australia; Amiranashvili et al., (2008) for Georgia; Lin et al., (2008) for Taiwan and Krüger et al., (2013) for Glasgow. Given the mentioned issues, it can be argued that the most suitable season for tourism in villages of northern part of Iran is autumn and the trend of tourism in this region is in such a way that this season can attract more tourists. Hence, tourism schedules and agendas of the region, including servicing to tourists (residencies, equipment, facilities and etc.), should be in accordance with it, in that providing services for tourists in the region should be focused in autumn months. For this reason, there should be an accurate and proper schedule to improve the conditions and tourism of the region in line with sustainable development.

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