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The impacts of climate change on the oasis tourism: The oasis of tighmert and asrir as a case study (Province of guelmim, Morocco)

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Abstract
In recent years, the tourism sector has become the largest source of economic growth in the world. It is the leading industry in many countries, as well as a substantial source of job creation worldwide. The oasis tourism activity is susceptible to climate change because of its strong connection to the natural climate. In that case, the interaction between tourism and climate change is very complex. It involves many activities that can have adverse environmental effects. The oases of Tighmert and Asrir are considered as one of the most popular tourist attractions in the region of Guelmim, but they are negatively affected by climatic change which will indirectly damage the natural environment in general. This problem is due to various causes. The main objective of this study is to examine some of the negative impacts of climate change on the oasis tourism product in the area of Asrir. To achieve this aim, we conducted a fieldwork survey in the community of Asrir which was taken place between 2018 until 2020. This fieldwork survey was carried out through a number of samplings that targeted the local populations of the oases of Tighmert and Asrir. It also targeted some tourists in different popular tourist sites as well as the professionals of tourism. Thus, the results of this study showed that the oases of Tighmert and Asrir were negatively affected by the climate change.

Keywords: climate change, impacts, oasis tourism, tighmert, asrir, guelmim, Morocco

Introduction

Nowadays, the problem of climate change has rapidly spread all over the world. It is disrupting national economics and affecting lives, costing people, communities and countries (Couissi, 2017, p. 56) [3]. It causes changes in the ecosystems and natural resources needed to sustain the tourism economy. Generally, the climate change has multiple impacts on the tourism sector including changing weather patterns, rainfall changes, droughts, flash floods, less productive fisheries and agricultural systems, rising sea levels, desertification, and other health-related problems, all of which are now rampant in Moroccan country. Clearly, it is known that no development plan can be prepared or implemented unless the resources and components needed for this plan are counted (Abou Hajr, 2011, p. 45) [1], and the tourism development plan does not deviate from that, so identifying the natural and human components available in the study area represents the starting point for setting alternatives to tourism development. Robinson in his book "Geography of Tourism", determined that the components of tourism, represented by location, accessibility, area, and scenery featured in the aspect of the land and water forms, the plant patterns, the prevailing climate, and the features of settlement represented in cities and villages, monuments and historical remains, as well as the cultural component that includes folklore, customs and style of life and handicrafts. And, the important aspect of sustainable tourism development focuses on tourism that is based on or directed towards the local community, and here the focus is on the participation of the local community in the tourism development and planning processes (Robinson, 1979, p. 42) [8]. The province of Guelmim with its oases is characterized by different potentialities that qualify it to be a major tourist attraction, given the historical site of the province which is anciently known as "Oued Noun", as well as the natural and cultural heritage, and the desert folklore. In fact, the region of Guelmim has been considered as a tourist destination since the ancient times, given its commercial role in the past between African countries and northern Morocco. It relies on two suitable factors that attract the first of which is its semi-desert climate, and the desire of its children, most of whom live outside the region, to visit family and friends; and despite the fact that the tourism development strategies in the region are mainly the product of the national tourism development project, but there is an urgent need to develop a coordinated, well-funded program to address the pressing issues facing tourism.

his program which is based mostly on an overview of the current tourism market situation in Morocco and an evaluation of tourism assets, and an analysis of strengths, weaknesses, opportunities and threats faced by oasis tourism in the region, in order to reach a comprehensive and familiar diagnosis of all the natural and human aspects that are investable in any development plan.

More importantly, the study of the impacts of climate risks on the oasis tourism product did not pay attention to the researchers, and this in turn created a simultaneous scientific vacuum from which the tourism library complains, considering climate one of the main pillars in the planning process for the development of this industry (Ghanim, 2010, p. 20) [4].

Additionally, studying the climate provides us with sites and seasons for tourism (Bazazo, 2010, p. 63) [2], then disclosure

of the problems and obstacles facing the tourism development process. So, it is necessary to examine and analyze the essence of this problem. Thus, the main objective of this study is to clarify how climate change can affect the oasis tourism product by presenting some examples of this current topic.

The essential issue of this study is as follows: « What are the negative impacts of climate change on the oasis tourism product in the area of Asrir?

In this study, I will firstly present the major impacts of climate change on the oasis tourism specifically in the oases of Tighmert and Asrir. Secondly, I will give some adaptation measures and strategies that can be interested in mitigating the problem of climate change in the oasis tourism. Finally, I will present a conclusion that summarizes the obtained results.

Materials and Methods

Presentation of case study

The oases of Tighmert and Asrir are geographically situated in the rural commune of Asrir, which is located in the region of Guelmim Oued Noun and comes under the Province of Guelmim about 10 km. It is limited to the north by the rural commune of Abaynou and the city of Guelmim, to the south by the rural commune of Aferkat, Tiglit and Labyar, to the east by the rural commune of Fask and to the west by the rural commune of Laqsabi and the city of Guelmim (Figure 1). It extends over an area of 923 Km². According to the General Census of Population and Housing (GCPH) of 2014, the commune of Asrir counts 3566 inhabitants and 708 number of households. It has a population density of 3.28 inhabitants/Km² (Haut-Commissariat au Plan, 2014) [5]. Also, this commune is characterized by a semi-arid climate (Ministère de l'Intérieur, province de Guelmim, 2014) [7].

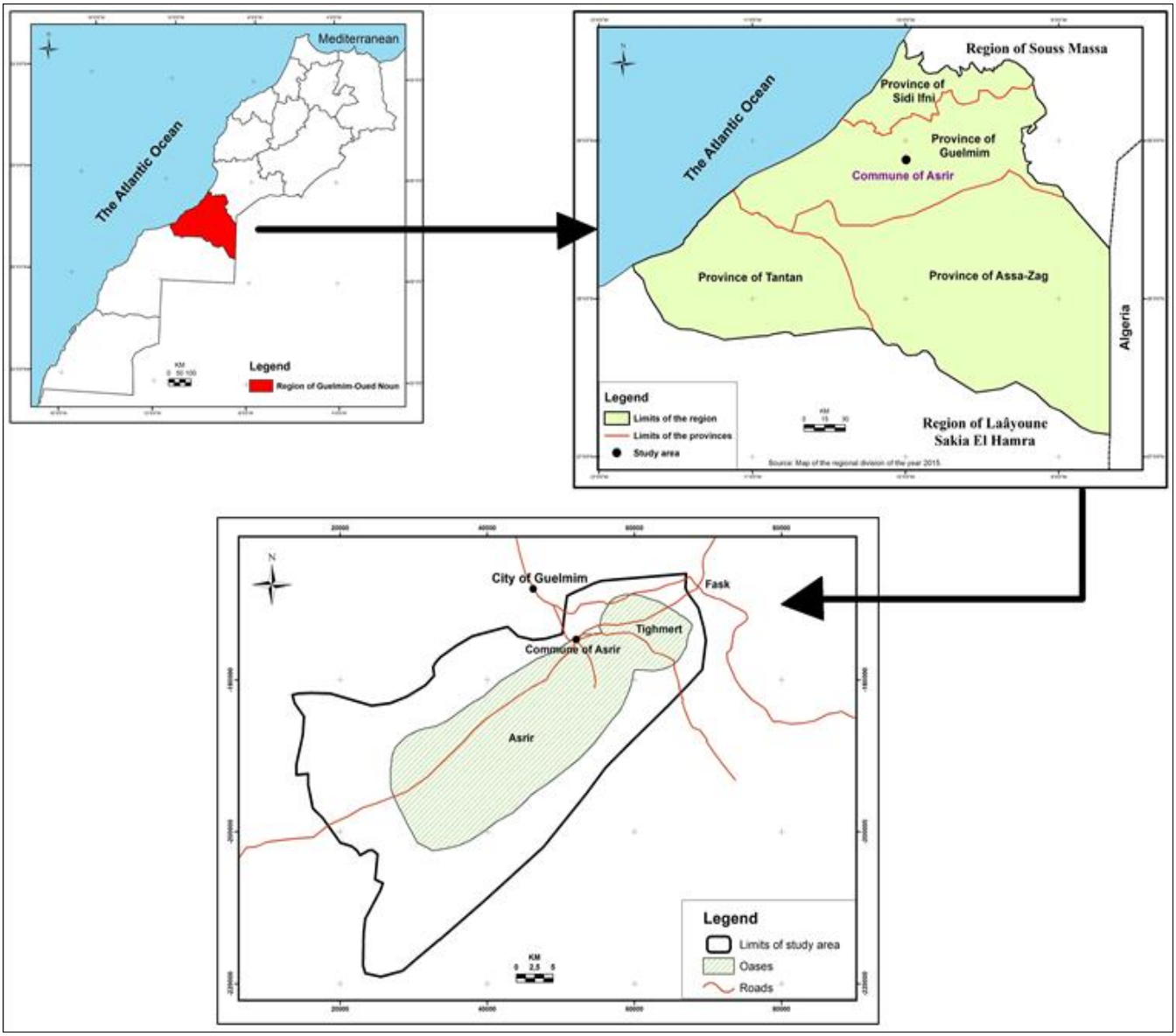

Fig 1: Geographical map of the study area (Province of Guelmim, 2014, modified and completed by S. ELBAIED, 2020).

Methodology

This study is based on three important approaches that are intertwined with each other and are integrated as follows: the theoretical approach, the critical approach, and the applied approach.

The theoretical approach

It seeks to study the principle of preserving the heritage in its two parts, natural and cultural, in the oases of Tighmert and Asrir, by addressing the natural components of the area, leading to a study of the components of the cultural fabric,

the historical environment, and urbanism based on the Arab and foreign library sources and references as well as the most important administrative documents concerned with the study area, which provided the research with some ideas, especially since the geographical research in this field is distinguished by its novelty.

The critical approach

It is based on analyzing and critiquing all field data, trying to reach the points of imbalance, and finding solutions to them based chiefly on the principle of a participatory approach to reviving oases, by strengthening the connection of the local population with them, re-using the natural areas and destroying historical buildings, and rehabilitating the basic infrastructure to ensure linking it with the rest of the historical parts of the Guelmim province, in order to create an integrated tourism dynamic between all the historical and the natural components of the area.

The applied approach

Due to the lack of official statistics on climate risks and their effects on the tourist sites in the studied oases, and in order to reach their aims, a field study had to be conducted to identify the size of the losses caused by the climate risks in the two oases, and this was done through the following essential elements:

- Visiting the studied places (the oases of Tighmert and Asrir), recording observations and topical notices, as well as taking some photographs of sites of the tourist attractions.
- Designing field study questionnaires and distributing them to the research sample: 150 random sample questionnaires destined to tourists, 100 questionnaires directed to the local populations and 53 questionnaires intended for the pro-fessionals of tourism.

Results and discussion

Impacts of climate change on the oasis tourism

The oases of Tighmert and Asrir are characterized by the natural resources, but they have started to deteriorate in recent decades, especially natural and water resources, as a result of unreasonable uses, from the degradation of arable lands, waste of water, and climate changes that have affected the quantities, regularity and distribution of rainfalls. These resources include soil and water resources, plant resources and biological diversity, all of which need special attention to increase their productive capacities.

What is more, the socio-economic mutations as well as natural factors (the climate changes) have had a great impact on these oases ecosystems, reflected in their most important components, as it is shown in the case of the oases of Tighmert and Asrir, which faced a number of threats that are presented in the followings elements:

The decline in water resources

Water is an important element of these oasis systems. Every imbalance in the water budget of the oasis will negatively affect biological diversity on the one hand, and human activities on the other hand. With the decline of this wealth, the oasis loses several components and characteristics, especially with regard to traditions and skills in dealing with the land, or with regard to managing water resources, and here we are talking about the traditional technique of "Khattarat" [1], this heritage has become seriously retreated and threatened with extinction.

The distinctive character of the oasis, wherever it is located, is the way in which water is managed, whether it is based on customs or laws, which were causing great contradictions over this vital component (Laaouina, 1996) [6], and we must not forget that not only should we think about saving water, but there is also how to preserve its quality. This is another challenge that these systems will face, especially in light of the rapid transformations that have become known to them. The oases of Tighmert and Asrir do not depart from this framework, so we should not think only about creating or attracting tourism investments, but we should particularly set up a local strategy related to how to manage water resources, especially if we know that tourism is the enemy of water, this blessing is the nation's natural heritage, so the culture of its exploitation and management, which reflects the national identity, should be rationalized, and it should be preserved with consideration for its fragility, and its exploitation must be rationalized to ensure its sustainability; this was affirmed by the National Charter for Environment and Sustainable Development. Therefore, it is necessary to determine the rights and duties towards the environment and water in particular, as well as the principles and values of sustainable development in order to better guarantee these rights and values and protect them against any disturbance of its balance.

The problem of floods

It is important to mention that floods are considered among the risks that threaten the continuation of oasis regions, as they are expected to occur at any time, especially in light of the climate changes that the world is experiencing in general and Morocco in particular, as it lives in the rhythm of irregular precipitations, including the hydrological risks of the inhabitants, the infrastructures, the urban installations, and the environmental systems, with apparently negative impacts in most cases through important losses such as the increase in the state expenditures, the destruction and collapse of facilities and infrastructures, and the destruction of many environmental and ecological systems. This issue necessitates an urgent intervention to modify and absorb the repercussions of the disaster on the populations, the infrastructures, the urban facilities, and the ecosystems.

Through a study of an expressive case of the extreme climatic situation, we can deduce that during the period of 30th November, 2014 and 28th September, 2018, the two oases experienced an extreme climate situation that resulted in floods and destructive outflows due to exceptional climatic conditions (Figure 2). This unusual situation is confirmed by the maps of the upper airspace and the aerial photos, where the flow of cold air masses towards central and southern Morocco is observed in the form of a concave, which is an anomalous position resulting from a defect in

[1] It is considered as one of the most widely used methods in the past, which allows the natural flow of water without the use of lifting techniques or use of mechanical energy.

the aerodynamic system, and these cold air masses rarely reach these lower levels of latitudes.

Source : Fieldwork reserach, 2018, 2019 and 2020.

Fig 2: Example of the floods occurred in the oasis of Asrir in 2018

Obviously, on September 28th, 2018, the Guelmim province experienced torrential rains that caused the soil erosion, the destruction of agricultural crops and the partial of most bridges of the national road n° 1, as well as some damaged bridges on the secondary roads in the Ifrane Anti-Atlas and the rural communities of Timoulay and Taghjijt, and also the Tighmert area as a result of the high water level in the valleys. This region has known unexpected floods that were carried by the valleys located in the province of Guelmim, and so many trees were swept and some of old buildings were demolished in the oases of Tighmert and Asrir.

By understanding the factors that lead to the exacerbation of the phenomenon of hydrological hazards in the two oases, we can find that these factors include what is natural and subjective and others acquired human subject to vertical stereotyped interventions, its spatial horizon dependent on micro-political and developmental balances, and not necessarily macro-developmental factors that control the regional and local appointees for solidarity and citizenship approaches regarding the act of territorial governance to ward off climatic risks in the Guelmim Oued Noun region.

In spite of what has been mentioned before, the drought leads to desertification of the soil, as well as its salinity and its inability to absorb and infiltrate water into the ground, in addition to human intervention in its various forms, throwing garbage in waterways, as this leads to obstruction of its flow, and the construction of narrow streams that can't bear the level of water during the period of heavy rainfall. These factors contribute directly to the rise of water from its original course and the inundation and sabotage of agricultural and residential areas.

The problem of fires

It is important to know that the problem of fires is considered as the most dangerous natural disasters that destroy the oasis ecosystems. In recent years, the oases of Tighmert and Asrir have experienced fires which led to the loss of important areas of palm trees. Obviously, the fires are phenomenon results from high temperatures or hot dry winds, and they occur after a severe drought, or may result from human behavior, and accordingly, the oases and forests in Morocco are threatened by the risk of fires that pollute the air and menace the safety of population and lead to the decline of forest cover in general.

Besides, the mechanism of high temperature and successive decades of drought (climatic drought, hydrological drought, agricultural drought), work on the dynamism of the danger of oasis fires, as well as the static practices resulting from the peasants' use of fires to clear their lands and liberate roadways. Of course, the rural commune of Asrir experienced three unprecedented events of fires with significant damage. The first event of March 31st, 2011 recorded that 100 palm trees were destroyed in the oasis of Tighmert for a period of nearly 3 hours (from 18:30 pm to 21.21 pm). The second event of October 14th, 2016 recorded that 30 palm trees were destroyed in the same oasis. The last event of March 25th, 2019 was the most severe fire that destroyed the oasis of Tighmert (Figure 3).

Source : Fieldwork reserach, 2018, 2019 and 2020.

Fig 3: The seroius events of the fires occurred in the oasis of Tighmert in 25/3/2019

The problem of desertification

The desertification is one of the phenomena that most countries of the world suffer from, considering that it is a phenomenon of reducing the biological capabilities of the land, its degradation and its inability to produce, and according to the United Nations definition, the concept of desertification means the degradation of soils in dry, semi-arid and semi-humid areas, according to several various factors including climate change and human activities. Further, the oases of Morocco as a whole have also affected by this problem which is due to various factors that are presented as follows:

The natural factors: are mainly represented in the lack or absence of precipitation and its irregularity, so that it does not exceed 200 mm annually, in contrast to the high temperature rise of up to 40 degrees, especially in the summer, and dry winds blowing due to the openness of these areas to the desert. Thus, all of these factors result the high evaporation and the prevalence of wind erosion, which works on transferring the sands.

The human factors: are principally linked to activities related to the land, such as uprooting and cutting trees for several purposes, intensive agricultural activities, and overgrazing.

In addition to this, the problem of drought as a natural phenomenon which threatens the future of oases regions, it greatly contributes to expanding the circle of desertification. In general, drought results in a decrease in rainfalls from their normal level during a particular year, in exchange for a rise in temperature, and thus it embodies the nature of the climate prevailing in the oases regions, and among its manifestations is the decline in the groundwater and surface levels.

In fact, resisting these challenges is an inevitable matter. When the productive capacities of agricultural lands in the oases of Tighmert and Asrir are exposed to danger as a result of their degradation, the source of production stops, especially these areas depend on agriculture as a main source of livelihood. Thus, it is necessary to think about new resources that guarantee the livelihood of the local population. In addition to the direct repercussions of drought on the natural heritage of plants and animals, the latter has become a refuge for many herds of livestock at a level that exceeds their actual capacities. This leads to disturbances in the ecological balance of natural resources, which in turn result in some forms of hidden desertification, in addition to demographic increase on the one hand and economic development at the expense of natural resources on the other hand. Consequently, all of these factors lead to the impoverishment of this biodiversity, so the plant and animal species are threatened with extinction as well as the impact of hunting and illegal poaching.

The problem of sand drift

It should be noted that the successive years of drought in the oases regions, the salinity of the land, the high temperatures and the strength of the winds, are the most factors that lead to the fragmentation of agricultural land which turns into sand that the winds started to move and transfer it to crawl over oasis areas, to suffocate palm trees and other plants, and to flood the waterways. Then, the problem of sand drift covers vast areas of cultivated land and kills hundreds of plants and reduces their productivity, and this encroachment also includes the buildings and basic equipment of oases, such as the drinking water channels and the public institutions, which prompted many residents of the oases to move to urban areas.

The palm crisis

The palm trees are considered as one of the most plantations that are spread in the oasis region, and are characterized by diversity, but most of their poor products are only suitable as fodder for livestock; due to the intertwining of cattle breeding with agriculture, the farmers consume the majority of the production. However, the number of palm trees remains in a continuous decline for many reasons, including the increase in drought, the decrease in the water level, and the exacerbation of the "Bayoud" [2] vascular disease. Therefore, those interested in this field have worked to intensify experiments so as to find modern and rapid scientific solutions to produce good dates, especially the Moroccan Oasis, half of its palms, is characterized by mixing. So, new varieties of palm trees will be prepared and given in order to resist the disease of "Bayoud" in the coming years (Figure 4).

Source : Fieldwork reserach, 2018, 2019 and 2020.

Fig 4: Example of a palm infected with the Bayoud disease

The problem of soil degradation and salinity

The soil degradation is one of the difficult environmental problems in the most oases areas, which occurs as a result of various productive activities, and man's attempt to exploit the natural resources that he has in agriculture and grazing to provide food for himself, his family and his animals. Then, the soil erosion is considered as a serious problem in sensitive areas especially in the ecosystems. In that case, we find that there are areas where the rate of soil loss exceeds

[2] It is considered as the most destructive disease of the date palm trees. It is present in the soil and moves from one field to another through water when watering. To limit the spread of this disease, the date palm must be cleaned and provided with organic and mineral fertilizers.

the rate of its natural formation (Figure 5).

Source: Fieldwork reserach, 2018, 2019 and 2020.

Fig 5: Example of an aspect of soil salinity

In recent years, the ecosystem of oases regions suffers from the high level of salinity of water and soil, and this is due to two main reasons: the excessive heat that leads to the concentration of various brine solutions in different soils and the loss of the water component as a result of evaporation, as well as a mineral source resulting from the geological framework, in which the important concentration of clay rocks with large salt levels caused an increase in the percentage of salinity. These two elements lead to making the soil unsuitable for agriculture and leading to a decline in vegetation cover.

The dangers associated with the cochineal insect harmful to the cactus plant

It is first to note that this insect feeds on wet plants and takes its name from its color. It spreads abundantly in many different oases of Guelmim area, and penetrates the cactus through its beak-like mouth and feeds on aloe vera juices. After mating, it creates the small nymphs; these nymphs secrete a white waxy coating on their bodies to protect against the loss of water and the excessive temperature (Figure 6).

Source: Fieldwork reserach, 2018, 2019 and 2020.

Fig 6: The cochineal insect which is harmful to Aloe Vera

The risks of locust invasion

During the months of August and September, and the end of the autumn season, the heavy rain and thunderstorms cause a huge surge in the growth of mobile desert locusts after a hot seasonal period, as the rain provides moist soil to lay locust eggs, and the numbers of locusts decrease during the period of drought. Generally, the issue of floods and hurricanes are often followed by locust outbreaks, and the lack of early warning can lead to an epidemic invasion.

In addition to this, the climate change has also affected the cultural heritage. It poses serious threats to natural and cultural sites, and it may harm the archaeological sites of the heritage [3]. Besides, there is no doubt that the changes in the cycle of rainfalls, droughts, humidity, and levels of groundwater, and thus on soil chemistry, will have some implications for the protection and preservation of the archaeological sites, and the rise in temperatures are the most factors which have serious consequences for this heritage. Also, there are analytical studies based on the way that affecting the rains, which are associated with the "El Niño" climatic phenomenon on the fragile soil engineering at the "Chan Chan" site, which goes back to the time of the ancient capital of "Chimú", one of the most important cities made of soil in American civilization before the arrival of Christopher Columbus (UNESCO, 2010, p. 6) [9] (Figure 7).

Source: Fieldwork Reserach, 2018, 2019 and 2020.

Fig 7: The manifestations of deterioration of the historical urban heritage in the oasis of Tighmert

Adaptation measures and strategies of climate change in the oasis tourism

There are different types of measures and adaptation strategies that can be interested in developing and promoting the oasis tourism product in the area of Asrir. These measures and strategies include a lot of elements. First of all, the preventive measures which include monitoring, reporting and mitigating the effects of climate change through environmentally sound options and decisions at a range of levels: the individual, the society, the companies and institutions. Second, the corrective actions that include adaptation to the reality of climate change through local and regional management strategies and plans. Most important of all, the knowledge exchange which

[3] Ban Ki-moon, Secretary-General of the United Nations, says : "Climate change doesn't respect borders, nor does it respect the social status of human beings, rich or poor, young or old, and this is what we call (global changes), which require the solidarity of the whole world". The permanent climate of the plant has made climate change issues a source of concern due to the magnitude of the unprecedented changes taking place in the world, and the reports indicate that humankind is responsible for climate change, as it leads to destabilization of environmental and social conditions around the world, and as a result, climate change has negatively affected World owned by natural and cultural heritage, the topic of climate change impacts on world heritage received great attention during one of the World Heritage Committee meetings. Available at the following site:
www.khaleej.ae

includes best practices, research, communications, public and political support, education and training, capacity building, networking, etc. In addition to this, education and communication which are the most powerful methods and tools to reduce the risk of climate change. These concepts should be based on educating and motivating people as well as tourists so as to be conscious of the environment and its responsibility (Couissi, 2017, p. 58) [3]. In that case, some campaigns should be made on magazines, television, radio, newspapers, conferences, etc. in order to achieve a sustainable oasis tourism development of any natural and cultural resources.

Conclusion

The results of this study were evidently noted that the oasis tourism product is affected by the climate change. It has bad impacts on the natural and cultural potentialities. Apparently, the climate change contributes to the extinction and deterioration of a group of living organisms in the two oases, and the lack of a group of plant species to adapt to the various climatic changes contributed to the disappearance of some of them. The two oases need to formulate appropriate solutions to alleviate the difficulties presented by climate change, which are represented by the problem of water scarcity, the deterioration of soil quality, the decline of biological diversity, the decline of agricultural activity (which is the main source of income for about 80% of the inhabitants of the oases), as well as the loss of local experience inherited through generations. Additionally, the oasis tourism product is also affected by human factors, namely the tourists or the local population. Thus, the oases of Tighmert and Asrir have faced economic difficulties in recent years, and the most important causes of them are the harsh climate as a result of drought and the expansion of desertification, and the decline in the number of tourists, which has negative impacts on the local residents that rely heavily on the tourism sector. So, it must be recognized urgently that environmental issues deserve political and economic priority, equally with other major issues. Specifically, the issue of environmental sustainability must be included in all aspects of development and public policies, and this is not achieved yet, and this is followed by strengthening capacities to take the necessary practical measures.

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