

Assessment of Eco-tourism Potentials to Enhance Tourist Attractiveness in Asir Mountains, Saudi Arabia.

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Abstract:

This study investigates the assessment of eco-tourism potentials to enhance tourist attractiveness in Asir Mountains. Eco-tourism seeks to support the tourism landscape. This occurs by its interaction with the historical, archaeological, and architectural or immaterial heritage. The interaction transpires also with the geographical potential, with an emphasis on environmental protection and sustainability. The study is based on various tourist facades and environmental diversity in Asir Mountains. Tourism development is a comprehensive undertaking involving many sectors. These are the challenges to which the country's tourism should respond in order to promote several aspects. These encompass domestic tourism, quality, the spatial pattern of tourism resources, climate comfort and natural disaster possibility. Such promotion is based on the analysis of collected multi-source datasets and the geo-morphological features of the area. Besides, a GIS database, comprising geological and topographical maps and satellite images, is created.

The main results of this study are the uniqueness, the geological and geo-morphological features, as well as the eco-cultural diversity which can be regarded as an influential factor in the development of eco-tourism. The findings of the study provided valuable insights into the role of environmental diversity in achieving tourism. Moreover, they examined the interrelationship between tourism and environmental diversity.

Keywords: Environmental diversity, Eco-tourism, Geo-tourism, sustainability

1. Introduction:

The concept of eco-tourism covers the geological and geomorphological data and the importance of preserving them for the purposes of tourism. It also means "the provision of interpretative facilities and services to promote the value and social benefit of geologic and geomorphologic sites and their materials and to ensure their conservation from the use of tourists" (Gavrilla, et al, 2011, p.198). For the geomorphological heritage concept, different terms like geomorphological assets, goods, sites, geo-topes, and sites of geo-morphological interest were used. In the present, for the geo-morphological heritage concept the term of "geomorphosite" is utilized (Reynard, 2005).

The term was defined as being a landform that has acquired a special value due to human perception. Thus, the geo-morphosites, due to the human perception, has two main values: scientific value and additional values (Reynard, 2005). Therefore, geo-morphosites are considered natural goods not only because of their intrinsic (scientific and aesthetic) value, but also due to their extrinsic (ecological, historical, cultural and economic) values. That is, they form the main resources underlying the development of geo-tourism. The concept of nature conservation was advocated as an environmental necessity. This was spurred by increased environmental awareness in terms of the effects of extinction. The cessation of a natural process is not reversible. Organisms that go extinct remain so forever. It is our duty to conserve archaeological sites and rare artistic creations. No less important is our responsibility for maintaining environmental diversity at all levels, including levels of genetic diversity, species diversity and the diversity of the ecological systems. Besides, nature conservation is in the best interest of humanity, given that the environment is the provider of products and services which sustain human life (Mooney, H.A., et al, 1997).

This study approaches a topical issue and follows the assessment of the Asir region to enhance the attractiveness of eco-tourism in the study area. In order to achieve the proposed objectives a field observation was done. Besides, the methods of geological and geomorphological mapping, and photo-interpretation and digital mapping were applied. As a result, the most representative elements of the topography are identified, and the researcher developed a digital map of landforms with geo-touristic potential. Due to the strategic location of Asir, which gives the region a high level of biodiversity, residents of the province enjoy relatively good atmosphere throughout the year. The high plains of Asir support the growth of many high-altitude trees such as juniper and Al-Taleh. Medium elevation ranges between 800-1,500 m, which supports coffee trees as well as AL-Salam, AL-Sidr and olive trees. On the other hand, AL-Dome and Al-Arak trees grow in abundance in the coastal plains of the province. According to AL-Wadee (2010), Saudi Arabia has more than 2243 wild plant species. Approximately 70% of the floras of Asir have medical uses and include many aromatic plants, which can generate revenues and contribute to the economy of use. However, these species are concentrated in different parts of the province, especially in the forests of AL-Fraa, Suda and AL-Serma, which cover an estimated area of about 457,780 hectares. It is self-evident that biodiversity is in the vanguard of cultural diversity, economic growth and environmental sustainability. It generates non-direct benefits and contributes to a larger gene pool (Eshtayeh & Jamus, 2002, p.28).

2. Literature Review:

Eco-tourism has been defined differently by different experts and several concepts are presented. The definition provided by World Tourism Organization encompasses any type of travel that includes at least one night, but no more than one year, away from a usual place of residence (Swarbrook, 1999).

Eco-tourism is a combination of eco- and tourism or ecological tourism. Though there is no exact definition for eco-tourism, the following definition can be provided. It "is a form of tourism inspired primarily by the natural history of an area, including its indigenous cultures" (Ziffer, 1989, p. 6). Ziffer also points to a number of characteristics of eco-tourism. These include visiting undeveloped areas in the spirit of appreciation, participation, and sensitivity, practicing a non-consumptive use of wildlife and natural resources and contributing to the visited area through

labor or financial means.

Recently there has been a surge of interest in studying eco-tourism and the attempts that have been made gained noticeable results. For example, Ólafsdóttir and Dowling (2013), in their investigative attempt, emphasized the importance of sustainable management in geo-tourism development. The authors aimed to assess the compatibility of geo-conservation and rural development within geo-tourism by exploring the challenges and potential outcomes of the geo-tourism development in Iceland. They also adopted the identification and analysis of the various potential outcomes of geo-park development. Besides, they proposed a strategic planning approach for sustainable geo-tourism planning and management in vulnerable environments. The results of their study pointed to nine distinctive sites for geo-park development, each of which presented the major challenge of using geological heritage as a basis for informing the area's 'ABC' components. That is, both visitors and locals are given a holistic appreciation of the area based on an understanding of its geology.

Chiu, Lee and Chen (2014) studied the environmentally responsible behavior of the tourists engaged in eco-tourism. They also investigated whether its level can change as a result of the eco-travel experience. In their article, Chiu et al. proposed a behavioral model in which perceived value, satisfaction and activity involvement with respect to the eco-travel experience shaped the tourist's environmentally responsible behavior. The results of analyzing 328 questionnaires showed that perceived value, satisfaction, and activity involvement could promote environmentally responsible behavior of tourists. The authors concluded that enhancing tourist's value perception about the eco-travel activity was a priority in a sequence of steps. That sequence would strengthen environmentally responsible behavior via increasing the eco-tourism's activity involvement and satisfaction levels.

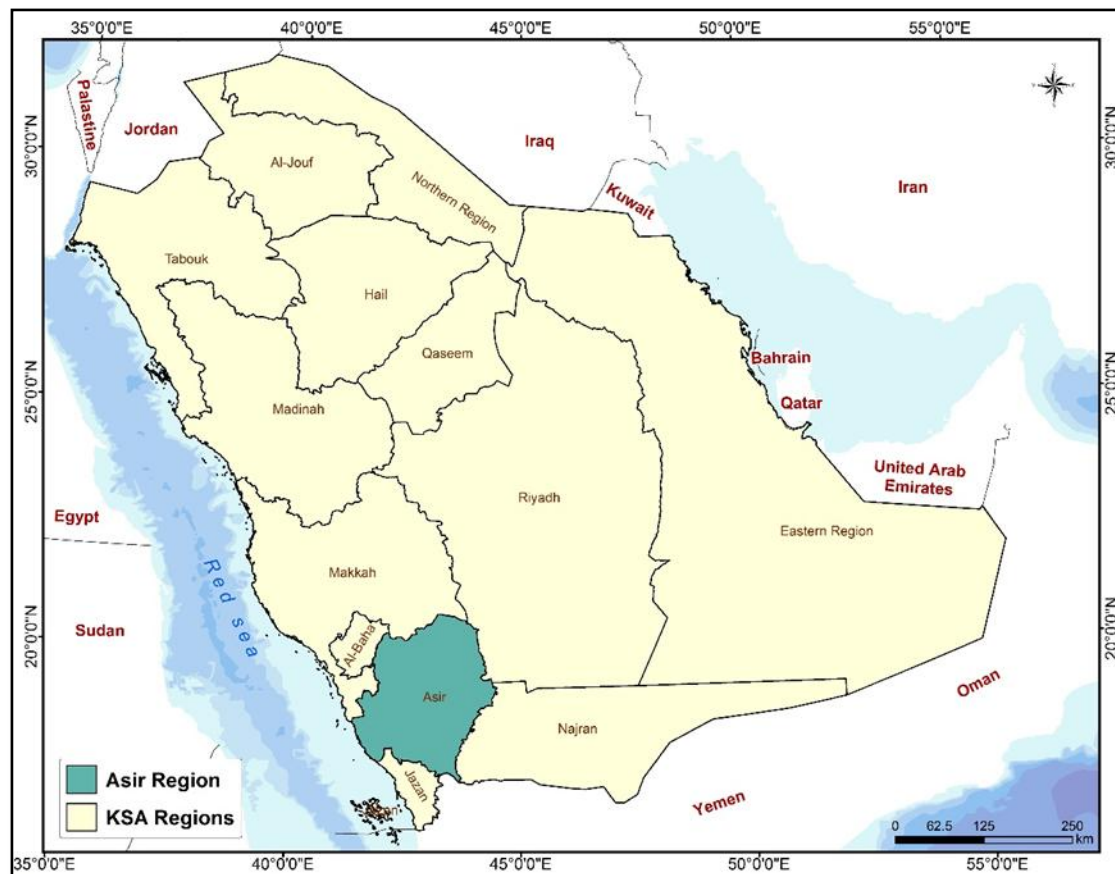
Tran and Walter (2014) in a quite recent research about eco-tourism, gender and development in northern Vietnam investigated women's participation in a community-based eco-tourism project. Applying Longwe's empowerment framework, the authors found a more equitable division of labor, increased income, self-confidence and community involvement, and new leadership roles for women. Nevertheless, they found inequities of social class, childcare, and violence against women.

In another study in Brunei Darussalam in Southeast Asia, Ahmad (2014) attempted to identify the prospect and challenges of sustainable tourism. It was done from the perspective of the business organizations or enterprises in the tourism industry. The research was based on the data collected from a survey conducted among travel, transport, hospitality and visitor attraction sectors in the country.

3. Study Area:

Asir is a model for the Kingdom's geographical regions that is differentiated in its topography and it is environmentally diverse. Asir region is located in the southwestern part of Saudi Arabia within the Arabian Shield region, between latitudes of 17° 25' north and 19° 50' north and longitudes of 50° 00' east and 41° 50' east. This is the highest and most rugged region of Saudi Arabia. It has an area of 84,365 km² —Figure (1) shows the location of the study area. It shares a short border with Yemen. Its capital is Abha, and other towns include Khamis Mushayt, Ahad

Rufaida, Bishah, etc. Geographically, the Asir region is situated on a high plateau that receives more rainfall than the rest of the country and contains the country's highest peaks which rise to almost 3,015 meters at Al Soudah Mountain near Abha.



Source: KSA Administrative Data, Updated Guidebook of the population names manual in the preparatory stages for the agricultural census 1436 AH.

Figure (1): Location of the Study Area.

The average annual rainfall in the highlands probably ranges from 300 to 500 millimeters (12 to 20 inches) falling in two rainy seasons. The chief one is in March and April with some rain in the summer. Temperatures are very extreme, with diurnal temperature ranges in the highlands are the greatest in the world. It is common for afternoon temperatures to be over 30 °C (85 °F), while mornings can be extremely frosty, and fog can cut visibility to near zero percent. As a result, there is much more natural vegetation in Asir than there is in any other part of Saudi Arabia. Besides, the sheltered areas even contain regions of dense coniferous forests, and fruit trees, though more exposed ridges are still very dry. Asir is home to many farmers who chiefly grow wheat and fruit crops, though irrigation has greatly expanded production in modern times (Som & Al-Kassem, 2013, p.2). This brought with it a variation in temperature and climate to provide winter and summer tourism.

As mentioned above, the climate of Asir is semi-arid as it is influenced by its high elevation. In stark contrast to a large portion of Saudi Arabia, the climate in this region is both cooler and wetter. Hence, the Saudi government has been promoting Asir as a tourist destination and has created events such as the ‘Abha Festival’ during the summer each year. This is to draw people to the city and its surrounding attractiveness. Abha International Airport, which lies to the east of the city, receives direct flights from major cities in the country as well as international flights from cities in the Gulf region (Som and Al-Kassem, 2013, p. 3). This area, three thousand meters above the sea level, is distinguished with its beautiful scenery and moderate weather in the summer. Asir region is distinct not only for its natural scenery, forests and wild trees which cover most of the area, but also is well-known for its heritage attraction and beaches at the foot of the mountains.

4. Materials and Methods:

The analysis of the environmental diversity assessment to enhance attractiveness of eco-tourism in Asir Mountains is conducted in two stages. The first stage consists of field campaigns in which morphological information is collected and the second stage consists in achieving the map of landforms with eco-touristic potential from the study area.

In the following stage (laboratory stage), by GIS analysis, the researcher recognized the digital elevation model of the Asir Mountains. The morphological information obtained during the field campaigns like ridges, peaks, steep slopes, gorges and quarries is added to the digital elevation model. Downscaled data is further used for evaluation of natural conditions. DEM and NDVI are used as variables for air temperature downscaling. Land surface temperature and average precipitation are considered as independent variables for relative humidity and wind speed.

Thus, by layers overlapping, a map that contains both the topography and morphology of Asir Mountains is developed. On the map of our study area, only those landforms that can be easily identified in the field and which can be valorized from the touristic viewpoint were represented. It is influenced by many factors such as air temperature, relative humidity, surface wind speed, and solar radiation etc. Furthermore, there exist complex relationships among different factors. Thus, the thermal environment model and cold environment one are used for a comprehensive evaluation of natural conditions in the following sections. Meanwhile, natural disaster risk is another important factor, and it might relate to altitude, slope, precipitation, etc. Besides, settlements, main access roads, adjacent morphological units etc. are also represented on the map. The resulting map, which highlights the areas with geo-touristic potential, represents the first step in achieving the geo-touristic map of Asir Mountains.

5. Results and Discussions:

Results of the research consist in achieving the digital map of landforms with geo-touristic potential of Asir Mountain, using GIS analysis. On the map, only spectacular landforms, respectively those areas where geological and geo-morphological features can be a resource for practicing geo-tourism, are represented.

The summer and winter resorts in Asir are among the best resorts in the Kingdom. Such a region is well connected with the Kingdom's other areas by air through a regional airport in Abha. It is also connected by land through a network of roads that extends across the valleys and

mountains. In addition to the integration of their infrastructure which contains transportation, water, electricity and modern communications, the upper structure is also integrated into gardens and parks. It also encompasses various touristic services. This in turn was reflected in higher involvement of Saudis in domestic travel trade and employment in tourism and hospitality industry.

However, the impact of tourism development on the environment has not been properly assessed (Briassoulis, 2000). The congestion and environmental risks, resulting from the excessive use of natural and cultural resources which tourism activities cause, have already led to degradation of the natural resources on which the industry depends. The National Commission for Wildlife Conservation and Development (NCWCD) was created in 1986 to manage wildlife reserves (Seddon & Khoja, 2003). Thus, the geological diversity, the age of the lithological deposits and the morphological variety singled out the Asir Mountains with real possibilities of practicing geo-tourism.

5.1 Rectifiers of Tourist Attractions in Asir Mountains:

Asir Mountains contain natural and human resources, through which tourism can be developed and promoted on a planning basis in the study area:

5.1.1 The Natural Potential of the Study Area:

Asir Mountains have a stunning and diverse natural potential. It is found in most of their cities that are characterized by their majestic mountains that are covered with various trees and flowers, as well as valleys, springs and a vast desert. This environment varies considerably. It can be exploited in various promotional and tourism activities. Moreover, environmental and natural lead to diversity for geo-tourism, and thus the development of tourism in Asir Mountains

- **Geological Features:**

The geological structure of Asir Mountains is characterized by great diversity (both in terms of age and genesis), it is an ancient land mass formed from igneous rocks, and metamorphic rocks which dates back to the pre-Cambrian era. It consists of various rock formations in terms of geological age and structure rock (Ben Laaboun, 2019, p. 37). The Asir region is geologically divided into two main parts: the Arab Shield and part of the Tihama plains in the west, and part of the Arab shelf in the northeast. The Arabian Shield is composed of igneous and metamorphic rocks, and the Arab shelf consists of a different group of sedimentary rocks and different geological formations that were deposited in the form of sedimentary layers tilted slightly towards the east and northeast, Figure (2) show the geological structure of the Asir region.

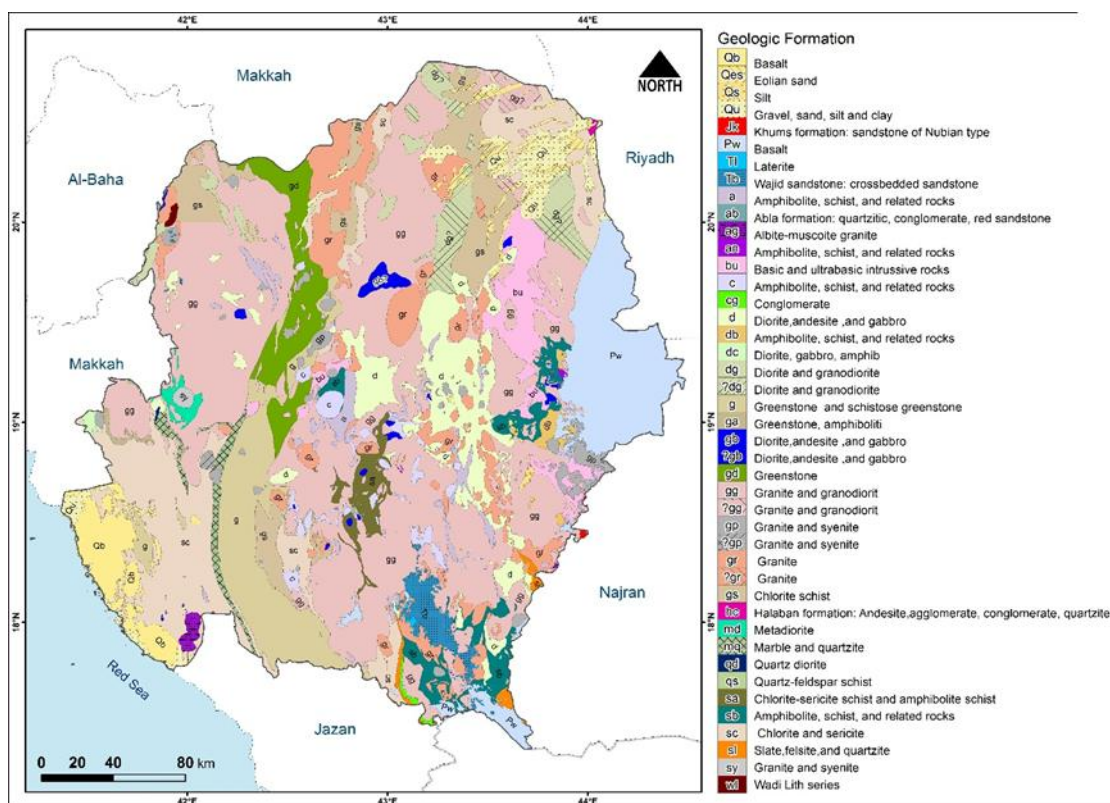
i. Arabian Shield:

The Arabian Shield represents the geological basis of the Asir region, on which the sedimentary layers were built, and it consists mainly of plutonic and metamorphic rocks that date back to the pre-Cambrian. Hills are a defining feature of this region in addition to the Harrat, where hills are found in a repeated pattern. The sedimentary rocks from the Paleozoic eras are covered as well as the sediments of the valleys, where the shield went through a complex structural history that was very folded, cracked, and interfered. The deep, narrow water drainage network governed by the

structure of the earth flows through steep cliffs, as the valleys that descend from the Arab Shield and flow to the west may not exceed 120 km in length to the Red Sea, but on the contrary, the valleys that flow to the east and northeast, the extent of their course may reach Over 1,200 km.

ii. Arab shelf:

The Arab shelf occupies the northeastern part of the Asir region, and the Arab sedimentary shelf consists of a different group of geological formations deposited during different geological times and eras as a result of the receding of sea water, and these formations become thicker as we head east from the Arabian Shield towards the Arabian Gulf.



Source:

Ministry of Petroleum and Mineral Resources - General Directorate of Mineral Resources - (Asir JM 217), (Najd Southern JM 2011), (Southern Hijaz JM 210), (Tihama Sham JM 216), 500000 scale.

Figure (2):The geological structure of the Asir region.

• Topography:

The surface features vary in the Asir region, extending from the shores of the Red Sea in the west to an expansive hilly area in the east, passing through the Sarawat Mountains, and a number of units can be distinguished. Topography in it includes the following:

a. The coastal area and the islands (Tihama Plain):

It consists of the beach of the Asir region, which is about 140 km long on the Red Sea coast, and extends from the north of the village of Saida Al-Sawalha to the south of the village of Al-Huraidah. Merka Island, Maraya Island, Zuqaq Island, Mother Island, Shamir Island, Mount Kodumbel Island, Al Dariqi Island, Hadar Island, Al Jabal Island, Al Aqiqah Island and others,

and the last four islands are the closest islands to the coast of Asir region and are less than two kilometers away from it. These islands and barriers of limestone massifs were originally parts of the hard skeletons of marine coral animals that build coral colonies with The passage of time and these parts mixed with different minerals to form various coral rocks (Abu Al-Enein, 1974).

As for the coastline, it is part of the eastern coast of the Red Sea and is characterized by its many meanings. Small ports are called lagoons or moorings, and some of them are connected to the estuaries of valleys descending from the Asir Mountains that flow into the Red Sea. These ports are also called "shrouds." Sharm El-Taana is in the southern part of the coast of the Asir region. The coastal plain of the Asir region is part of the Tihama plain that extends along the coast of the Red Sea and the foothills adjacent to it or scattered in it, and low-altitude such as the hills of Jabal Zour al-Hamat (805 m above sea level, grazing (278 m), Jabal al-Kharma (351 m) and Jabal Al-Abal (3 m) and Jabal Al-Zour (20 m), and this plain is known as Tihama Asir and constitutes about 17.5% of its total area, and the western part of it is called the coastal Tehama, while the eastern part is known as Tihama Al-Asdar, and the boundary between it and the coast line (Ministry of Municipal and Rural Affairs, 18), and this plain constitutes a transitional zone between the Red Sea and the high Asir Mountains in the east, and its average height above sea level ranges from 100 to 150 m, The coastal plain is penetrated by a number of canyons and valleys that carry rain water from mountainous areas and western slopes to flow into the Red Sea.

b. Foothill's area:

The coastal plain is bordered on the east side, and it is called by this name because of its location in the foothills of the high mountainous region, and it forms a gradient transitional zone penetrated by many valleys between the coastal plain and the mountain region, ranging in width between 20-30 km, and spread by volcanic and rift hills of origin and covered by alluvial soil Gravel, and the height of these hills decreases. This region gradually merges with the slopes of the western cliff, the Asir mountains, and its hills are characterized by their strong tendencies and slopes. Therefore, the inhabitants constructed agricultural terraces on their slopes wherever they were able to do so, and the numerous valleys whose upper streams coincide with the fault axes scattered in the region, which head from the northeast. To the southwest in general, before these valleys were diverted to penetrate the coastal plain leading to the Red Sea, and most of these valleys are Narrow gorges in which erosion activates to deepen and widen their courses.

c. The steep slope, or rocky cliff:

It is a steep rocky slope, whose height ranges between 800 and 1500 meters above sea level, and consists of volcanic and metamorphic rocks, which arose as a result of the faults and fractures that accompanied the formation of the Red Sea and the separation of the Arabian Peninsula from the African continent. The topography of the cliff area is characterized by severe ruggedness and the presence of steep valleys in the form of deep gorges, and the area is barren almost bare of biological cover (soil) because the steep slopes hinder the formation and aggregation of soil, and therefore it is almost devoid of vegetation, except for some plants Sporadic, especially juniper trees that appear in some places. (Ministry of Agriculture and Water, 1974).

d. The Mountain Range: (Sarat Asir).

It is considered part of the western heights of the Sarat Mountains, which are considered the most

important terrain phenomenon in the Arabian Peninsula extending from Aqaba in the north to the Yemeni border in the south, and the length of this chain in the Asir region is approximately 300 km, and the height of this chain ranges between 1500 and 2000 meters above the level. The sea surface, which extends from the northwest towards the southeast and forms a narrow strip with its width extending from the top of the cliff wall towards the east, with an average width of about 25-30 km, and is dominated by rocky peaks of basalt and granite, and this chain is also called Sarat Asir as it is part of the Sarawat Mountains. They are refractive mountains that are peaceful in shape, steeply steep to the west towards the Red Sea, and its slope ranges between 20 and 20 degrees and surpasses it in some parts, and gradually slopes towards the east towards the interior regions (Al-Zahrani, 2006). and the heights of its peaks vary from one place to another, for example it exceeds in the northern part of it More than 2000 m, such as Jabal al-Anqq (2065 m above sea level) and Barish Mountain (2081 m) located in the northern part of Shamran country, and its height increases in the central section until it reaches 2860 m south of El Atinin City, and 2617 m near the upper course of Wadi al-Teh To the north of the city of Abha, about 25 km, and more than 2700 m north-east of the city of al-Namas, and about 2203 m in the Mushrifa mountains, and exceeded 2500 m in the southeast of the city of Tanuma, and 2402 m in the al-Soud mountains in Bilad al-Hammar, and 2748 m to the west of the village of Al Asim Its heights continue to increase as we head south towards the city of Abha, where it exceeds 3000 m, and where the Soudah summit (3015 m above sea level) is located northwest of Abha at a distance of 15 km, and it is the highest peak in this chain in the Kingdom of Saudi Arabia, to the south and east of the city of Abha Several peaks exceeding 200 stand out, such as Jebel Nahra N (2673 m), Jabal Damak (2376 m), Jabal al-Sahn (2380 m), and 2623 m in the holiday area southeast of the city of Sarat Abidah, and in these mountains there are valleys with steep sides and are in the form of (V) with few places From flood sediments deposited by water. These valleys are evidence of the processes of sculpture and erosion that this area has witnessed and have led to the complexity of its contradictions (Survey Administration, 1407 H).

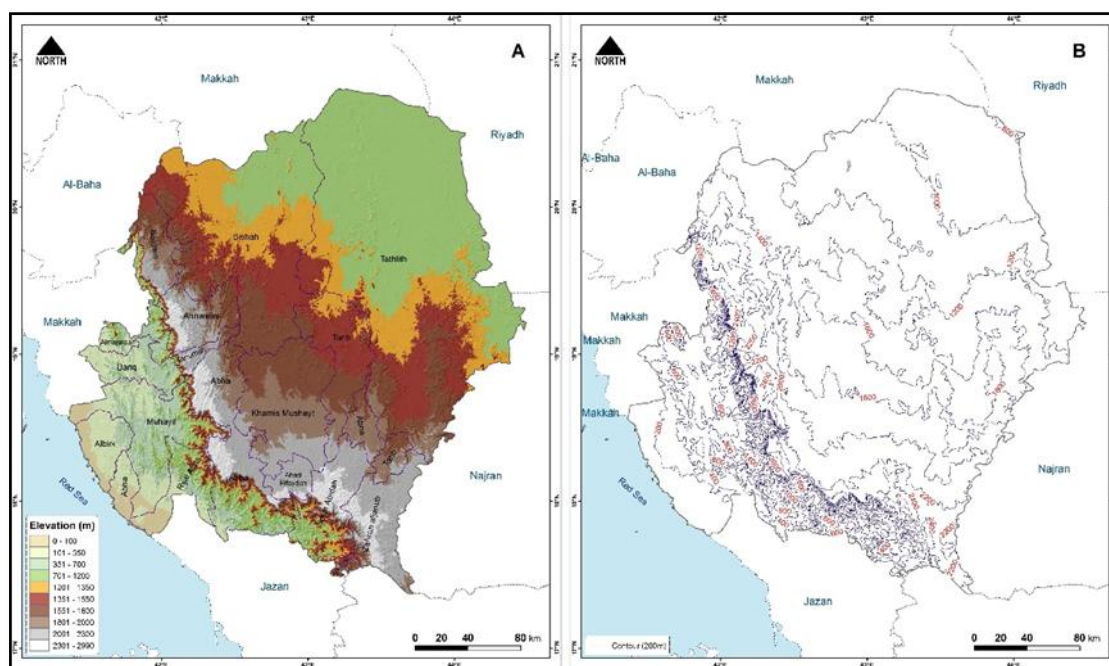
e. Eastern plateau:

is also known as the Asir Plateau, located to the east and north-east of the Sarawat Mountains and covers the lands of the Bisha and Tilith governorates, which occupies about half the area of an area, and it is a transition region graded between the western highlands in the west and the Najd plateau located in the east and north, and the Empty Quarter desert in the east and gradually slopes towards the north and east. Its height ranges between 1000 m in the east and 1,700 m in the west above sea level.

f. Water drainage network:

The valleys of the water drainage network are one of the important terrain phenomena in the tourism activity, in addition to their environmental importance, which is represented in the drainage of water, and the appropriate conditions are available for the expansion of the vegetation cover in their stomachs dearly, and the preparation of terraces and basins suitable for agriculture, especially in the regions of the Kingdom of Saudi Arabia, including the Asir region. Its touristic importance stems from the picturesque landscapes it offers, which arouse surprise and strangeness in the soul, especially if their shapes are distinguished by their deep depths, their steep sides, their rocks refined by sculpture, and their green bellies.

The Asir region is rich in the valleys of the water drainage network of various shapes and directions, which are considered one of the kingdom's most flowing valleys with water, and these valleys can be classified into two main groups separated by the edge of the Asir heights, which is the water division area between them. Inland to the east, and it often consists of sand veins or clusters, while the second group includes valleys whose waters drain to the Tihama Plain and pour into the Red Sea basin. The wadis that descend to the west are distinguished by their steep streams, and their narrow valleys and tributaries. Figure (3) shows a digital elevation model (DEM) and a contour map of the study area.



Source: Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global, NASA & NGA, 2011.

Figure (3): (A) Digital Elevation Model (DEM), and (B) Contour Map of the Study Area.

- **Climate:**

Climate is a salient resource for tourism and a dominant attribute of a tourist destination. It has a major effect on tourism demand, satisfaction and decision-making since tourists are sensitive to climate and climate change (Maddison et al., 2001). Thus, it is vital to assess the suitability of climate for tourism for the sake of decision-making by tourism participants. For instance, tourism planners could better evaluate a destination for tourism development and incorporate climate in infrastructure planning and programming. The insurance industry might design diverse weather insurance products for the tourism industry. Tourists can choose a destination and take out insurance on likelihood of poor weather conditions occurring while on holidays.

Researchers have made considerable efforts to devise climate indices owing to the multifaceted nature of weather and the complex ways the weather variables come together to give meaning to climate for tourism. In this study, temperature-humidity index (THI) (Gonzalez, et al., 1974) is chosen to assess the thermal comfort and cold comfort separately.

Thermal comfort is the condition of mind that expresses human physiological satisfaction under the influence of temperature and humidity. THI is calculated by means of dry bulb temperature and relative humidity, and its expression is as follows (Gonzalez, et al, 1974):

$$THI = t_d - 0.55(1 - 0.01RH)(t_d - 14.5)$$

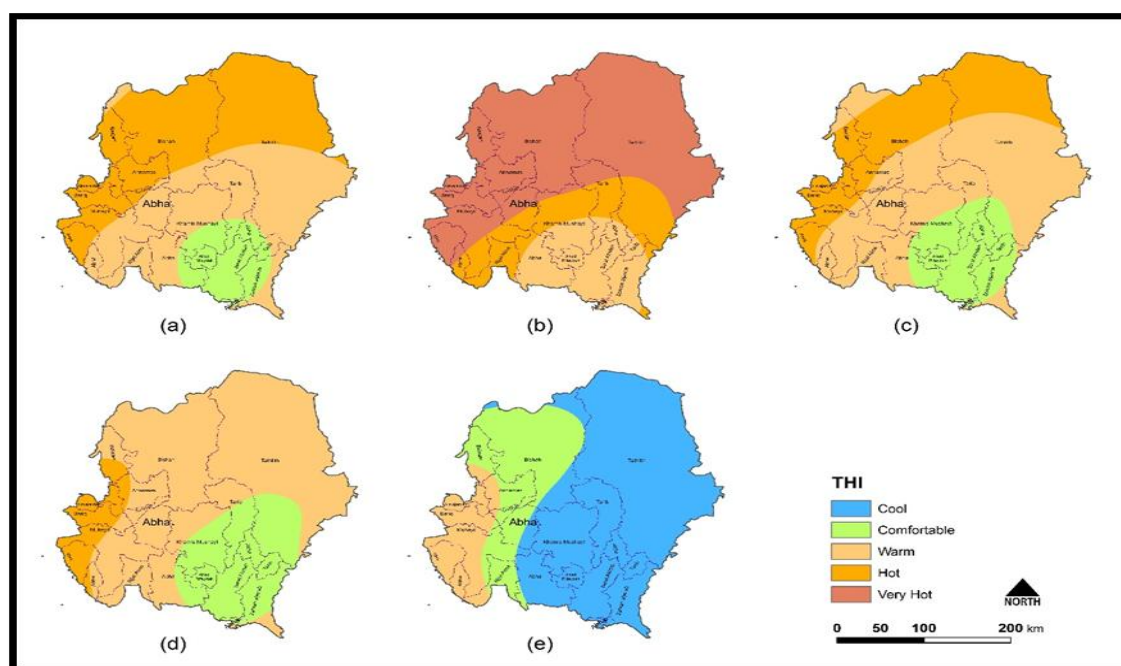
where t_d represents the dry bulb temperature ($^{\circ}\text{C}$), RH is relative humidity (%). Herein, monthly mean air temperature and relative humidity are used for calculation of THI, and they are reclassified into five categories: cold, cool, comfortable, warm and hot —Table (1) according to Kyle's study of the bioclimatic environment.

Table (1) Classification of Temperature-Humidity Index (THI) and Wind Effect Index (WEI)

THI ($^{\circ}\text{C}$)	Category	WEI
-1.7~13.0	Cold	-800~-600
13.0~14.0	Cool	-600~-300
15.0~20.0	Comfortable	-300~-200
20.0~26.5	Warm	-200~-50
26.5~29.9	Hot	-50~80

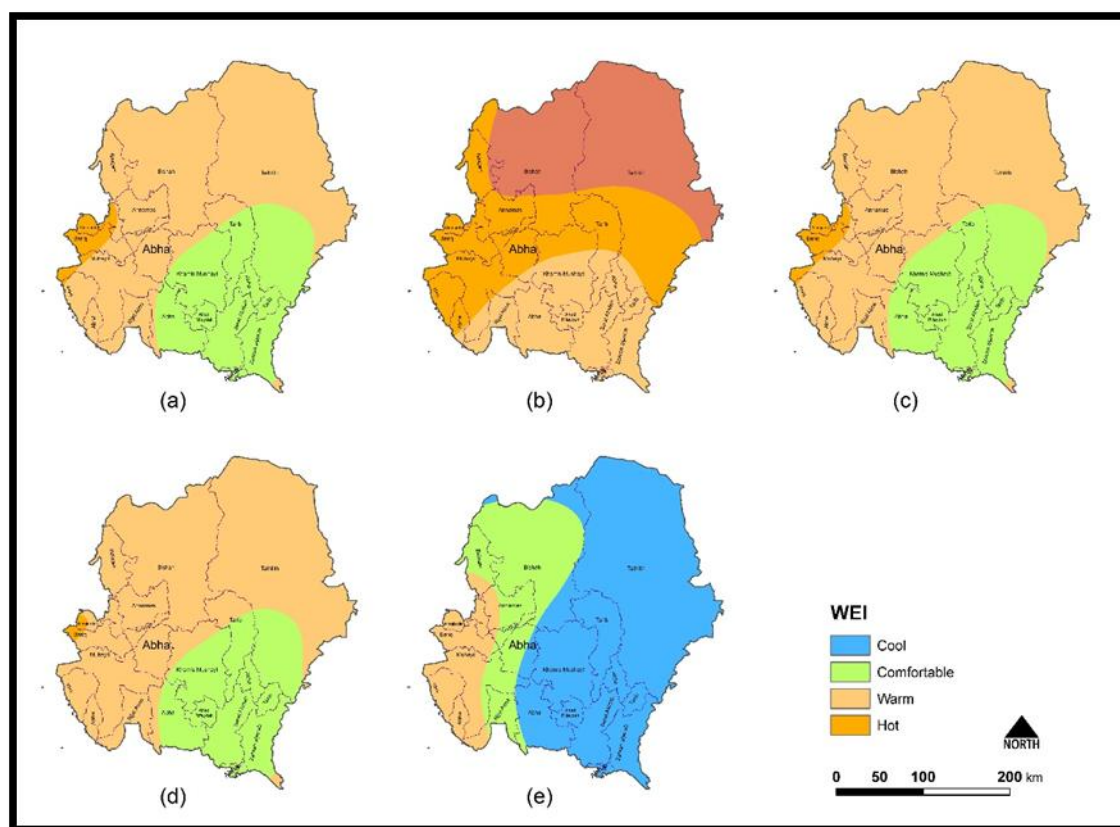
Source: (Jiang et al, 2018, p. 3)

The characteristics of the climate in Asir can be described as “four distinctive seasons, comfortable spring, warm autumn, no severe cold in winter, and no intense heat in summer”. It means that Asir is semi-arid as it is influenced by its high elevation. In stark contrast to a large portion of Saudi Arabia, the climate in this region is both cooler and wetter. Figure (4) shows variation of temperature-humidity index in different seasons, and Figure (5) shows variation of wind effect index in different seasons.



Source: Spatial Statistics using PME Metrological Data (1978-2017).

Figure (4) Variation of Temperature-Humidity Index in Different Seasons: (a) Spring, (b) Summer, (c) Multi – year average (1978- 2017), (d) Autumn, (e) Winter.



Source: Spatial Statistics using PME Metrological Data (1978-2017).

Figure (5): Variation of Wind Effect Index in Different Seasons: (a) Spring, (b) Summer, (c) Multi – year average (1978- 2017), (d) Autumn, (e) Winter.

5.2 The Human Potential of the Study Area:

Asir has many human resources that still remain until now. The most important of which are:

1- Archeological Sites:

Ahad Rufaida, Jurash site, Hadbat Aleurus, Rock inscriptions in Badia Bani Amr, Shamsan Castle, and Wadi Ayan.

2- Historical sites: Shada Palace, Ibn Hamsan Heritage Village and Almulaha Palace.

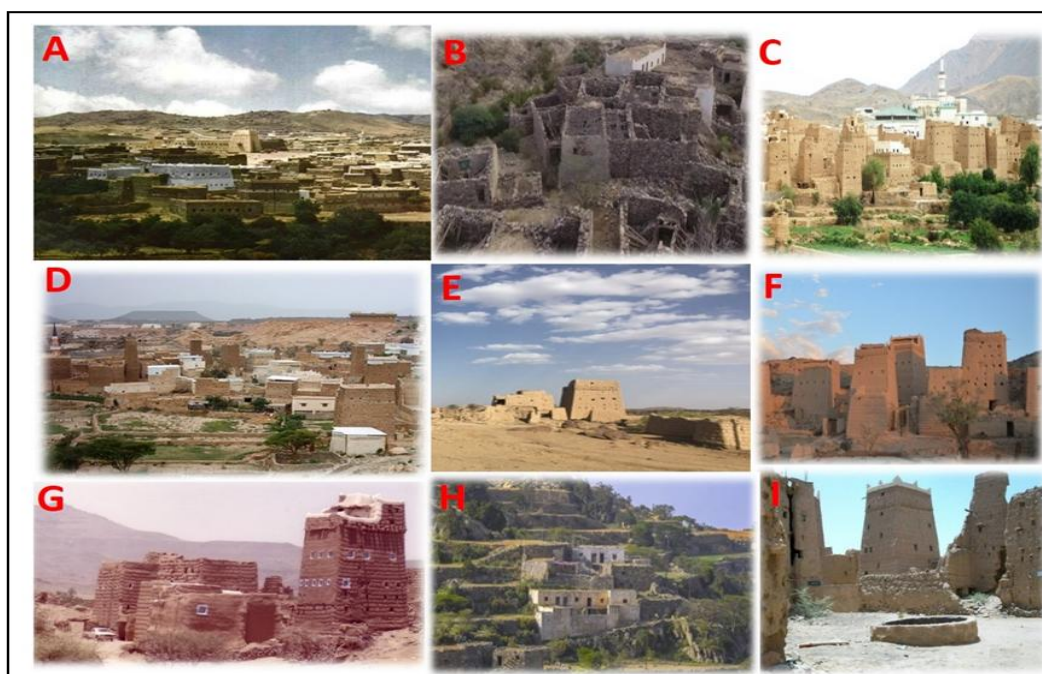
3- Museums:

There are many museums in Asir that contain thousands of archaeological holdings and collections that represent different types of human activity and all the social, political, military, and cultural aspects, and narrate the history of civilization throughout the ages. These museums are tourist attractions for the various categories of visitors such as El-Muftaha Palace, an archaeological Museum in Abha; Shada Palace Museum in Abha; Tanumah fort, an example of the popular heritage in Abha; and Abdul Aziz Al - Khushn Museum in Ahad Rafidah.

4- Heritage Villages

In Asir Mountains, sites and heritage villages were confined to about 4275 villages. Heritage villages and collectibles are characterized by being preserved until now. There are 542 heritage villages in Abha. The number of villages in Khamis Mushayt is 325. However, the number rises to 715 villages in Mahayel Asir, while there are 246 villages in Bisha and its suburbs. In Al-Namas and its suburbs, there are 216 villages. In Tathleeth and its suburbs, there are 262 villages. In Zahran Aljanub and its suburbs, there are 127 villages. In Rijal 'almaa and its suburbs, there are 406 villages. In Ahd Rafida and its suburbs, there are 164 villages. In Sarat Eubayida and its suburbs, there are 237 villages. In Balqurn and its suburbs, there are 182 villages among the most famous archaeological sites which belong to a tribe of Bani Hilal. Furthermore, there are some other places such as Abu Zayd Al-Hilali, the well of Abu Yazid, the grave of Alia Alia, the wife of Abu Zayd Al-Hilali; and the trench of Bin Sarhan.

Al-Bark Governorate is characterized by the presence of heritage villages and collectibles which are still preserved until now. Al-Bark Governorate preserves a cultural heritage dating back to the third and fourth centuries AD, in addition to the historical landmarks drawn by its famous wall that dates back to more than 800 years. Besides, there is the mosque of Caliph Abu Bakr Al-Siddiq, May Allah be pleased with him. There are 66 villages in Tarib and its suburbs. In Bariq and its suburbs, there are 220 villages. In Almujarada and its suburbs, there are 397 villages. In Tanawma and its suburbs, there are 73 villages. In Alharija and its suburbs, there are 127 villages (General Authority for Tourism and Urban Heritage, 2019). Figure (6) shows heritage villages in the study area.

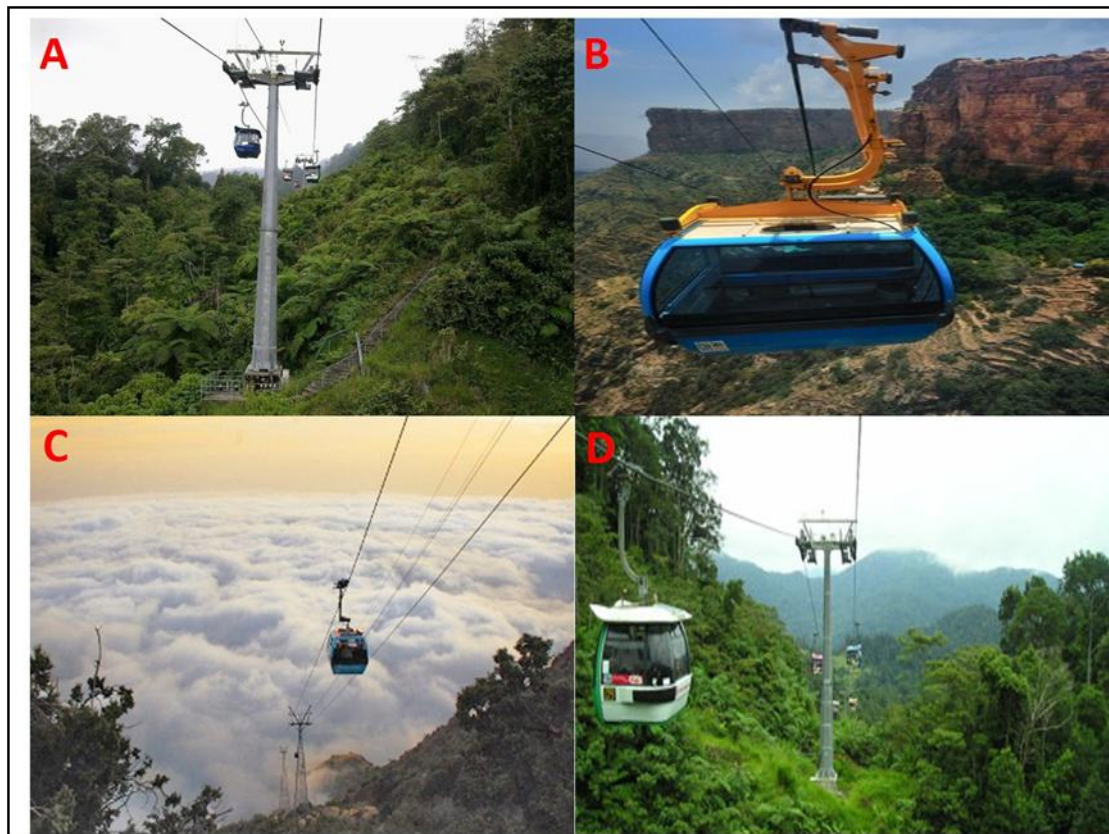


Source: Saudi Commission for Tourism & National Heritage, 1439.

Figure (6) Heritage Villages in the Study Area: (A) Abha, (B) Almujarada, (C) Zahran Aljanub, (D) Sarat Eubayida, (E) Tathleeth, (F) Tarib, (G) Ahd Rafida, (H) Al-Namas, and (I) Zahran Aljanub.

5- Festivals and Parties Summer:

Festivals and parties summer takes place annually and witnesses many events and sports activities of all kinds. Cable cars are one of the tourist attractions in the Asir region. They give tourists and visitors of the region a chance to enjoy the picturesque nature and watch the most prominent natural landmarks through the four stations which are distributed between Abha, Al-Soudah and Al-Habla parks. Figure (7) shows cable cars in the study area.



Source: (<https://ar.m.wikipedia.org>)

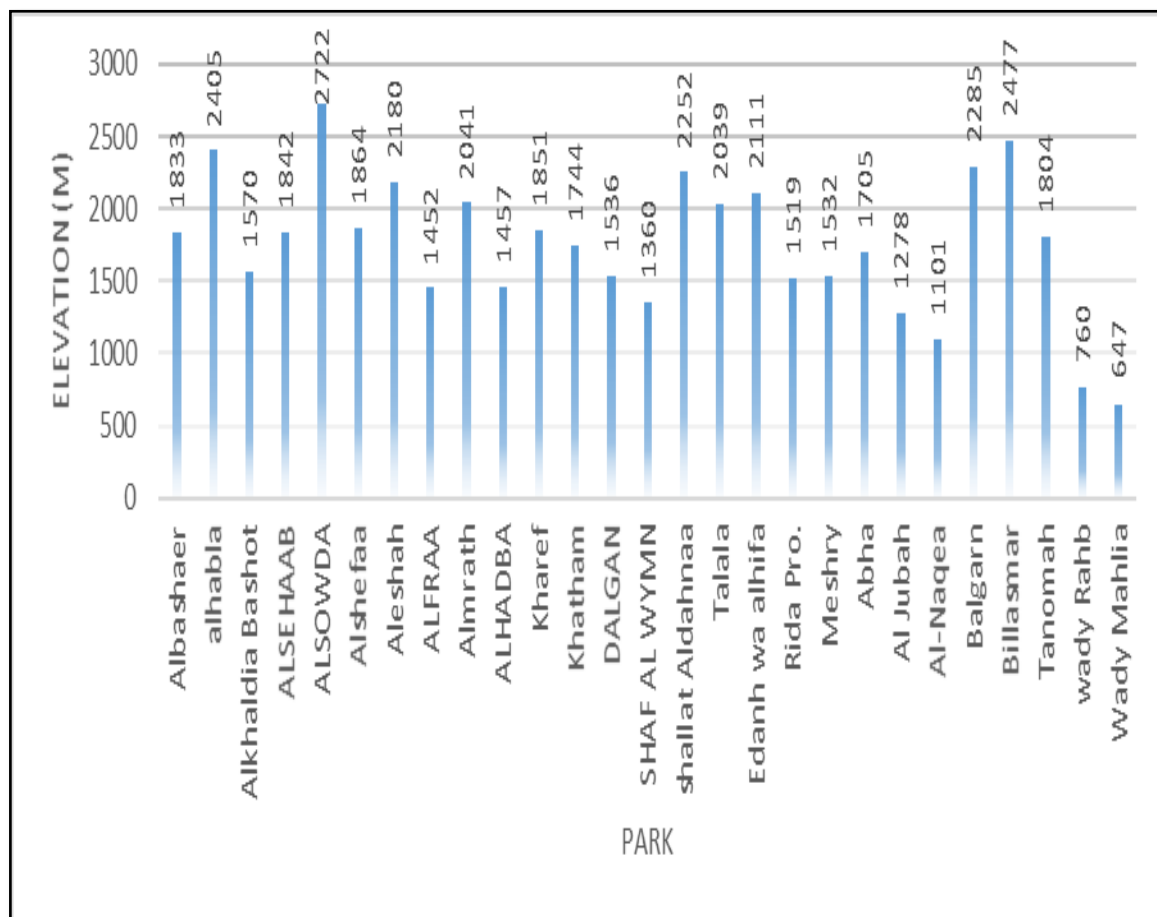
Figure (7) Cable car in the Study Area.

6- Popular Markets:

Like other regions of the Kingdom, Asir region is characterized with its popular markets. They are of the oldest markets, and thousands of tourists and visitors flock to them. Most of these markets are named after days such as Tuesday Market and Friday Market where shops and stalls are open.

7- Parks and Gardens:

There are a number of parks and gardens in Asir region. Figure (8) shows and explains the classification of parks by height. Table (2) shows a quantitative analysis of park heights, Figure (9) shows sites of heritage villages, parks and gardens by height in the study area.



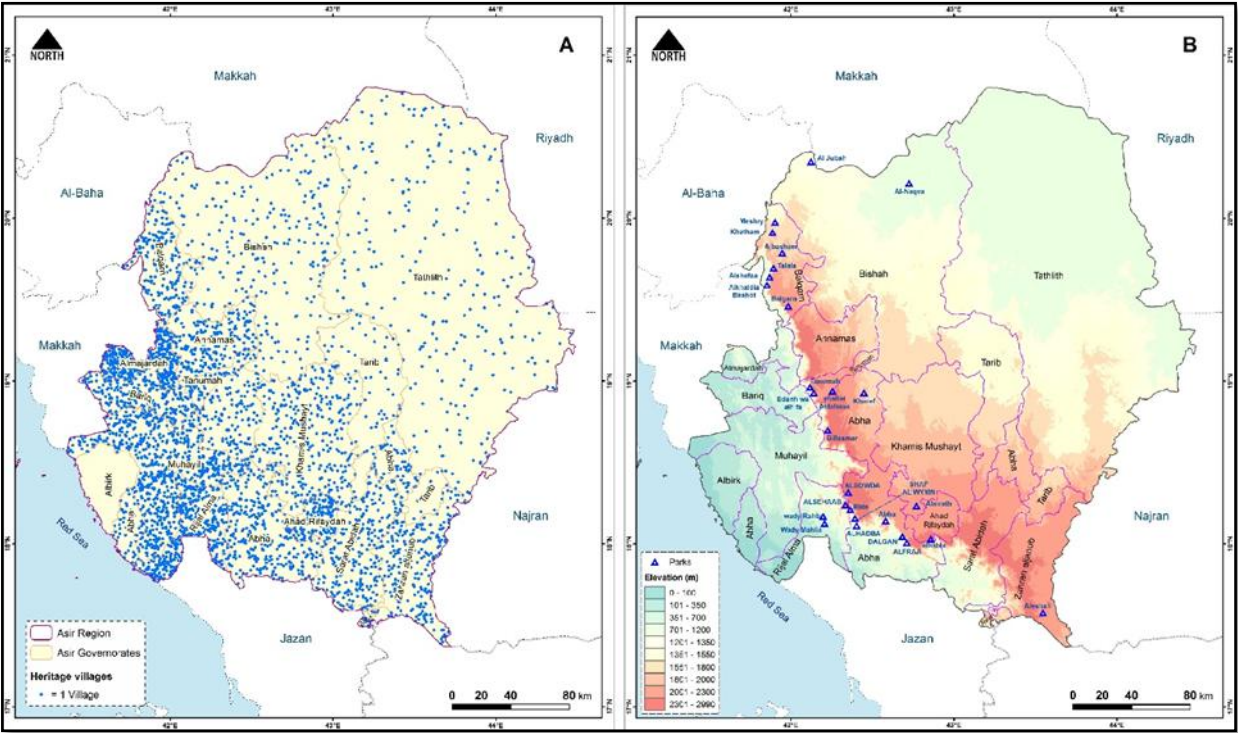
Source: Detailed Land use plan, Asir Municipality, 2018 Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global, NASA & NGA, 2011

Figure (8) Classification of Parks and Gardens by Height.

Table (2) Quantitative Analysis of Park Heights

<i>Elevation (m)</i>	
Mean	1754.33
Standard Error	94.83
Median	1804.00
Standard Deviation	492.78
Sample Variance	242828.38
Kurtosis	0.15
Skewness	-0.31
Range	2075.00
Minimum	647.00
Maximum	2722.00

Source: Detailed Landuse plan, Asir Municipality, 2018 Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global, NASA & NGA, 2011



Source: Detailed Landuse plan, Asir Municipality, 2018 Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global, NASA & NGA, 2011.

Figure(9): (A)Sites of Heritage Villages, (B)Sitesof parks and Gardens by Height in the Study Area.



Figure(10):(A) and (B) Al-Soudah Park (King Abdul-Aziz).

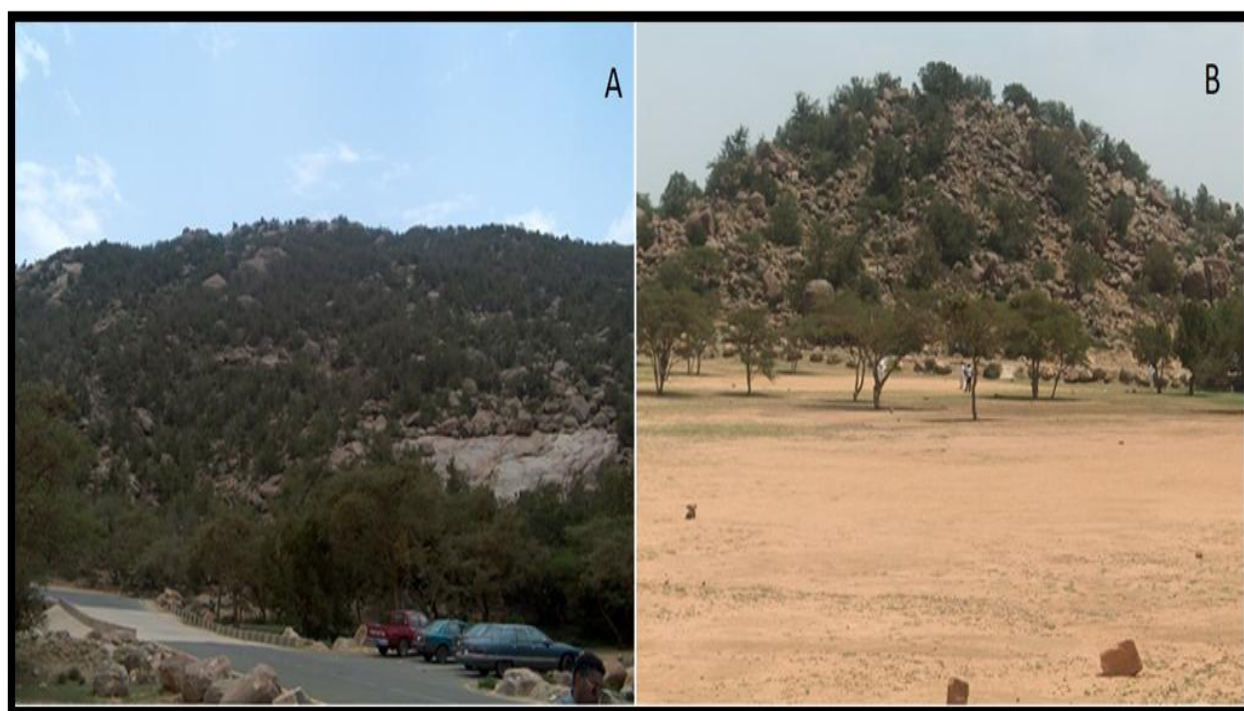


Figure (11): (A) and (B) Prince Sultan Park and Al Maskqi (Al Qara'a).

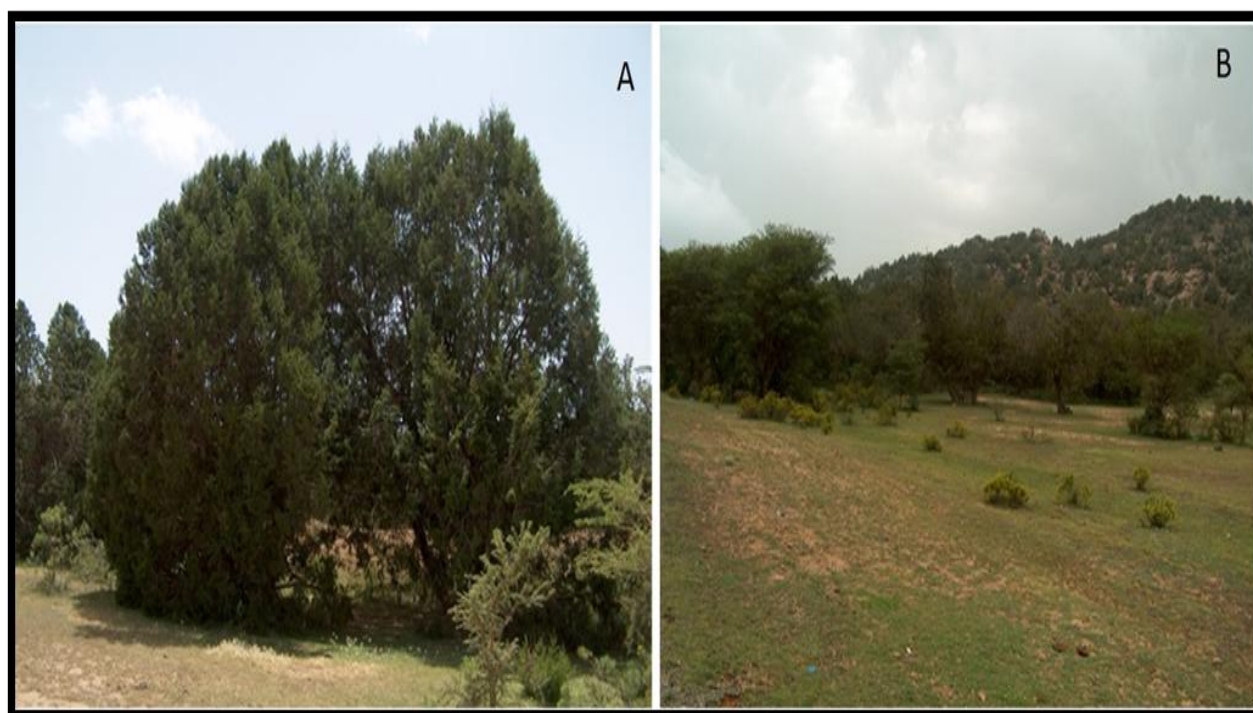


Figure (12): (A) and (B) El-Jar Park.

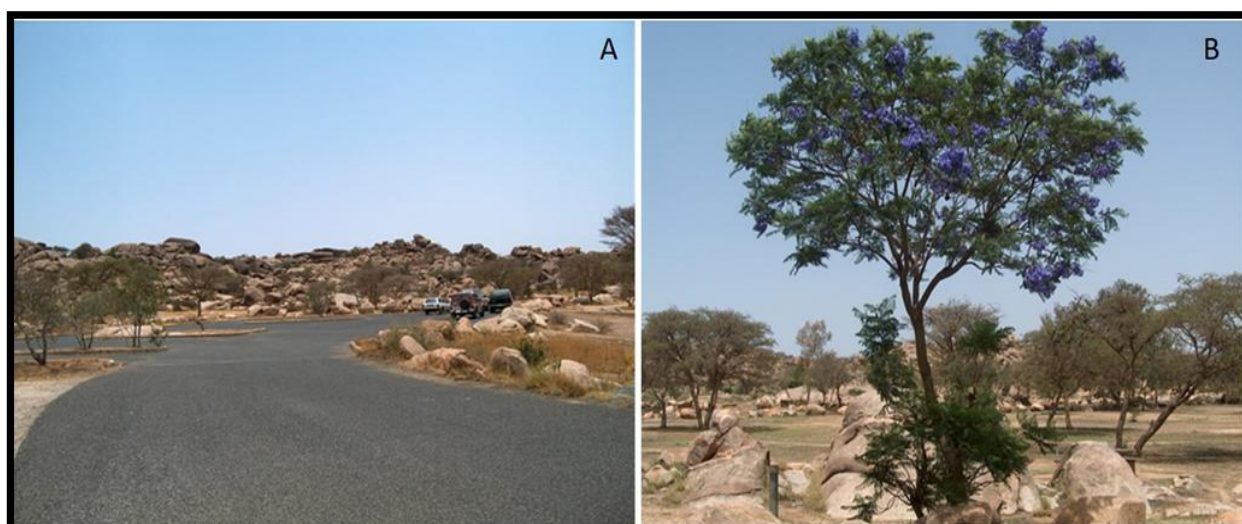
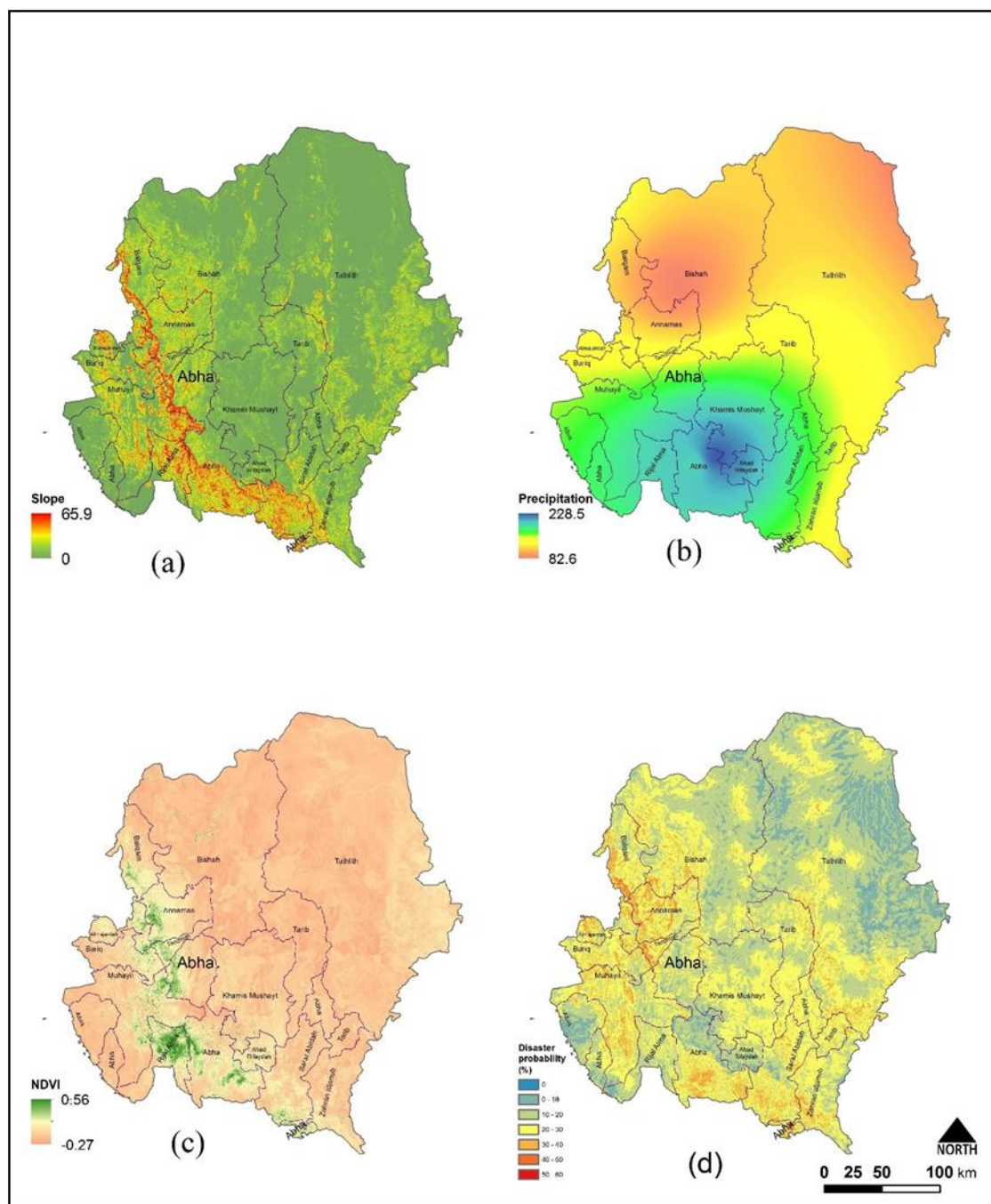


Figure (13):(A) and (B) Dalgan Park.

5.3 Evaluation of Disaster Risk:

Mountains provide a thoroughly challenging environment for special sports and leisure activities that attract aficionados such as mountain paragliders, or downhill skiers (Mountain, 1995). Mountain geo-tourism, especially mountain adventure tourism, differs from general mass tourism in low land regions due to its higher requirements on the safety of the tourism area (Beedie, 2003). Natural hazards e.g. volcanic eruptions, seismic events, landslides, avalanches in the high mountain regions, high waves and intense precipitations, hurricanes for coastal areas etc. can affect tourist activities and tourist destinations. Besides, they can substantially modify the landscape of a certain region. The paper presents some examples of natural hazards that affect geo-sites, tourist activities and tourist destinations negatively and positively.

This section intends to gain spatial continuous results of disaster possibility in Asir region, referring to the method in ref. (Chen et al, 2016). Four inducing factors are taken into consideration: Slope, Figure (14a); precipitation, Figure (14b); NDVI, Figure (14c) and altitude, Figure (14). Note that the precipitation is a 14-year average value from 2005–2019 and NDVI is 1-year average value in 2019. Each factor is divided into five levels (1, 2, 3, 4, 5) through the Jenks natural breaks classification method (Jenks, 1967). The higher level means a greater possibility of disaster risk. Then, the weighted sum of all factors is used for evaluation of comprehensive disaster possibility. Herein, the weights are 0.574, 0.291, 0.090, and 0.045 for slope, precipitation, NDVI and altitude, respectively. All weights are determined by the analytic hierarchy process (AHP) (Saaty, 2008), a subjective method that can reflect difference of relative importance among indexes properly. Figure (14d) shows the final assessment results. Let the possibility 100% correspond to the maximum value 5, then the possibilities 90%, 80%, 70%, and 60% equal 4.5, 4, 3.5, and 3, respectively. In the northeast and the central mountain area, the disaster possibility is over 90% due to the large slope and excessive precipitation. In contrast, the possibility in the southwest is relatively small with a large slope but little precipitation and dense vegetation.



Source: Slope: Shuttle Radar Topography Mission (SRTM) 3 Arc-Second Global, NASA & NGA, 2011.- **NDVI:** Landsat 8, OLI, 2019, Different scenes3.- **Precipitation:** Spatial Statistics using PME Metrological Data (1978-2017)- **Disaster Map:** Spatial Statistics using ArcGIS Environment

Figure (14) Evaluation of Natural Disaster Risk: (a) Slope, (b)Precipitation, (c) NDVE, (d) Results of Disaster Risk.

5.4 Environmental Diversity Impacts on Tourism in Asir:

Since the establishment of the General Authority for Tourism and National Heritage in 2000, Saudi Arabia has sought to facilitate the massive development of tourism on the national level. The efforts so far are likely to bring about massive tourism expansion in the upcoming years. Development in the Saudi tourism sector has rather focused on areas of high potential to be mass

markets. That is, due to their natural elements, environmental diversity, mild climate, natural beauty, good infrastructure, hospitality and the historic sites and regions included in the national tourism plan, such as Asir Mountains, have become tourist destinations on national and international scales.

Domestic tourism has soared in recent years. More than four million domestic trips were recorded in 2010, of which nearly 430,000 involved Asir (Heritage, 2015). Domestic tourism revenues increased by 80% between 2013 and 2014 which is an increase of 18.5 billion Saudi Riyal (US \$4.93) (Al-Mamony, 2015). Asir is now considered the main tourist attraction in the Kingdom of Saudi Arabia. Hundreds of local, Arab and international tourists annually visit the region. Asir is currently one of the most popular tourist destinations in the Arab world and has been selected to be the Capital of Arab Tourism in 2017 (Arab Tourism Organization, 2015).

As tourism moved into the 21st century, enterprises have made the environment a priority. Tourism now is the world's largest industry. Therefore, the environment is taking the central stage in tourism development (Muhanna, 2006). Tourism is not only a powerful economic force but also a factor in the physical environment. Any form of industrial development brings about an impact on the physical environment where it takes place. In view of the fact that tourists have to visit the place of production in order to consume the output, it is inevitable that tourism activity is associated with an environmental impact. For this reason, some authors have traditionally pointed out that tourism can lead to environmental negative consequences. The highly polarized nature of development also generates intense environmental problems. This reduces the quality of life for the locals, as well as the tourists, and may ultimately threaten the viability of the tourist industry itself (Williams & Shaw, 1991).

The depletion of natural resources can result in water shortages, creating a great pressure on other local resources like energy, food, etc. That might be in short supply already or destroy beautiful scenic landscapes. Pollution from tourists has an impact on the global level, which disturbs the local population of the affected community. Solid waste and littering typically spoil the natural environment. Physical effects can include degradation loss of wildlife habitats and of scenery, as well as the disturbance and erosion of the local eco-system caused by clearing forested land and the construction of tourism facilities and infrastructure (UNEP, 2001). However, tourism can be positive for the preservation of natural areas. In many tourism projects, the conservation of the natural, cultural and built environment is an important motivation for the initiation of the project. Moreover, some projects deter local communities from illegal use and overuse of natural resources.

They also integrate protected natural areas in regional and local development plans and programs. Therefore, tourism should positively contribute to environmental preservation. This can be more meaningful when we think about tourist motivation in visiting one specific place. The benefits and costs of environmental impacts are highlighted below (Jaber & Marzuki, 2018, p.5). Table (3) shows the environmental impacts: a comparison between benefits and costs.

Table (3): Environmental Impacts: A Comparison between Benefits and Costs

Benefits	Costs
<ul style="list-style-type: none"> • Conservation of natural areas and wildlife. • Re-evaluation of environmental policies to respond to tourism growth. • Increased environmental awareness and respect for nature among tourists. • Rehabilitation and occasional transformation of old buildings and sites into new facilities. • Introduction to planning and management. • Tourism may be less damaging to nature compared with human activities involving agriculture and forestry. 	<ul style="list-style-type: none"> • Loss of aesthetic values. • Noise. • Generation of waste. • Deforestation to build accommodations. • Cutting down trees to obtain firewood resulting in water and air pollution. • Disturbance of ecosystems and disruption of animal breeding patterns and habitats. • Destruction of beaches, dunes, coral reefs and many national parks and wilderness areas through trampling and/or use of vehicles. • Change of landscapes permanent environmental modification. • Seasonal effects on populations' densities and structures. • Overuse of resources.

Source: (Muhanna, 2006, p.20).

The ability of big and small operators to utilize their supply chain to support sustainable tourism could be an important driver for change. This might require financial support for SMME's to enable them to both change their own operational practices and to understand the opportunities that they have in influencing the supply chain. The involvement of the community could also be an important marketing point (Muhanna, 2006, p.29). The impact of media focusing on the program of tourism is already reverberating. A similar approach to the environment might also result in a positive incentive.

5.5 Multi-Criteria Evaluation (MCE):

The analytical method of Multi-Criteria Evaluation (MCE) has been used to build a model that defines tourist areas. The idea of a multi-criteria assessment method is based on the production of Suitability Maps for tourism.

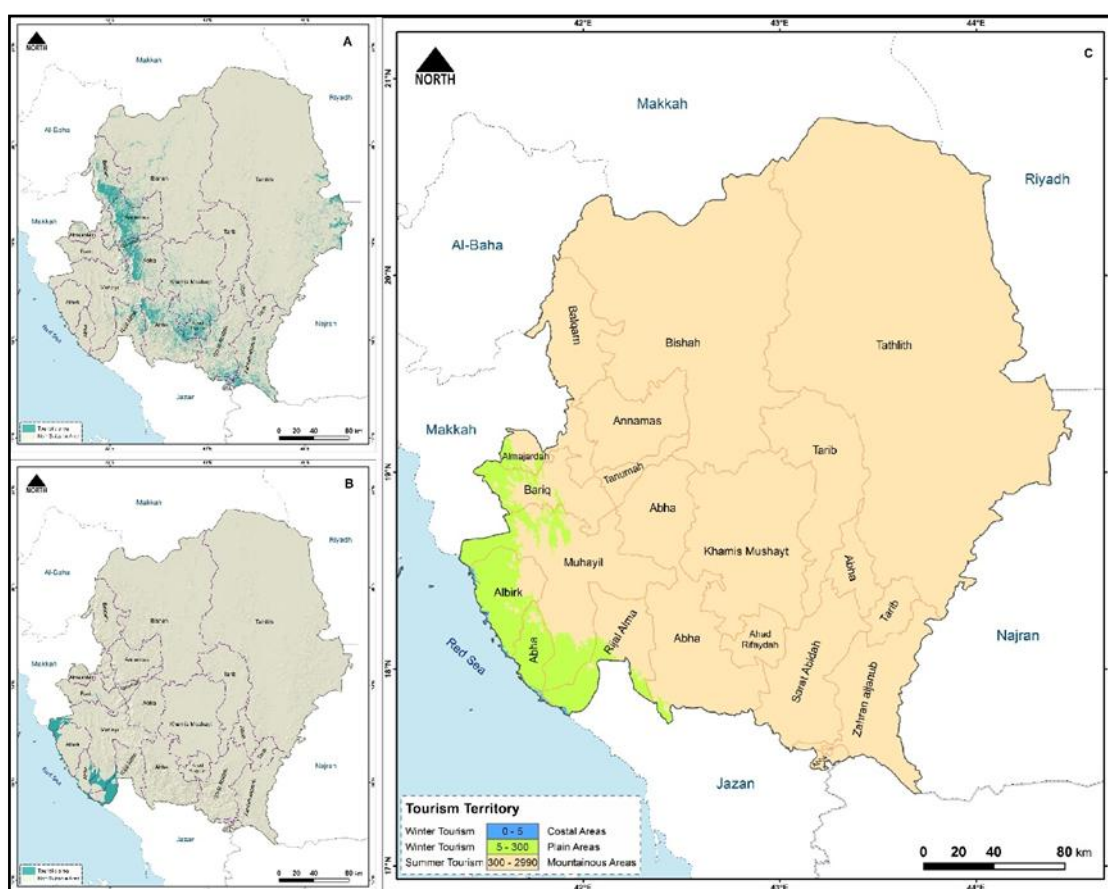
5.5.1 A Proposed Model of Asir Tourist Areas in the Summer:

The elements of the model were determined based on the most important natural ingredients and tourist attractions. They are prioritized depending on the degree of importance. These elements are mountain highland areas. In the summer, tourist areas have to be more than 900 m high above the sea level as temperature decreases with height. Other elements include stunning views of vegetation and an appropriate regression that is less than 15 degrees to establish facilities and roads. Figure (15, A) shows the best areas suitable for summer tourism, in

accordance with previous standards and criteria.

5.5.2A Proposed Model of Asir Tourist Areas in the Winter:

The elements of the winter tourist areas model have been identified according to the degree of importance in the tourist attractions for the purpose of eco-tourism. The model included five elements: basins of valleys (to make sure the distance is safe), stunning views of vegetation, low topography (for the warmth of winter), slope degree for the establishment of facilities and roads, and distance from water flooded areas. In addition to land resources (plain areas), Figure (15, B) shows the best areas suitable for winter tourism, in accordance with the previous standards and criteria.



Source: Cartographic Modeling using ArcGIS Environment

Figure (15) (A) The Best Areas Suitable for Summer Tourism, (B) The Best Areas Suitable for Winter Tourism, Tourism Territory in Asir Region

Based on the case study, some general recommendations are present to address the current problems for the environmental diversity assessment for geo-tourism development in Asir region. These involve (1) to improve the quality of manmade tourism resources and enrich cultural tourism products through cultural creativity; (2) to integrate tourism industry with regional development, strengthen regional cooperation with nearby tourism areas and focus on the construction of tourism infrastructure in backward areas; (3) to design tourist sightseeing routes adapting to the spatial and temporal characteristics of different landscapes; (4) to respect the laws of nature and avoid exploitation in areas with fragile natural ecological sustainability

and high risk of natural disasters; (5) to strengthen the construction of infrastructure and building up a complete tourism traffic network. Not only should the quantity of geo-tourism resources be highlighted, but also their quality and spatial layout should be taken into consideration.

6. Conclusions:

The paper aims to assess eco-tourism potentials to enhance the attractiveness of tourism in Asir region. This is for the purpose of geo-tourism development and sustainability. The climate and geography turn Asir into a tourist attraction all year round. In that sense, the geological and geomorphological features of the study area are analyzed. Besides, landforms that consist in geotouristic attractions are identified, and their spatial distribution is represented on the resulted digital maps. It is essential to analyze the status of tourism in Asir to ascertain the potential of domestic tourism for a sustainable regional development in Saudi Arabia. Moreover, tourism diversification in this region can be undertaken in terms of product, market and geographical areas.

As tourism development projects are massive undertakings, they affect many sectors and involve many stakeholders. Hence, it is critical that the government adopts multi-hierarchical, all-inclusive and well-coordinated development strategies. These are the challenges to which the country's tourism industry should respond in order to promote domestic tourism.

In order to achieve sustainable tourism development in Asir, it is prudent to analyze the environmental diversity in the region. An understanding of the relationship between domestic tourism and sustainable regional development in Saudi Arabia is crucial. The preservation of environmental diversity contributes to sustainable tourism socially and economically as it operates on a platform of nature conservation and community awareness. Asir region is a unique tourist destination; it has considerable unrealized ecological potential. Thus, the government policy on domestic tourism should be reviewed. Tourism products and market diversification in the region are possible, considering that the province has many distinct geographical areas. Good tourism policies should promote resource diversity and respond to the challenges facing the tourism sector in a manner that advocates sustainability.

It should be noted the environmental impacts on eco-systems, whenever negative effects on the natural environment are dealt with, rarely influence the personality of the place. The ecological impacts of tourism usually affect the eco-systems as a whole. Besides, natural environment does not only affect pristine natural areas, but also cultivated land, which is an important part of the natural and cultural heritage of the region, it is ecologically valuable. In addition, the environmental impacts of tourism occur at the local, regional and global levels. The study came up with a digital suitability map, a comprehensive model of the tourist areas and attractions of Asir region in the summer and winter, and unique rectifiers of the environment.

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