HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

DEMAND AND SUITABILITY EVALUATION OF RECREATION ACTIVITIES IN ASWAN CITY

THE Ph.D. DISSERTATION

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LIST OF ABBREVIATIONS

AHP - **A**nalytical **H**ierarchy **P**rocess

AS - **A**ttractive **S**its

CR - **C**onsistency **R**atio

CES - **C**ulture **E**cosystem **S**ervice

CPP - **A**ctive **P**ollution **P**oints

DE - **D**emand **E**valuation

DEM - **D**igital **E**levation **M**odel

DSMW - **D**igital **S**oil **M**ap of the **W**orld

GAUP - **G**eneral **A**uthority for **U**rban **P**lanning

GIS - **G**eographical **I**nformation **S**ystem

LEM - **L**and **E**valuation **M**odel

LIR - **L**ayer **I**ndex **R**eclassification

LSA - **L**ow-**S**uitable **A**reas

LSE - **L**and **S**uitability **E**valuation

MCE - **M**ulti-**C**riteria **E**valuation

MA - **M**illennium **E**cosystem **A**ssessment

MSA - **M**ost-**S**uitable **A**reas

NDVI - **N**ormalized **D**ifference **V**egetation **I**ndex

NSA - **N**ot **S**uitable **A**rea

PGIS - **P**articipatory **G**eographical **I**nformation **S**ystem

PPGIS - **P**ublic **P**articipation **G**eographic **I**nformation **S**ystem

RT - **R**oad and **T**ransportation

RA - **R**esidential **A**reas

RE - **R**ecreation and **E**cotourism

RES - **R**ecreation and **E**cotourism **S**ervices

SA - **S**uitable **A**reas

SPSS - **S**tatistical **P**ackage for **S**ocial **S**ciences

USGS - **U.S**. **G**eological **S**urvey

UNWTO - **U**nited **N**ations **W**orld **T**ourism **O**rganization

WB - **W**ater **B**odies

WLC - **W**eighted **L**inear **C**ombination

WTP - **W**illingness **T**o **P**ay

GPS - **G**lobal **P**ositioning **S**ystem

VIF - **V**ariance **I**nflation **F**actor

GIS-MCE - **G**eographical **I**nformation **S**ystem based **M**ulti-**C**riteria **E**valuation

1. INTRODUCTION

1.1 Research Background

Recreation and Ecotourism have become one of the most significant economic sectors. It is noted that the Arab region attracts only 3% of the arrivals and international tourism revenues. Whilst the great cultural, natural, and historical resources that the region provides for the development of tourism can definitely catch much stronger flows of tourists from all over the Arab region as well as from outside it (Groizard and Santana-Gallego, 2018). The Arab region, with the exception of a few countries, remains very marginal in the global economy of the tourism sector (Sghaier *et al.*, 2019). As the cradle of world religions, and ancient civilizations, the Arab world has one of the densest collections of monuments and antiquities, including the ancient Egyptian monuments and the rock-carved city of Petra in Jordan. The extension of Islam and Arab civilization aided produce a common cultural heritage for the public of the region. Growing up over the centuries, Arab culture has created a rich tradition of urban culture in countries, including special architectural structures, and artisanal workshops (Ali Al Moosa, 1989). Moreover, the geography of the region contains a variety of natural forms, like the beaches of North Africa, magnificent rock formations, the underwater marine life and coral reefs of the Red Sea, and the various wildlife protected in nature reserves throughout the Arabic region. Whilst many countries such as Tunisia, Egypt, the United Arab Emirates, and Morocco, the development in the rest of the region has long been hindered by the cause of regional political instability (Sghaier *et al.*, 2019).

The Arab region is ready to expand its industry in the tourism sector. These contain nature-based tourism and cultural heritage. However, achieving this goal will require sustainable planning strategies for different kinds of Recreation and Ecotourism Services (RES). Egypt is one of the Arab countries with a population that exceeds 90 million and still expanding rapidly. Hence, the government policies headed towards constructing new urban settlements to absorb this vast increase. However, according to recent surveys, planning doesn’t consider the needs of citizens in the Arabic region, especially Egypt. Thus, the good quality of Egyptian life has been decreased over time. While many countries such as Morocco, Tunisia, and the United Arab Emirates have been thriving in encouraging Recreation and Ecotourism (RE) development (Groizard and Santana-Gallego, 2018; Sghaier *et al.*, 2019).

The presence and quality of public services are considered one of the life criteria qualities. RES have always been a beneficial resource to human societies. It usually provides various social and environmental facilities that increase citizens' quality of life. Nevertheless, the presence of RES

could be a criterion of human life quality and adequacy. Moreover, many criteria can be utilized to evaluate the quality of RES. Evaluation criteria include levels of accessibility to the RES and the quality of this service (Zoderer *et al.*, 2016; Bogdan *et al.*, 2019; Clemente *et al.*, 2019; Ebrahimi, Nejadsoleymani and Mansouri Daneshvar, 2019).

The Recreation and Ecotourism Services (RES) is high on today's research and planning agenda (Forster, 1989; Dağıstanlı, Turan and Dengiz, 2018). First of all, planning authorities in the Arab countries have begun to acknowledge the link between Outdoor Recreation (OR), active living, and public health (Seddon and Khoja, 2003; Seyfi, 2018). Lifestyle diseases receive a lot of political and public attention, and the functional role of OR in prevention and recuperation regarding stress and obesity is integrated into planning objectives (Nahuelhual *et al.*, 2013; Stålhammar and Pedersen, 2017). Research has shown that opportunities for RES have become an integrated part of municipal afforestation policy municipal landscape planning (Peña, Casado-Arzuaga and Onaindia, 2015; Schneider and Lorencová, 2015). Furthermore, closeness to nature and green spaces with opportunities for OR plays a key role in peoples' choice of settlement. The RES sustainable planning contributes to development by supplying economic benefits to urban societies (McClellan and Medrich, 1969; Nadim *et al.*, 2018).

Due to growing interest in RES, the need to quantify and account for them increases by evaluating them (Paracchini *et al.*, 2014; Mahiny and Mirkarimi, 2016; Stålhammar and Pedersen, 2017). There are various benefits of evaluation RES. Research on RES must share one goal: the maintenance of practices and policies to ensure the sustainable provision of RES and related benefits to humans' well-being[1]. Unfortunately, most of RES cannot be directly evaluated, therefore making the use of assessing criteria required and classifying them to main criteria and sub-criteria for accounting and measuring of RES categories[2]. Moreover, only a small number of criteria are being used for those that cannot be measured directly, due to data on modeling and assessing RES remains limited (Bryce *et al.*, 2016; Doğu. G and E, 2016; Dağıstanlı, Turan and Dengiz, 2018). So as to produce reliable and accurate results in RES assessment, robust quantification is required. Thus, a review of criteria used for evaluating RES is necessary to develop reliable and feasible criteria for assessing them and bridging current RES data source gaps.

Overall, more interest has been placed on assessing Culture Ecosystem Services (CES). Furthermore, more research has focused on the assessment of RES by examining preservation and

[1] (Chakrabarty, 2011; Lindholst, Caspersen and Konijnendijk Van Den Bosch, 2015; Peña, Casado-Arzuaga and Onaindia, 2015; Nadim *et al.*, 2018; Derek, Woźniak and Kulczyk, 2019)

[2] (April 2010; Aklıbaşında and Bulut, 2014; Beeco, Hallo and Brownlee, 2014; Javed et al., 2015; Doğu. G and E, 2016; Dębski and Nasierowski, 2017; Bernetti, Chirici and Sacchelli, 2019; Bakogiannis et al., 2020).

management procedures that incorporate user perceptions[3]. The human perceptions term refers to these views from local communities. The perceptions of the local communities are the ones least reflected by the demand's evaluation of these kinds of services. The literature is divided into two categories. First, the literature explored residents' perceptions by utilizing non-spatial RES criteria. Second, the literature investigating land suitability valuations of RES to evaluate the current and potential land evaluation of these services based on spatial criteria. There is little, if any, previous research focusing on RES evaluation based on land and service demand evaluations. The results of this dissertation seek to assist fill in current research gaps in the current literature by analyzing and comparing people's perceptions of current and future demands and land evaluation of RES. This study, is one of the few studies that examine the users' perceptions and preferences toward the development of future RES demands in the Arab world and the integration between the demand evaluation of RE and Land Evaluation (LE) of RES.

This dissertation concentrates on evaluating RES in Arab countries. And I will apply a methodological approach that integrates land evaluation and demand evaluation of RES in Aswan city -Egypt, as an example of Arab countries. As the south-Egypt recreation destination, Aswan was focused upon it because it has many recreations, natural and attractive cultural sites, and vacation-oriented businesses. This study will attempt to answer a central question: Should the development of RES be continued as a means of uplifting human well-being in the lagging economies in the Arab countries -Aswan as a case study? This utilized approach enables the author to identify particular problems and policy areas that require analysis before planning is undertaken or implementation of changes is considered.

1.2 Statement of the Problem

Problem1: Because of the urban planning development goals in the Arab region, the urbanization process was rapidly increased. Moreover, RES, as the main source of human well-being, have been affected by the fast development and urbanization.

Influences: Recent surveys have shown that the quality of local's life has decreased in several Arab countries because planners do not consider the citizens' needs in the city's planning process (Mahmoud and El-Sayed, 2011). Thus, in the present study, the land evaluation of the current state of RES in Aswan city, as a case study of Arab countries, is necessary to improve and develop human well-being and fulfill locals' future demands.

[3] (Kara and Demirci, 2010; Brown, 2012; Szell, 2012; Katz-Gerro and Orenstein, 2015; Brown and Hausner, 2017; Figueroa-Alfaro and Tang, 2017; Oteros-Rozas *et al.*, 2018)

Problem2: Culture services support human well-being worldwide and directly support more than one billion people in Arab countries. In general, unsustainable use and degradation of Culture Ecosystem Services (CES) worldwide threatens the health and livelihoods of many people. So, the Millennium Ecosystem Assessment (MA) highlighted the current state of degradation of many CES, like RES, and the importance of these services to human well-being worldwide, especially in Arab countries.

Influences: According to the MA, it is apparent that more than 60% of CES around worldwide are being transformed or degraded (MA, 2005). So, it is urgent to safeguard CES and pay more attention to research related to the sustainability of cultural services and the challenges and threats facing CES, especially in Arab countries.

1.3 Significance of the Thesis

The primary purpose of the dissertation is to develop a new approach for evaluating RES based on both location and local demands. To achieve the main goal of this dissertation, I applied the proposed evaluation approach on RES as a common kind of CES category. In that respect, I study and evaluate RES in Aswan city-as a case study- by utilizing both land and demand evaluation of this service. The aim of this dissertation is to test the hypothesis that the integration between the land evaluation of RES based on Multi-Criteria Evaluation (MCE) and the demand evaluation of RES based on public participation (PPGIS) and semi-structured interview, are more effective technique than single evaluation techniques.

What is the importance of Land Evaluation of RES?

Importance 1: This dissertation discusses and evaluates the existing and potential RES in Aswan city. The evaluation of current recreation services and their distribution in Aswan city is classified into Land Evaluation (LE) and Demand Evaluation (DE), including spatial and non-spatial criteria. Chapter four addresses the land evaluation of existing and potential RES in Aswan city using specific spatial criteria. This case study highlights significant weaknesses and threats facing RES development and provides suggestions and alternatives to solve the study problems by utilizing the GIS-based MCE approach. Moreover, land evaluation of RES should be considered as an essential tool for urban planning in community development, especially in Arab countries such as Egypt.

What is the importance of Demand Evaluation of RES?

Importance 2: According to the service demand evaluation, demand means how democratic values are met within the participating methods such as PPGIS and questionnaire. The demand evaluation includes the user's perceptions and preferences in the planning process by measuring participants'

volumes and diversity. It is not the purpose of this dissertation to compare all possible types of public meetings or PPGIS. Instead, the aim is to reach an approach to public meetings where citizens are invited and share their thoughts through discussions. Furthermore, the dissertation shows possible GIS analyses on PPGIS collected data from consultation processes originating from the study area. The purpose of the GIS analyses is to give planners statistically grounded answers to what areas require revitalization and show the proposed recreation sites to fulfill future demands.

1.4 Research Questions

The main goal of the dissertation, as I mentioned above, is to develop a new approach for evaluating the RES based on spatial and non-spatial evaluation criteria in Arab countries by assessing the land and services demand of RES. Therefore, to achieve the main goal, four fundamental questions are addressed:

1. **Are the evaluation criteria addressed in the previous literature sufficient to develop a sustainable, diversified RES?**
    - What proper criteria have been used in the land evaluation of RES?
    - What are the strengths and weaknesses of using existing geo-information and GIS-based MCE to evaluate and develop current RES?
    - What is the best RES evaluation technique for indexing and weighting RES evaluation criteria?
2. **What are the potential reasons for locating some RES in suitable areas and others in non-suitable regions based on a land evaluation map?**
    - What are the potentially suitable lands in Aswan city which could be used to create and sustain a successful RES product?
    - How can the collected results help the planner and decision-makers in the local government for RES planning?
3. **Are the existing RES facilities' efficiency sufficient to develop and improve a diversified RES product?**
    - What are residents' perceptions of RES and the management of the recreation areas?
    - What are residents' attitudes and perceptions toward current recreation area management?
    - What are the main reasons for visiting recreation sites across the demographic category?
    - What are the significant constraints that prevent people from practicing RES?
    - Does the income affect the willingness to pay for recreation service maintenance?

- What areas of Aswan city are in most urgent need of development and revitalization, according to the citizens' perceptions?

4. **Based on land and service demand evaluation of RES in Aswan city, what are the general evaluation aspects of RES?**
    - Are the current RES located in the suitable areas based on the land evaluation map?
    - Are the current RES need more development and improvement efforts to fulfill current and future local demands?
    - What is the difference between land and service demand evaluation results?

1.5 Research Aims and Objectives

Objectives of the research will address based on the research questions as follows:

Research Question 1: Are the evaluation criteria addressed in the previous literature sufficient to develop a sustainable, diversified recreation service?

- Identify and implement criteria to evaluate RES.
    I. Spatial criteria
    II. Non-Spatial criteria
- Identify the most appropriate methods for RES evaluation.
- Calculate evaluation criteria importance and weights by using Analytic Hierarchy Process (AHP).

Research Question 2: Based on a land evaluation map, what are the potential reasons for locating some RES in suitable areas and others in non-suitable regions?

- Prepare criteria maps of RES within the study area.
- Create evaluation model by using ArcGIS
- Produce land evaluation map by integrating between land evaluation model and criteria.
- Identify the most suitable lands which could be used to fulfill future demands and needs of RES in Aswan city.
- Highlight the potential reasons for locating some RES in suitable areas and others in non-suitable regions based on a land evaluation map.
- Identify how the collected results help the planner and decision-makers in the local government for RES planning.

Research Question 3: Is the existing RE facilities' efficiency sufficient to develop and improve a diversified RE product?

- Indicate the influence of decreasing the recreational areas on residents.
- Indicate the residents' perceptions of RES and the management of the recreation areas.
- Highlight some of the significant factors of RES that influence users' awareness, attitudes, and perceptions.
- Highlight the importance of PPGIS as a more effective method for RES evaluation regarding collecting opinions from the citizens, compared to traditional public participation methods.
- Indicate the most common reasons for visiting recreation sites across demographic categories
- Illustrate the constraints that prevent people from practicing RES.
- Indicate the relationship between income and willingness to pay for RES maintenance.

Research Question 4: Based on land and service demand evaluation of RES in Aswan city, what are the general evaluation aspects of RES?

- Illustrate which RES are located in a suitable and unsuitable location.
- Indicate if the current RES needs more development and improvement efforts to fulfill current and future local demands or not.
- Identify the differences between the land and service evaluation.
- Indicate the intricate relationship between Land Suitability Evaluation and Demand Evaluation in the development of RES
- Illustrate the importance of integrating land and demand evaluation to achieve sustainable planning for RES.

1.6 Thesis Structure

This dissertation consists of Seven independent research chapters (Figure 1. 1):

Chapter One provides the outline of the dissertation, the statement of the research problem, the significance of this study, the research objectives, the research question, and the dissertation structure.

Following the introduction, **Chapter Two** gives the historical, geographical, and theoretical background of the subject and reviews relevant literature for RES. All literature sources are related to the evaluation of RES for development, the classifications used for RES development, and the techniques and methods utilized for assessment. Moreover, this Chapter provides a literature review about the land evaluation, the utilization of the MCE model, and the steps of using the AHP

method. Furthermore, this Chapter provides an overview of evaluation criteria used in the literature to evaluate RES.

Chapter Three discusses the utilized methodology in the evaluation process, describes the methods used for collecting the data and the methods behind the GIS analysis, and presents the framework for evaluating the participation methods. Moreover, this Chapter includes general information about the study area, and an introduction with a brief background about recreation development in Aswan city-Egypt.

Chapter Four presents the results of research questions 1 and 2 as provided in the previous section. The main focus is collecting the evaluation criteria and ordering them based on their importance by involving experts in the online questionnaire. Moreover, in this Chapter, I calculate the weights of the collected criteria based on their order by using AHP method. Furthermore, this Chapter focuses on the land evaluation of RES in Aswan city by evaluating the existing RES with a detailed overview of existing and potential RES sites in the case study area and an assessment of their current situation. This section uses Geographical Information System (GIS) for spatial analysis, data queries, and map production. Thereby, this Chapter provides baseline data used to evaluate existing RES and determine potential lands of RES and the suitability as alternative sites of development and urban extension benefit. This Chapter and the next Chapter are the most important in this dissertation. Moreover, this Chapter suggests strategies to evaluate RES sites based on spatial evaluation criteria used in the land suitability evaluation. Suggestions and alternatives for developing and improving RES infrastructure have been addressed to ensure that RES development is successful and sustain.

In **Chapters Five**, I try to answer research question 3 and 4. It tackles to evaluate the current and future demand of RES in Aswan city and its ability to support the RES development. In this context, the purpose of this Chapter is to study and evaluate the demand of the RES in Aswan city by using public meetings and PPGIS as methods for public participation in urban planning process. By the end of this Chapter, suggestions, and alternatives for developing and improving existing and potential RES infrastructure to ensure long-term and short-term goals are achieved and strategies to guarantee involvement by the local community.

Chapter Six encompasses the discussion and the main new scientific results of this dissertation.

Chapter Seven contains the summing-up of the essential finding and future work.

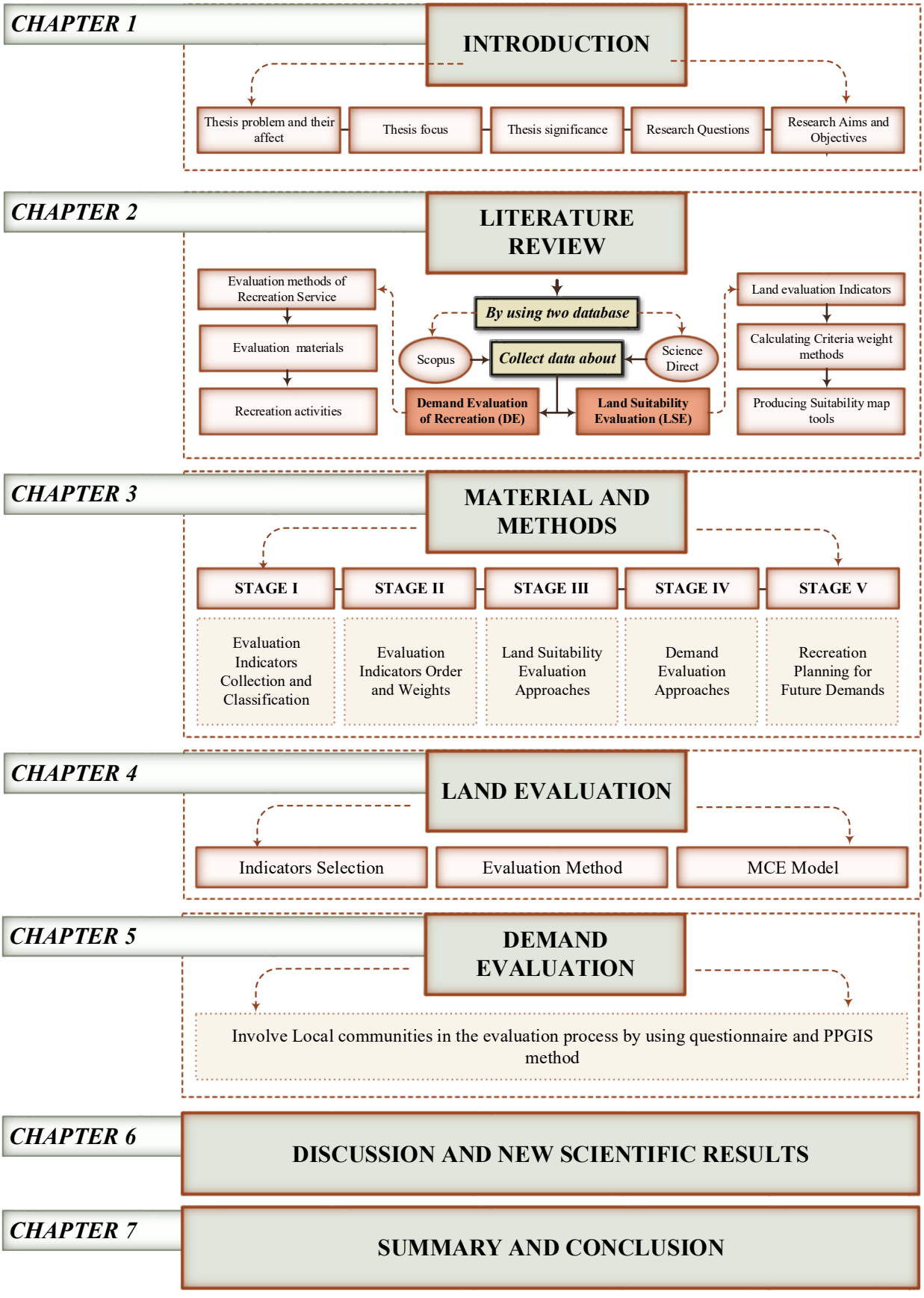


Figure 1. 1: Research Design and Chapters Distribution (Source: Author)

2. LITERATURE REVIEW

During this Chapter, I review the literature on evaluating Recreation and Ecotourism Services (RES) as a common type in Culture Ecosystem Services (CES) categories. And I summarize the theoretical framework for understanding the differences between Land Suitability Evaluation (LSE) of RES and Demand Evaluation (DE) of RES and the intricate relationship between Land Suitability Evaluation and Demand Evaluation in the sustainable planning of RES. I begin by examining the literature that focuses on Culture Ecosystem Services (CES) to provide a general overview of previous studies that addressed the evaluation of CES, especially RES. Following that, I discuss the state of RES in the Arab world and indicate the sustainable planning strategies of CES. And I examine the literature on RES evaluation criteria. After that, I discuss the evaluation criteria utilized for evaluating different categories of RES. And in this section, I provide the primary data about standard methods used for LSE and DE.

2.1 Cultural Ecosystem Services (CES)

Cultural Ecosystem Services (CES) is defined as "the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences"[4]. There are many ecological environments where culture interacts with nature, from local parks to national landscapes, that contribute significantly to fulfilling basic individual and social needs[5]. However, CES are those services least likely to be adjudicated by socioeconomic factors. This means that once cultural services deteriorate, they are unlikely to be replaced by technical or other means[6]. In this context, a recent study at the global level supplied practical proof that human reliance on CES rises in the context of a country's economic development. While the reliance on the provision of replaceable ecosystem services is decreasing. Therefore, recognizing and monitoring CES dynamics is vital for assessing the effects of ecosystem degradation on human well-being (Dickinson and Hobbs, 2017; Chen *et al.*, 2019).

CES and other services indicate what individuals gain from the natural environment and thus raise public awareness to protect the environment from degradation issues (Opdam *et al.*, 2015; Plieninger *et al.*, 2015). Furthermore, the results of the CES assessment consider as the main support for practical application and policymaking (Egoh *et al.*, 2008; Lautenbach *et al.*, 2011;

[4] (Willis, 2015; Wolff, Schulp and Verburg, 2015; Tratalos *et al.*, 2016; Ponizy, Majchrzak and Zwierzchowska, 2017; Stålhammar and Pedersen, 2017)

[5] (Bieling, 2014; Brown, Pullar and Hausner, 2016; Brown and Hausner, 2017; Dickinson and Hobbs, 2017; Dou et al., 2017, 2019)

[6] (Katz-Gerro and Orenstein, 2015; Wolff, Schulp and Verburg, 2015; Ala-Hulkko et al., 2016; Tratalos et al., 2016; Dickinson and Hobbs, 2017)

Pareta, 2013; Beeco, Hallo and Brownlee, 2014). Assessment represents the method of evaluating the value of something (Hirons, Comberti and Dunford, 2016; Cheng *et al.*, 2019). The scientific literature often used several keywords as a synonymously of assessment such as valuation, evaluation, accounting, quantifying, and mapping (Peña, Casado-Arzuaga and Onaindia, 2015; Tourkolias *et al.*, 2015; Burkhard *et al.*, 2018; Zhang, Liao and Zhai, 2018). These different keywords often indicate different theoretical concepts, and they apply different methods but share common methods for evaluating CES.

Cultural service categories have grown greatly from the original classifications: initially recognizing only leisure and culture (Forster, 1989; Kirtland *et al.*, 2004; Lee, Huang and Yeh, 2010). CES categories are spiritual and religious, recreation and ecotourism, inspirational, aesthetic, cultural heritage, sense of place, and educational (Andersson *et al.*, 2015; Tratalos *et al.*, 2016; Ament *et al.*, 2017; Ponizy, Majchrzak and Zwierzchowska, 2017). Figure 2. 1 shows the most common CES categories. And in this dissertation, I intend to focus on RES as the most common category of CES and contribute to increasing socioeconomic values by evaluating both the land where the service is located and the current and future demands of the services.

Figure 2. 1: The Common Categories of Culture Ecosystem Services (Source: WEB[1] Editing By Author)

2.2 Recreation and Ecotourism

Recreation and Ecotourism (RE) are generally seen as a set of interrelated and overlapping concepts. While there are many important concepts, definitions of RE remain contested in terms of how, where, when and why they are used (Arni and Khairil, 2013) . In this sense, RE are generally regarded as subsets of the wider concept of CES. This indicates the value of viewing RE as part of a wider concept of CES (Leung, Marion and Farrell, 2008).

Recreation can be defined as the practicing of leisure activities during one's spare time. If people participate in activity near their home or community, it is considered recreation, such as hunting, fishing, riding bikes, mountain climbing…etc. However, if these activities are further away, and people must travel some distance to participate in them, they are often described as ecotourism such as visiting historical areas to study, admire, and enjoy scenery, plants, animals, and cultural attractions (Arni and Khairil, 2013; Nahuelhual et al., 2013; Leung, Marion and Farrell, 2008)

Recreation includes activities that people practice in their leisure time, and it could be multifaceted, containing cognitive, physical, emotional, and social components[7]. Recreation include two main kind which are Outdoor Recreation Activities (ORA) and indoor recreation activities. In case of ORA, it includes various activities such as visiting areas like river sailing, social meeting, horse riding, and mountain climbing and participating in different physical exercises like fishing, trekking, camping, and hunting. etc (Figure 2. 2). However indoor recreation activities include reading, cooking and watching movies ..etc. Participating in recreational activities is essential for maintaining individuals' mental and physical health, families, and communities (Forster, 1989; Kirtland *et al.*, 2004; Jabir and S, 2014; Stålhammar and Pedersen, 2017). As indicated in various studies, engaging in recreational activities two or three times a week or for half an hour a day is beneficial for human health (Mclaughlin, 1973; Kara and Demirci, 2010; Aklıbaşında and Bulut, 2014). A positive relationship was found between human health and green areas in recent studies whose findings support the idea that parks, green spaces, and their facilities affect public health positively (Kirtland *et al.*, 2004; Beeco, Hallo and Brownlee, 2014; Schneider and Lorencová, 2015; Doğu. G and E, 2016). Recreation today means more as it becomes the platform for people to know the meaning, the history and relevance of the environments and parks to their lives (USDA, 2010). Due to this, the rise of recreation activity, is seen as a trend. Recreation activity occur in many places, such as within neighborhoods, undeveloped woodlots and streams, city parks, and county open spaces. Benefits of recreation activity include[8]:

- The vital force for physical, spiritual health, and mental
- It addresses other critical societal problems, such as education problems, substance abuse, parent-child communication, and childhood obesity.
- Affect in the travel and accommodation patterns.

[7] (Lee, Huang and Yeh, 2010; Nahuelhual et al., 2013; Dağıstanlı, Turan and Dengiz, 2018; Olaniyi, Akindele and Ogunjemite, 2018)

[8] (Kara and Demirci, 2010; Olafsson, 2012; Beeco and Brown, 2013; Jabir and S, 2014; Javed *et al.*, 2015)

Figure 2. 2: Example of Recreation and Ecotourism Activities (Source: WEB[2] Editing By Author)

Ecotourism is defined as travel to historical areas or relatively undisturbed to admire, study, enjoy the scenery, animals, plants, and cultural attractions (Chakrabarty, 2011; Olaniyi, Akindele and Ogunjemite, 2018). There is a difference between ecotourism and recreation, if the people must travel some distance to participate in activities, they are often described as ecotourism such as visiting historical areas to study, admire, and enjoy scenery, plants, animals, and cultural attractions. However, if people participate in activity near their home or community, it is considered recreation, such as hunting, fishing, riding bikes, mountain climbing…etc. Moreover, ecotourism is an industry in which lovers of nature and its surroundings can enjoy the atmosphere. It is becoming an increasingly popular form of ecotourism as visitors search for great areas and scenic spots to take an active excursion (Arni and Khairil, 2013; Nahuelhual et al., 2013; Leung, Marion and Farrell, 2008). Ecotourism is reliable travel that encourages nature conservation and preserves the well-being of local people (Bakogiannis *et al.*, 2020; Zabihi *et al.*, 2020). Ecotourism is characterized by a small development that is organized in order to: (1) attract visitors to unique and accessible natural environments; (2) using tourism to improve nature protection through education and changing perspectives at all levels; (3) supplying entrepreneurship and employment opportunities for citizens[9]. The advantages of a flourishing ecotourism plan are:

[9] (Dębski and Nasierowski, 2017; Olaniyi, Akindele and Ogunjemite, 2018; Bakogiannis et al., 2020; Zabihi et al., 2020)

- Providing local job opportunities, either directly or in the tourism sector, support sectors, and managing various resources.
- Great improvement in handicrafts, restaurants, hotels, transportation systems, and guide services.
- It stimulates the effective usage of marginal lands for agriculture, and it promotes vast areas to remain covered with natural vegetation.
- It promotes respect for the local community and delivers the opportunity for greater awareness and contact between people from various backgrounds.
- It indicates the significance of natural and cultural resources to the economic and social well-being of a community and can assist to maintain them.

The planning processes for RE are becoming larger in scope and scale. Planning now need to involve locals, government and non-government organization. Besides, the demographic changes of users and shifts in populations with many of residential are located near or close to public lands results in more landscape area being used as recreational sites. This will add strain to visitor facilities, services and natural settings whereby this must be taken into account when planning for recreation activities as a kind of recreation concept (USDA, 2010). Public acknowledgment of the role of RE in regional development and their implications for land use planning has led to a range of approaches for its spatial assessment from different disciplines[10].

2.3 Recreation and Ecotourism in The Arabic Region

The Arab countries, as defined by the United Nations World Tourism Organization (UNWTO), include the following countries: Egypt, Bahrain, Iraq, Kuwait, Jordan, Libya, Lebanon, Oman, Palestine, Saudi Arabia, Qatar, UAE, Syria, and Yemen. It is noticed that these countries have outstanding natural and cultural attractions and tourism potential. Still, this has not been exploited for political, cultural, and economic reasons. In contrast, countries have used to support their economic sectors by developing and enhancing RE because of their built attractions and infrastructure. Compared to other regions, the Arab region is an undeveloped market for RE, except pilgrimage, and economically unnecessary by Arab countries (Groizard and Santana-Gallego, 2018; Sghaier *et al.*, 2019).

There are many possibilities that make the growth of tourism in the Arab countries promising. For international tourism growth an increase is expected because of: (1) being close to the

[10] (Kienast *et al.*, 2012; Olafsson, 2012; Beeco and Brown, 2013; Liaghat *et al.*, 2013; Casado-Arzuaga *et al.*, 2014; Paracchini *et al.*, 2014; Weyland and Laterra, 2014; Ellensburg, 2015; Javed *et al.*, 2015; Schneider and Lorencová, 2015; Mahiny and Mirkarimi, 2016; Dağıstanlı, Turan and Dengiz, 2018; Nadim *et al.*, 2018; Tibesigwa *et al.*, 2018; Bakogiannis *et al.*, 2020; Kaptan Ayhan *et al.*, 2020; Zabihi *et al.*, 2020)

comprehensive excursion markets in Northwest Europe; (2) extensive tourist infrastructure like good airports and roads with international standards; (3) the large hotel development in major cities and coastal resorts; (4) the richness of cultural monuments (historical, archaeological, and religious sites) where the region was occupied by the oldest civilizations and the three major world religions (Judaism, Christianity and Islam); (5) the favorable climate for beach tourism, the increase in the number of resorts, and the opportunities to practice some winter sports in some mountain ranges (Helmy and Cooper, 2002). For intraregional tourism an increase is expected because of: (1) the similarity in traditions and customs plus the common language; (2) the ease of dealing with hotels, airports and shops due to the common language. The new tourism trends growth such as "medical tourism" among Arab countries (like Jordan, which hosts a number of visitors from the Libyan Arab Jamahiriya, Iraq, Yemen, and the Syrian Arab Republic). As well as educational tourism of Arab students which increase in the Arab universities, especially after September 11, 2001. The Arab world, for example, is identified as one of the fastest-growing global destinations; a considerable growth in terms of tourism facilities is witnessed (Groizard and Santana-Gallego, 2018; Sghaier *et al.*, 2019).

2.4 Methods Utilizing in RES Evaluation

In previous research, the authors utilized different evaluation methods of RES[11]. TEEB (2010) divided these assessment methods into preference-based and biophysical methods. Christie (2012) also classified preference-based evaluation methods into non-monetary and monetary evaluation methods (Christie *et al.*, 2012). Hirons (2016) divide all methods into non-monetary and monetary evaluation methods Table 2. 1 (Hirons, Comberti and Dunford, 2016). Various researchers have studied the non-monetary evaluation methods for assessing RES[12], and monetary methods[13].

2.4.1 Monetary Evaluation Methods

According to the literature review analysis, two evaluation methods were identified as a monetary evaluation method of a different kind of CES (Table 2. 1). For example, Sumarga (2015) evaluated RES by calculating entrance fees paid for parks and earnings (Sumarga *et al.*, 2015). Christie (2012) assesses the usefulness of ecotourism and leisure by utilizing data to estimate the costs related to travel to a destination (Christie *et al.*, 2012). Van Berkel (2014) calculated a time-cost demand curve for the sample set (Van Berkel and Verburg, 2014). The definition of the monetary

[11] (Raymond and Brown, 2007; Lindholst, Caspersen and Konijnendijk Van Den Bosch, 2015; Brown *et al.*, 2017; Cheng *et al.*, 2019)

[12] (Kara and Demirci, 2010; Brown, 2012; Szell, 2012; Ellensburg, 2015; Katz-Gerro and Orenstein, 2015; Peña, Casado-Arzuaga and Onaindia, 2015; Willemen *et al.*, 2015; Brown *et al.*, 2017; Figueroa-Alfaro and Tang, 2017; Oteros-Rozas *et al.*, 2018)

[13] (Heyes and Heyes, 1999; Schuhmann *et al.*, 2013; Khan *et al.*, 2014; Liu, 2020; Ren *et al.*, 2020)

evaluation method can be described as the following:

- **Market price:** the evaluation of economic values of CES by estimate the products cost that can be sold and bought in the market. For instance, Sumarga (2015) calculated RE based on the entrance fees paid to the parks and the revenue generated in the local ecotourism sector (Sumarga *et al.*, 2015).
- **Travel cost:** CES economic values estimation based on travel costs. By using this method, RE in ecosystems could be valued to destinations where recreational activities, such as wildlife viewing, hunting, and fishing, are available. For example, by assuming that visitors travel by car to an area, Van Berkel (2014) calculated a time cost demand curve for the sample group (34 euro cents/km rate) (Van Berkel and Verburg, 2014).

Table 2. 1: CES Evaluation Method Classification (Source: Author)

Method classification	Evaluation method	Literature example
Monetary method	Market Price	Sagoff, 2008; Pirard, 2012; Sumarga et al., 2015; Czembrowski and Kronenberg, 2016
	Travel Cost	Iamtrakul, Teknomo and Hokao, 2005; Tourkolias et al., 2015; Torres-Ortega et al., 2018;
Non-monetary method	Observation	Cheng et al., 2019;
	Social media-based	Willemen et al., 2015; Figueroa-Alfaro and Tang, 2017; Oteros-Rozas et al., 2018; Richards, Tunçer and Tunçer, 2018;
	Interview	Ellensburg, 2015;
	Questionnaire	Bateman et al., 1996;
	Participatory mapping method	Dramstad et al., 2006; Raymond and Brown, 2007;
	Participatory GIS (PGIS) method	Brown and Hausner, 2017;
	Public participation GIS (PPGIS) method	Brown, 2012; Brown et al., 2017
	Scenario simulation method	Zhang, Liao and Zhai, 2018; X. Sun et al., 2019;

2.4.2 Non-Monetary Methods

Monetary methods can be difficult, particularly when the problem is complicated and not all CES can be represented in monetary, however, non-monetary valuation methods attracted more attention and interest over the past few years (Christie *et al.*, 2012). The non-monetary evaluation methods used to map CES categories received the most attention in my dissertation's analyzed studies. Based on that, eight non-monetary mapping methods have been identified, of which the first three mapping methods utilized revealed preference methods for measuring and quantifying

CES categories. These methods namely, document, observation, social media-based, and the rest used stated preference methods; interview, participatory mapping, questionnaire, public participation GIS (PPGIS), participatory GIS (PGIS), and scenario simulation (Table 2. 1). The definition of the non-monetary evaluation method can be described as the following:

- **Observation**: It looks directly at human behavior and action to indicate the social value of culture services. For example, Cheng (2019) monitored individuals engaging in a precise activity like fishing (Cheng *et al.*, 2019).
- **Social media-based**: The CES evaluation concentrate on social media data from various sources. Willemen (2015), for instance, evaluate RES based on the wildlife photos number posted on a photo websit (Willemen *et al.*, 2015).
- **Interview**: gain a deeper understanding of why and how individuals value CES by using face-to-face interaction. Individuals can express their thoughts and feelings freely to better understand the services like inspiration or sense of place. Ellensburg (2015), for instance, utilized face-to-face interviews to ask people to evaluate eight parks' benefits, which contained sense of place, recreation, and inspiration (Ellensburg, 2015).
- **Questionnaire**: It contains questions for collectting data about CES from users. For instance, Batman (1996) developed questionnaire by involving 1,220 residents to demonstrate the advantages of CES that contribute in human well-being (Bateman *et al.*, 1996).
- **Participatory mapping**: It integrate between modern assessment tools and participatory evaluation methods. For instance, Brown and Hausner (2017) prepare questions to ask participants about where they have visited CES using a questionnaire based map (Brown and Hausner, 2017).
- **Participatory GIS (PGIS)**: It integrates between the geographic information system (GIS) and participatory evaluation methods (Brown and Hausner, 2017).
- **Public participation GIS (PPGIS)**: It is based on the collection of data about CES by involving local communities in the evaluation process. For instance, Brown (2012) determined the distribution and characters of culture services in a coastal region by using various social and physical environments utilizing PPGIS (Brown, 2012).

2.5 Sustainable Planning of Recreation and Ecotourism.

The concept of sustainability expresses the idea that people must live within the capacity of their environment to support them and this becomes important especially in RES industry since the viability of the industry is dependent upon the maintenance of the environment qualities. Contemporary emergence of the concept of "sustainability" can be traced to the 1987 report of the World Commission on Environment and Development, which advanced the principle that

managing the environment for the benefits of the present generation should not preclude the ability of future generations to attain needed environmentally related benefits (Senes and Toccolini, 1998). Since then, many efforts have been undertaken to define sustainability in a more operational way and to apply it in a number of fields of study and practice such as in our case study.

High density of population living and working on land which itself becoming inadequate with declining and degrading environment will require soothing and relieving through high quality recreation experiences (Fung and Wong, 2007). However, high recreational use can have significant effect on the land. It can lead towards ecological and social degradations in some areas, especially where there is a limited suitable natural landscape close to urban or densely populated areas (Manning *et al.*, 2011). Many researches carried out on recreation management have concluded that the application of carrying capacity, a careful visitor management and continuous improvements to the site are necessary to ensure sustainability of the environment. In order to sustain the benefits of recreation for present and future generations, it is crucial that the recreation program must address and work toward a sustainable balance among environmental, urban, and economic conditions. Sustainability is disrupted by arising conflicts among users of the recreation site. Aspects, such as social conflicts between users who have to share the same infrastructures and conflicts over development and management of the resource contributes towards rising anxiety among stakeholders. Apart from that, there is a rising concern for increased public participation and collaboration in the recreation areas planning (McCool, 1994; Nahuelhual *et al.*, 2013).

The traditional planning models often used a more centralized approach to planning, resulting in unsustainable distribution of different kinds of recreation activities. Sustainable land use planning requires an in-depth analysis of the existing resources localization, features, sensitivity to development and an understanding of development characteristics resource needs (Senes and Toccolini, 1998). It is therefore essential to improve the quality of recreation activities management by adopting effective strategies and tools such as using MCE in the evaluation process before starting the planning for new recreation activities sites. Continuous monitoring of recreation activities conditions is key for sustaining the quality of a site environment, especially in high-density urban areas. One option is to select and apply suitable criteria to evaluate the suitability conditions of the potential recreation activities. As a result, a knowledge gap exists, and research is needed to develop additional management tools such as the companion between the demand and suitability evaluation of the recreation activities in the selected study area (Fung and Wong, 2007; Chan, Si and Marafa, 2018; Arni and Khairil, 2013).

To achieve the sustainable planning for recreation activities, a proposed activity must be developed where the necessary natural resources exist (landscape scenery) and only when the environment is

capable of absorbing the impact of the development (carrying capacity) (Leung, Marion and Farrell, 2008; McCool, 1994).Research has helped identify criteria for evaluation of recreation for many diverse recreational sites and related areas. Criteria help define and measure the sustainability of recreation activities by offering empirical expressions of management objectives.

The management objectives of sustainable recreation activities planning are therefore multidimensional and range from institutional aspects and resource provisions to the social equity of user experience and satisfaction. It is thus important to understand users' perception of recreation activities management and to increase their involvement (Dramstad *et al.*, 2006; Katz-Gerro and Orenstein, 2015; Cheng *et al.*, 2019). Whereas adding large public recreation activities into compact urban areas is difficult, an equally important way to cope with recreation activities usage is to strengthen management and enhance the sustainability of existing recreation activities. Sustainable recreation possesses the following characteristics:

- Conscientious, low-impact visitor behavior
- Connecting people with their natural and cultural heritage
- Sensitivity towards, and appreciation of, local cultures and biodiversity
- Sustainable benefits to local communities
- Local participation in decision-making
- Balancing societal, economic and environmental needs

2.6 Evaluation Approaches of Recreation and Ecotourism Services

There are two main types of evaluation approaches for the evaluation of RES to achieve the sustainable planning. The first evaluation type is known as Land Evaluation (LE) which utilizes the spatial criteria in the evaluation process, and the second type called Demand Evaluation (DE) which considers the users' opinions and demands in the evaluation process (Dramstad *et al.*, 2006; Katz-Gerro and Orenstein, 2015; Cheng *et al.*, 2019).

2.6.1 Land Evaluation

The evaluation of land predicts the potential use of land-based on its attributes. Determination of land use has always been part of the development of human society (Bunruamkaew and Murayama, 2011; Ahmed, Mahmoud and Aly, 2016; Kaptan Ayhan *et al.*, 2020). In the more crowded world of the present, the development of services is frequently carried by the process of land use planning by the land evaluation (Dağıstanlı, Turan and Dengiz, 2018; Olaniyi, Akindele and Ogunjemite, 2018; Kaptan Ayhan et al., 2020). The sustainable planning process usually takes place in all parts of the world, including developed and developing countries (Bunruamkaew and Murayama, 2011). This planning must be based on understanding the natural environment and the

kinds of land use envisaged (Zarkesh, Almasi and Taghizadeh, 2011; Colantoni *et al.*, 2016). There are various examples of damage to natural resources and unsuccessful land use through failure to take account of the connection between land and the uses to which it is put[14]. Land assessment functions to bring about such knowledge and help planners compare the most promising kinds of land use (Pareta, 2013; Mahiny and Mirkarimi, 2016; Olaniyi, Akindele and Ogunjemite, 2018).

Land evaluation is concerned with assessing land performance when used for specified purposes (Zarkesh, Almasi and Taghizadeh, 2011). It involves the execution and interpretation of primary surveys of soils, vegetation, climate, and other aspects of land evaluation regarding the necessities of alternative structures of land use. Rapidly growing cities and fast changes in lifestyles also change land uses and selection criteria for land use (Lawal *et al.*, 2011; Pareta, 2013; Dębski and Nasierowski, 2017). RES as land use result from rapid growth and change. Living in crowded and noisy cities, more and more people need to rest play sports in recreational areas in their spare time. Land evaluation of these areas has many aspects: sociological, ecological, economic, transportation, and so on (Caglayan *et al.*, 2020; Kaptan Ayhan *et al.*, 2020; Karim *et al.*, 2020). These aspects must be considered to provide sustainability planning (Olaniyi, Akindele and Ogunjemite, 2018; Kaptan Ayhan *et al.*, 2020).

2.6.1.1 The Land Evaluation Criteria Characteristics

Several criteria needed to be selected to analyze the suitability of individual portions of the area for recreational usage. Several studies were reviewed to determine appropriate criteria for RES evaluation[15]. See Appendix 1 for more details about the evaluation criteria.

To be a criterion, a parameter must be stated in a specific enough manner to be monitored unambiguously. Mclaughlin (1973), Kliskey (2000) and Gül (2006) describe characteristics of criteria (Mclaughlin, 1973; Kliskey, 2000; Gül, Örücü and Karaca, 2006). Five desirable characteristics, including the requirement of specificity, are as follows:

- **Measurable**: Criterion must be quantitative--subject to measure.
- **Reliable**: criterion must be qualified of being estimated accurately.

[14] (April, 2010; Lawal *et al.*, 2011; Beeco, Hallo and Brownlee, 2014; Dębski and Nasierowski, 2017; Kaptan Ayhan *et al.*, 2020; Karim *et al.*, 2020)

[15] (Mclaughlin, 1973; Kliskey, 2000; Bunruamkaew and Murayama, 2011; Chakrabarty, 2011; Chandio *et al.*, 2011; Zarkesh, Almasi and Taghizadeh, 2011; Hernández-Morcillo, Plieninger and Bieling, 2013; Nahuelhual *et al.*, 2013; Pareta, 2013; Jabir and S, 2014; Villamagna, Mogollón and Angermeier, 2014; Richards and Friess, 2015; Bryce *et al.*, 2016; Doğu. G and E, 2016; La Rosa, Spyra and Inostroza, 2016; Mahiny and Mirkarimi, 2016; Dębski and Nasierowski, 2017; Dağıstanlı, Turan and Dengiz, 2018; Nadim *et al.*, 2018; Ruskule, Klepers and Veidemane, 2018; Kaptan Ayhan *et al.*, 2020)

- **Significant**: Criterion should associate with essential features or requirements of nature. A good criterion must be qualified for noticing changes that, if they happened, would be caused severe problems, such as containing changes that continue for a long time.
- **Efficient**: Criterion is most efficient if it reflects the state of itself as this decreases the number of elements that should be monitored.

2.6.1.2 The Survey of Land Evaluation Criteria in The Previous Studies

There are different kinds of spatial and non-spatial criteria utilized in the sustainable evaluation process of Culture Ecosystem Services (CES), especially RES (Appendix 1). For example, Dağıstanlı (2018) addressed criteria, namely land-use type, distance from water surface, natural and cultural areas, distance from residential areas, distance from transportation or roads, flora cover density, erosion, slope, and their sub-criteria and weightings, which are typically employed in the evaluation of land for recreational suitability, in the compilation of information on the study area (Dağıstanlı et al., 2018). Nahuelhual (2013) utilized all of the singular natural resources, scenic beauty, accessibility, tourism attraction capacity, and tourism use aptitude, as land evaluation criteria for RE (Nahuelhual *et al.*, 2013). Bunruamkaew (2011) determined criteria for selecting a region as a tourism area (Bunruamkaew and Murayama, 2011).

These criteria at the macro-level include two main categories, environmental and socioeconomic features (Mahiny and Mirkarimi, 2016). Each of the mentioned categories consists of many sub-criteria that enjoyed significant importance in tourism land capability evaluation of the land (Bunruamkaew and Murayama, 2011; Dağıstanlı, Turan and Dengiz, 2018; Ruskule, Klepers and Veidemane, 2018). Environmental features include physical and biological criteria. Physical criteria, including climate, topography, geology, and pedology, are placed at the fourth level (Mclaughlin, 1973; Zarkesh, Almasi and Taghizadeh, 2011; Nadim *et al.*, 2018). Biological criteria in the fourth level contain fauna and flora, and two sub-criteria land cover density and animal distribution. There are several factors in the economic and social characteristics including land uses buffers and distances (Hernández-Morcillo, Plieninger and Bieling, 2013; Mahiny and Mirkarimi, 2016; Ruskule, Klepers and Veidemane, 2018). Carrying capacity of the landscape also include as a social-economic criterion in the proposed evaluation criteria of recreation activities: how much use can be accommodated in the recreational site before the quality of the visitor experience is degraded to an unacceptable degree? So, the carrying capacity is an indicator/criterion which evaluate the quality or the efficiency of the recreation services. For example, Cupul Magana & Rodriguez-Troncoso (2017) argue that using the carrying capacity concept in a recreation area may generate a satisfactory experience for the recreation with an acceptable or minimum impact on the resource of the natural and cultural area (Cupul-Magaña and

Rodríguez-Troncoso, 2017). Rodríguez-Troncoso (2017), Atanga (2019) and Aliyeva (2020) proposed a method to calculate the recreational carrying capacity by calculating the number of visitors per day in a recreational area or recreational facility for a certain period of time (Cupul-Magaña and Rodríguez-Troncoso, 2017; Atanga, 2019; Aliyeva, Farabi and Saidullayev, 2020).

Some of mentioned criteria defined in the articles are considered for my study. In the light of these studies, necessary criteria for the study are determined in Appendix 1. More explanation about the determination of the utilized criteria for land evaluation of RES found in Chapter 3 and Chapter 4. Additionally, the articles helped determine the methodology that could be utilized for land evaluation of RES.

2.6.1.3 Use of Geographic Information Systems and Multi-Criteria Evaluation Analysis

Geographic Information Systems (GIS) techniques and procedures are essential in analyzing spatial decision problems (Lee, Huang and Yeh, 2010). Undoubtedly, GIS is frequently identified as a Multi-Criteria Evaluation (MCE). Furthermore, MCE supplies a group of methods and strategies for managing decision designing and problems, evaluating, and prioritizing alternative decisions (Bunruamkaew and Murayama, 2011; Chandio *et al.*, 2011, 2013; Butt *et al.*, 2019). GIS-MCE can be thought of as a procedure that transforms and combines value judgments and geographical data to get information for decision-making (Şener *et al.*, 2010; Nahuelhual *et al.*, 2013; Pareta, 2013; Jabir and S, 2014). Spatial decision problems commonly contain a combination of decision alternatives, conflicting, and asymmetric assessment factors (Kienast *et al.*, 2012; Wabineno and Omondi, 2018; Butt *et al.*, 2019). Several individuals often evaluate the alternatives (managers, decision-makers, interest groups, stakeholders). People usually have unique preferences concerning the relative importance of criteria based on which the alternatives are evaluated (Dağıstanlı, Turan and Dengiz, 2018; Butt *et al.*, 2019; Mahmoody Vanolya, Jelokhani-Niaraki and Toomanian, 2019). The critical aspect of spatial decision analysis is that it involves the evaluation of the spatially defined decision alternative and the decision maker's preferences (Chakrabarty, 2011; Zulian, Polce and Maes, 2014). This means that the results of the analysis are based not only on the geographic pattern of the decision alternatives but on the value, judgments involved in the decision-making process as well (McClellan and Medrich, 1969; Liaghat *et al.*, 2013; Zabihi *et al.*, 2020). At the most basic level, GIS-MCE considers as a process that integrates geographic data and decision-maker preferences into a resultant decision. The procedures of GIS-MCE include the use of geographical data, the preferences of the decision-maker, the processing of data, and priorities in accordance with the applicable decision rules (Şener et al., 2010; Chandio et al., 2013; Russo and Camanho, 2015; Nilsson, Nordström and Öhman, 2016).

A GIS supplies procedures and methods utilized for transformation collected geographical data into obtaining decision-making information. Nevertheless, GIS has minimal abilities for analyzing and storing data on the preferences of decision makers. CES abilities could be improved by combining GIS with MCE. The MCE provides a procedure to guide the decision-maker(s) through the essential method of describing assessment criteria and determining importance appropriate to the decision situation (Chandio et al., 2011; Olafsson, 2012; Beeco, Hallo and Brownlee, 2014; Olaniyi, Akindele and Ogunjemite, 2018). The important benefit of integrating MCE and GIS is that the decision-maker can make value judgments (i.e. preferences regarding decision criteria and alternatives) in the GIS-based decision-making process. The combining between MCE and GIS can also improve the confidence of decision maker's in the potential results of assuming a clear procedure related to their values (Bunruamkaew and Murayama, 2011; Nahuelhual *et al.*, 2013; Mahiny and Mirkarimi, 2016). The MCE can aid the decision makers to understand the outcomes of GIS-based decision-making techniques, including trade-offs between policy goals, and then utilize the findings in a systematic and defensible manner to develop policy recommendations (McClellan and Medrich, 1969; Turskis, Lazauskas and Zavadskas, 2012; Liaghat et al., 2013; Nilsson, Nordström and Öhman, 2016).

Many studies in the literature integrate the GIS applications and MCE models. A notable feature of the GIS-MCE strategies is the wide range of management and decision situations that have been applied. The main application areas contain: (1) Environmental management and planning[16], (2) Recreational and ecotourism planning and management[17], (3) Urban and regional planning[18], (4) Waste management[19], (5) Outdoor recreation planning[20], (6) Agriculture and forestry[21].

2.6.1.4 Analytical Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is considered an efficacious tool for dealing with complex decision-making and may assist the decision-maker in selecting preferences and constructing the best decision (Chandio *et al.*, 2013; Tonny and Wulan, 2020). By facilitating complex decisions

[16] (Tiwari, Loof and Paudyal, 1999; Ferrarini, Bodini and Becchi, 2001; Pohekar and Ramachandran, 2004; Sheppard and Meitner, 2005; Ananda and Herath, 2009; Tsoutsos *et al.*, 2009; Oikonomou, Dimitrakopoulos and Troumbis, 2011; Mosadeghi *et al.*, 2013; Mustajoki and Marttunen, 2017)

[17] (McClellan and Medrich, 1969; Bunruamkaew and Murayama, 2011; Chakrabarty, 2011; Zarkesh, Almasi and Taghizadeh, 2011; Liaghat *et al.*, 2013; Nahuelhual *et al.*, 2013; Beeco, Hallo and Brownlee, 2014; Chow *et al.*, 2014; Mahiny and Mirkarimi, 2016; Dağıstanlı, Turan and Dengiz, 2018; Nadim *et al.*, 2018; Olaniyi, Akindele and Ogunjemite, 2018; Zabihi *et al.*, 2020)

[18] (Sheppard and Meitner, 2005; Yang *et al.*, 2008; Iojă *et al.*, 2014; Jain *et al.*, 2014; Mosadeghi *et al.*, 2015; Pili *et al.*, 2017; Rezaeisabzevar, Bazargan and Zohourian, 2020; Simwanda, Murayama and Ranagalage, 2020)

[19] (Generowicz *et al.*, 2011; Achillas *et al.*, 2013; Özkan, 2013; Milutinović *et al.*, 2014; Soltani *et al.*, 2015; Jovanovic *et al.*, 2016; Goulart Coelho, Lange and Coelho, 2017; Coban, Ertis and Cavdaroglu, 2018)

[20] (Lawal, Matori and Balogun, 2011; Moshref Javadi, Ghandehari and Hamidi Pouyandeh, 2013; Chow *et al.*, 2014; Dağıstanlı, Turan and Dengiz, 2018)

[21] (Mendoza and Prabhu, 2003; Jeffreys, 2004; Wolfslehner, Vacik and Lexer, 2005; Gül, Gezer and Kane, 2006; Ananda and Herath, 2009; Colantoni *et al.*, 2016; Kaim, Cord and Volk, 2018)

to a string of pairwise comparisons and then synthesizing the results, the AHP aids in catching both subjective and objective elements of a decision. Additionally, the AHP includes a helpful method for checking the consistency of the decision maker's evaluations, therefore decreasing the bias in the decision-making process (Liaghat *et al.*, 2013; Ahmed, Mahmoud and Aly, 2016).

The AHP process is performed in three main steps (Figure 2. 3). The first step is an even comparison between each of the two criteria, and the results are put into a comparison matrix. The comparison matrix is occupied with specific values which indicate the order and importance of the criteria across other criteria. These values range from 1 to 9 and the fractions range from 1/9 to ½ (Table 2.2) (Chandio *et al.*, 2013). The next step is to calculate criterion weights. Finally, the items from each row of the modular array are averaged. The consistency ratio is estimated to ensure that the comparison of criteria made by the decision-makers is consistent. The weights received in this way are interpreted as the average of all possible weights. Furthermore, the benefit of this technique is that only two factors have to be compared at the same time (Şener *et al.*, 2010).

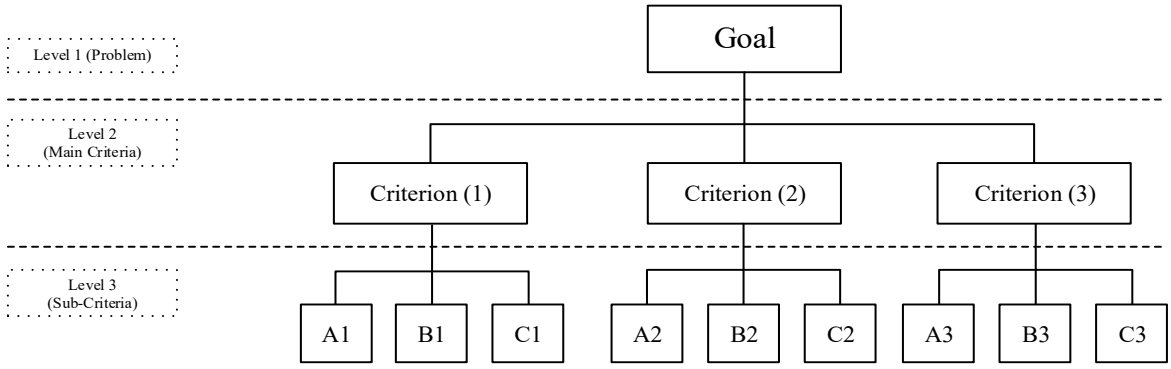


Figure 2. 3: Analytic Hierarchy Process model (Wabineno and Omondi, 2018)

Table 2. 2: The Comparison Scale in The AHP Method (Saaty1980)

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Weak importance of one over another	Experience and judgment slightly favor one activity over another
5	Essential or strong importance	Experience and judgment strongly favor one activity over another
7	Demonstrated importance	An activity is strongly favored and its dominance is demonstrated in practice
9	Absolute importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between the two adjacent judgments	When compromise is needed

2.6.2 Demand Evaluation

The demand evaluation focuses on measuring recreation demand for resource policy, planning, and management at multiple scales. Several ways have been used to evaluate the future demands of RES. Assessing the quality of facilities and the outcomes for those who participate is necessary for the attainment of organizational goals and objectives, ascertaining the benefits of recreation facilities and programs, and for evaluation purposes relative to accountability[22].

2.6.2.1 Attitudes and perceptions of local communities

The studies of local perception in RE areas are valuable because of their capability to reveal awareness about conservation and current attitudes toward maintenance efforts (Kara and Demirci, 2010; Szell, 2012). Gaining a better understanding of the human behaviors that appear in the recreation area integrating them into future development can improve the effectiveness of maintenance and sustainable use (Dramstad *et al.*, 2006; Raymond and Brown, 2007; Katz-Gerro and Orenstein, 2015).

The perception studies importance in developing more successful maintenance management programs is emphasized in the scientific literature[23]. For example. Katz-Gero (2015) outlined the main reasons by which the social component influences the development and preservation of recreational areas, and the importance of developing participatory management by integrating the local population, so the attitudes and perceptions of the local population should be investigated (Katz-Gerro and Orenstein, 2015). Although little attention has been focused on local perceptions of recreational areas, knowledge in this area is still limited. Thus, investigating the perceptions of locals and identifying criteria that influence views toward recreational use will provide a starting point for understanding the fundamentals of successful conservation management (Kara and Demirci, 2010; Szell, 2012).

2.6.2.2 Willingness To Pay

Because of the fact that both the general public's awareness and the environmental protection programs are the most familiar problems that policymakers face in the urban planning process. Furthermore, the understanding of public attitudes and perceptions and investigating individuals' willingness to provide financial support for the RES areas are addressed (Nicosia *et al.*, 2014). Although many natural resources are valued in the previous research, the natural goods resources (such as RES) usually have no real economic value due to the problem of their valuation. While

[22] (Raymond and Brown, 2007; Kara and Demirci, 2010; Christie *et al.*, 2012; Szell, 2012; Katz-Gerro and Orenstein, 2015; Peña, Casado-Arzuaga and Onaindia, 2015; Willemen *et al.*, 2015)

[23] (Dramstad *et al.*, 2006; Raymond and Brown, 2007; Kara and Demirci, 2010; Szell, 2012; Katz-Gerro and Orenstein, 2015)

since it provides a unique benefit to users, the economic value should be attributed to them[24]. The previous research provides many non-market valuation methods, and the metrics most commonly utilized in the evaluating of natural areas are measures of well-being, like measuring the willingness to pay (WTP) of users (Liu, 2020; Ren *et al.*, 2020). Even though there are many other evaluation procedures, the individuals preferred the willingness to pay using the contingent evaluation method of non-market environmental goods over other evaluation techniques (Dhakal *et al.*, 2012; Khan *et al.*, 2014; Verlicchi, Al Aukidy and Zanni, 2018; Ren *et al.*, 2020).

The contingent assessment process utilizes a semi-structured questionnaire to make a virtual market. Individuals can represent their own WTP to support the environmental good maintenance such as RES (Nicosia *et al.*, 2014; Verlicchi, Al Aukidy and Zanni, 2018). Even though this method is not without debate, it is still used in numerous studies related to the demand for the non-market of environmental goods. A previous study analyzed by Dhakal (2012) concluded that most WTP estimations passed the validity test. This test includes comparing the willingness to pay (WTP) values with values derived from methods of real behavior, like the cost of travel and leisure demands (Dhakal *et al.*, 2012). There are many studies that investigate the WTP for evaluating the future demand of RES[25].

2.7 Literature Review Summary

Evaluation approaches techniques, assessment methods, evaluation criteria, indicators of the evaluation of RES were explained and demonstrated in this Chapter. Previous research focused on one evaluation aspects of CES. Moreover, the integration between demand and suitability evaluation does not exist. The relationship between the visitor demand evaluation and land suitability evaluation as a key for the sustainability planning concept did not compare in the previous research. Besides, the sustainable evaluation strategies which integrate between demand and land suitability evaluation, should put into practice in various scales such as urban scale, local scale, and peri urban.

The research on the sustainable evaluation of different kind of CES is still not sufficient detailed from the landscape architect point of view, especially in developing countries. Recreation as an activity which involves three major elements: service seekers (users), service providers, and a place. Service seekers are the main players in the recreation system and their needs and desires must be taken into account to achieve a sustainable evaluation of recreation services. The service

[24] (Heyes and Heyes, 1999; Bernath and Roschewitz, 2008; Dhakal *et al.*, 2012; Schuhmann *et al.*, 2013; Khan *et al.*, 2014; Verlicchi, Al Aukidy and Zanni, 2018)

[25] (Heyes and Heyes, 1999; Bernath and Roschewitz, 2008; Baranzini, Faust and Huberman, 2010; Dhakal *et al.*, 2012; Schuhmann *et al.*, 2013; Khan *et al.*, 2014; Nicosia *et al.*, 2014; Verlicchi, Al Aukidy and Zanni, 2018; Liu, 2020; Ren *et al.*, 2020)

preferences, which would be interested in consuming the specific recreation services under offer, must be identified. Service providers seek to meet the needs of the visitors. Place is a very important element for determining the scope of recreation services in any region by checking the potential carrying capacity of the natural areas and the sensitivity of the place. Recreation does not occur randomly, and success varies from one region to another, depending on recreation potential site selection to attract visitors. Thus, any recreation activity in a region cannot begin unless its potential is evaluated, identified, categorized, and realized. It must be understood that basic recreational resources, which are required for a specific recreation sites attraction, differ substantially from one area to another based on various kind of recreation site selection criteria. Furthermore, recreation evaluation studies vary as to how they classify recreation resources and recreation attractions.

A variety of different models for evaluation CES have been proposed. Three main criteria aspects in the evaluation model have to be considered in the sustainability evaluation of recreation services in general, which are environmental, social, and economic criteria, and these three aspects and related sub-criteria are identified based on literature review analysis in Chapter 3. The collected criteria and sub-criteria from the literature review classified to spatial and non-spatial criteria. The evaluation technique of recreational services does not only include spatial criteria, it also encompasses criteria and facilities which evaluate the demand of visitors. In general, recreation development and evaluation require a variety of information about potential recreation sites which will assist developers and decision-makers and information about visitors demands and future needs. Once a place/area of recreation site interest has been identified, it is essential to inventory and classify existing and potential recreation sites based on the carrying capacity of the landscape and nature areas. Inventorying recreation resources such as landscape senary is the first step which should be taken when evaluating recreation potential. It includes information about natural and cultural resources, together with recreation services and facilities. Based on previous research, two approaches could be utilized for evaluating potentials: 1) study the potential sites for recreation activities; and 2) explore visitors' preferences and perceptions of a destination's attractiveness. Determining site potentials can be accomplished by inventorying and summarizing different evaluation criteria which represent recreation resources and infrastructures.

The utilization of mixed research methods (e.g., questionnaires, PPGIS, interviews, and field observation) together with a descriptive research design to conceptualize, evaluate, and inventory existing and potential recreation resources is essential step in the sustainable evaluation process. Priority should be given to identifying existing and potential recreation sites in the study area and its surrounding areas. Varying techniques are applied as strategic tools to support the decision-

making process of site selection of recreation services, such as GIS, multi-criteria decision analysis, and multicriteria decision methods. Alternative evaluation methods are based on fieldwork, for example interviews, questionnaire, and group discussions.

However, the evaluation of RES has many benefits, such as; 1) learned about the environment and resource management to make accurate decisions; 2) identify the covered and uncovered areas with the RES; 3) indicate the suitability areas for different kind of RES and many other benefits, It still has some challenges and the most common challenge is the unsustainable planning for RES. So, the research in the field of sustainable planning of RES trends towards facing this challenge and solving the evaluation problem of the RES by integrating between suitability evaluation and visitors demand evaluation. There are many categories of RES, and in this research, I focus on sustainable evaluation planning of recreation activities. The results of this dissertation seek to assist fill in current research gaps in the current literature by analyzing and comparing people's perceptions of current and future demands and land evaluation of RES. This study, is one of the few studies that examine the users' perceptions and preferences toward the development of future RES demands in the Arab world and the integration between the demand evaluation of RE and Land Evaluation (LE) of RES.

3. MATERIAL AND METHODS

3.1 Methodology Overview

The methodology Chapter consists of a description of the data and methodology for the results. In the first part, the description of the study area is addressed; in the second part, the land evaluation process and related data collection and steps are described, and the data used for the demand evaluation is presented in the third part. Figure 3. 1 illustrates a methodology flowchart of the study. From left to right is the land evaluation part using the MCE process. From right to left is demand evaluation which consists of the data regarding public meetings, PPGIS data, hotspot-analysis, response rate analysis, and the local's perceptions and preferences using a standard questionnaire.

3.2 Study Area

Aswan is the most popular tourist city in the southern part of Egypt, situated along the Nile River banks. Aswan is an ancient city. There are various kinds of archeology and history in Aswan, and visitors can visit some of the best-preserved temples and burial sites in Egypt in this wonderful city. By visiting Aswan the visitors can explore Islamic mosques, visit Christian monasteries, and see the bustling souks and markets in the old City. There are different kinds of Recreation and Ecotourism Services (RES) (Figure 3. 2) (Andersen, 2011; José Luis *et al.*, 2019; Gaber *et al.*, 2020; Mohamed and Abdelhady, 2021).

3.2.1 Location

Aswan is located at the southern tip of Egypt and is the state capital of the Aswan governorate (Figure 3. 3). Aswan city is considered the south gate to Africa. The town of Aswan's population is almost about 900,000, and its area is approximately 35,7 km2. Aswan considers one of the best tourist destinations worldwide because of its distinctive tourist features, especially in Winter. In addition, its moderate and dry climate is the essential feature of Aswan city because of its location on the Nile east bank. During the Summer, average high temperatures remain above 23 °C (73.4 °F), while in the Winter, the average low temperatures remain above 8 °C (46.4 °F). So, Aswan city considers an international winter resort. Moreover, it has many different archaeological and historical attractive sites, so it is known as one of the best open museums that date back to various ages and spread all over the city (Andersen, 2011; Ayoub and Elseragy, 2018; José Luis et al., 2019; Gaber et al., 2020).

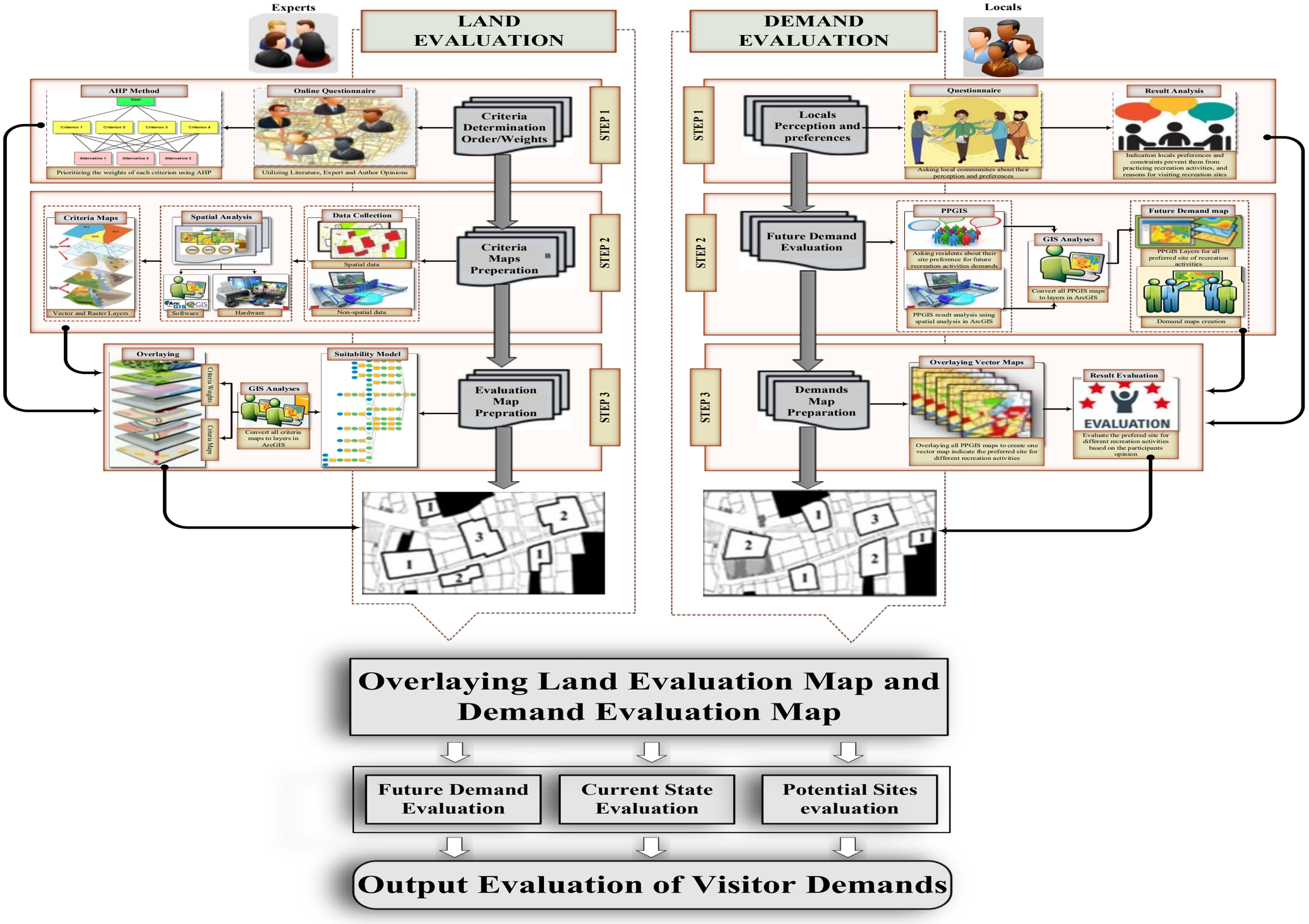


Figure 3. 1: Study Framework (Source Author)

Figure 3. 2: The Common Recreation and Ecotourism Activities in The Study Area (Source: WEB[3] Editing By Author)

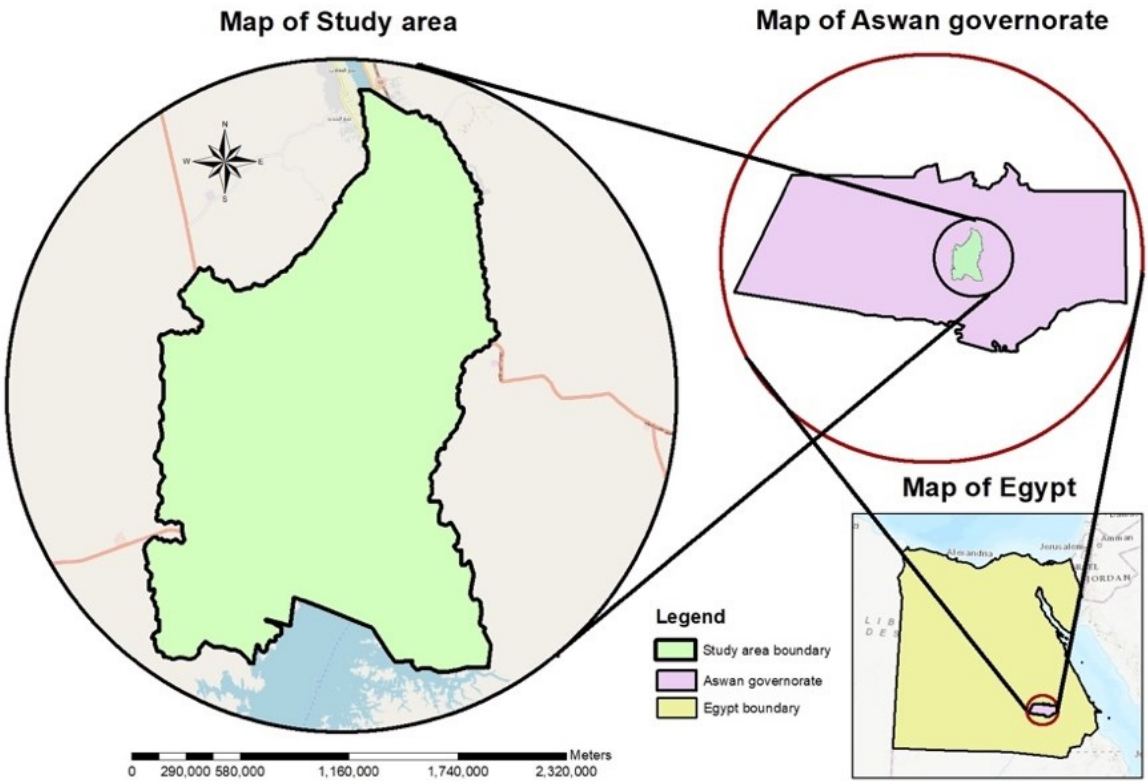


Figure 3. 3: Study Area Location and Boundary (Source: Author)

3.2.2 Climate in Aswan City

The climate in Aswan is called a desert climate. There is virtually no rainfall during the year. This climate is considered to be BWh according to the Köppen-Geiger climate classification (Galal, Mahmoud and Sailor, 2020). The average annual temperature is 26.6 °C | 79.8 °F in Aswan. About 0 mm | 0.0 inch of precipitation falls annually. With an average of 34.3 °C | 93.8 °F, August is the warmest month. At 15.9 °C | 60.7 °F on average, January is the coldest month of the year (Figure 3. 4) (Gaber *et al.*, 2020).

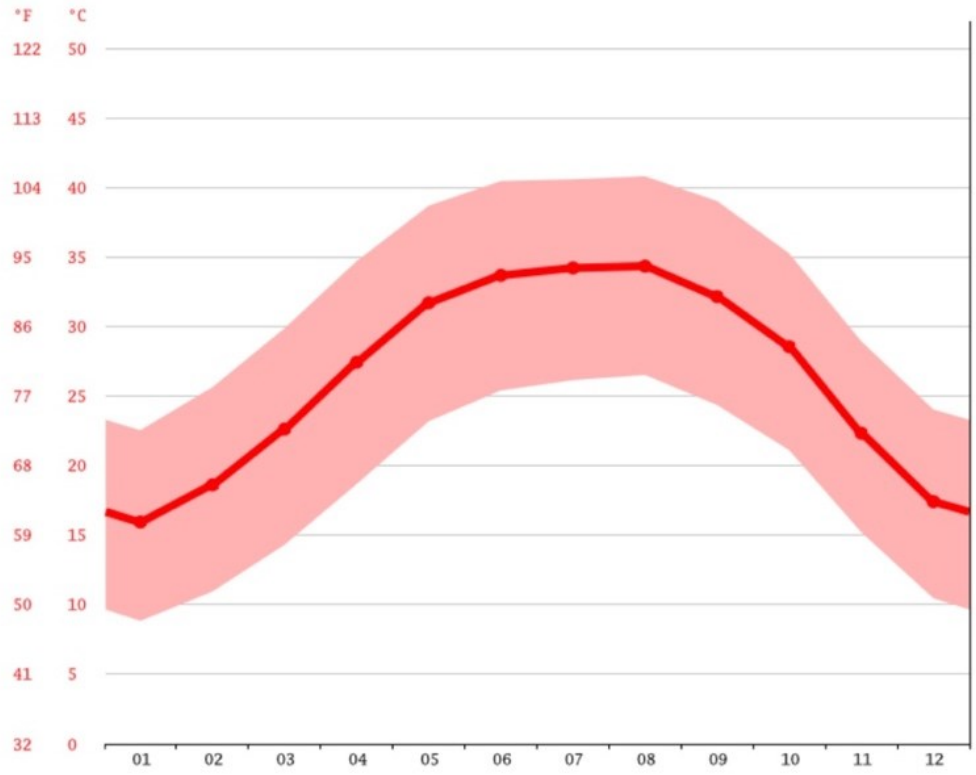


Figure 3. 4: Average Temperature Aswan (Source: WEB[4])

In Aswan, the month with the most daily hours of sunshine in June, with an average of 12.11 hours of sunlight. In total, there are 375.35 hours of daylight throughout June. The month with the fewest daily hours of sunshine in Aswan is January, with an average of 9.89 hours of sun a day. In total, there are 296.65 hours of daylight in January. Around 3988.08 hours of sunshine are counted in Aswan throughout the year (Figure 3. 5). There are 131.07 hours of sunlight per month (Mohamed and Abdelhady, 2021) .

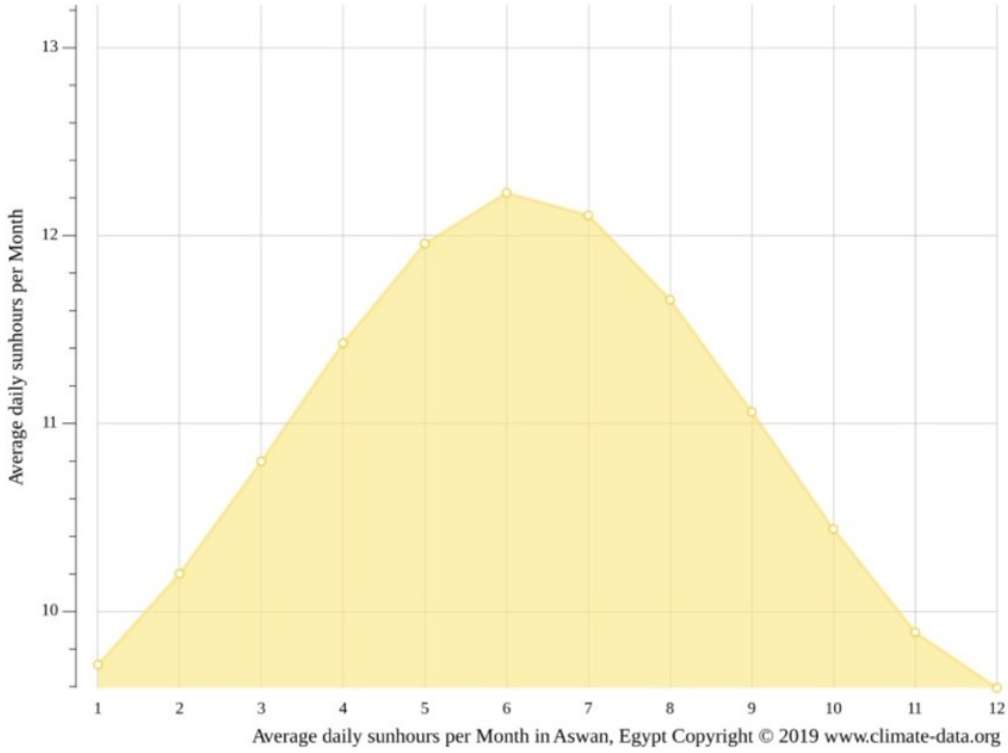


Figure 3. 5: Hours of Sunshine In Aswan (Source: WEB[5])

3.2.3 Nature and Culture Attraction Sites

A. Historical Sites (WEB[6])

Kalabsha Temple contained a wide range of religions and empires example that founded through Aswan, Egypt. This majestic temple was the biggest of its time and was constructed by the Roman Emperor Augustus as a dedication to the Nubian deities. Like numerous other historical sites in Aswan, this temple was also transferred to its present location to prevent it from flooding (Figure 3.6 A).

The Aswan Museum was established on Elephantine Island which considers one of the central districts in the city. There is a large collection of artifacts concentrating on the general Nubian culture in antiquity (Figure 3.6 B).

The Temple of Philae (Temple of Isis) is found on a remote island in the south part of Aswan, Egypt. Philae Temple container the diversity of ingenuity and beliefs not only the ancient Egyptians but modern cultures as well (Figure 3.6 C).

Abu Simbel Temples built as royal tombs, the Great Temple of Ramses II, and the Temple of Hathor are some of Egypt's best-known archeological sites. Step past the enormous sandstone statues carved into the temple facades and explore the interiors, which are decorated with art and hieroglyphics (Figure 3.6 D).

Dating from 180BC, **Kom Ombo Temple** is unique as it is duplicated, mirroring itself on either side of a central axis. This is because it was dedicated to two gods: Sobek, god of fertility and creator of the world, along with Hathor and Khonsu, and also Horus. Some of the hundreds that have been discovered nearby are now on display in the temple (Figure 3.6 E).

Figure 3. 6: The Attractive Historical Sites in The Study Area (Source: WEB[7])

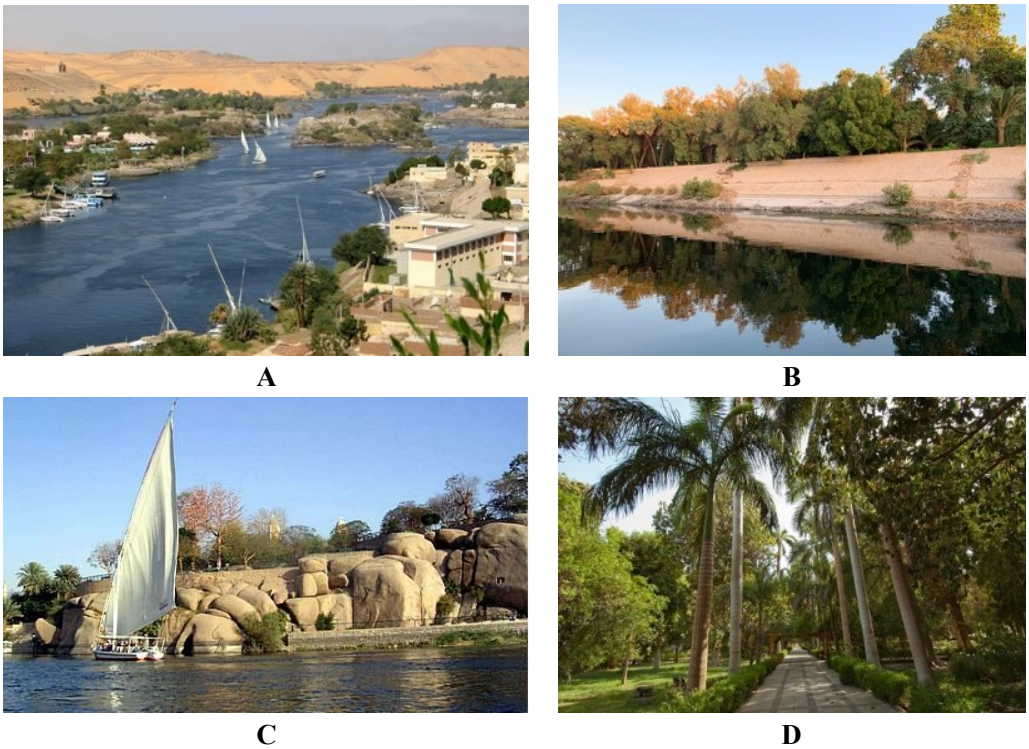
The Temple of Horus (at Edfu) was built as an homage to the falcon-headed god Horus, was erected between 237 and 57 BC, during the reign of six different Ptolemies. It's the second-largest temple in Egypt, only after Karnak, and its principal building includes several marginally preserved reliefs. Visitors to this ancient site can trace history through old etchings that record years of land donations and even depict the annual Triumph of Horus. This yearly ritual uses ten harpoons to kill a ceremonial hippopotamus (Figure 3.6G).

The Nilometer is considered the most wonderful historical site that visitors can discover which is located on the Elephantine Island. It is considered as the most interesting thing to do using visiting Aswan because visitors will notice with their own eyes how clever the ancient Egyptians were and how much they depended on the Nile River (Figure 3.6 H)

B. Natural Sites (WEB[8])

Nile River measures a mighty 4,150 miles (6,680 kilometers) from end to end, and it is considered the world's longest river. It's also the lifeblood of Egypt, flowing through the heart of the Sahara Desert and passing through cities, including Aswan, Luxor, and Cairo, before emptying into the Mediterranean Sea at Alexandria (Figure 3.7 A).

On the Nile River, one of the best things to do in Aswan is to take a trip to **Kitchener Island**. Named for the infamous British colonial figure, Lord Kitchener, the island is home to Aswan's beautiful Botanical Gardens (Figure 3.7 B).



A **B**

C **D**

Figure 3. 7: The Attractive Natural Sites in The Study Area (Source: WEB[9])

Elephantine Island is found in the middle of the Nile River, Elephantine Island is considered one of the oldest inhabited areas in Aswan, Egypt. There are various historical sites on the island of Elephantine as over the centuries it formed the border between Egypt and Nubia (Figure 3.7 C).

Lord Kitchener designed **Aswan Botanical Garden,** and the 16-acre Aswan Botanical Garden is home to trees, flowers, and plants from India, Africa, and even the world beyond. Travelers can relax in the wide-open spaces of this garden's breathtaking natural beauty or wind through the vast exhibit hall of towering palm trees. More than 400 species of subtropical vegetation exist in this urban oasis that's just a Nile cruise away (Figure 3.7 D).

C. Culture Sites (WEB[10,11])

Aswan High Dam was built to control the Nile River's annual floods. The Aswan High Dam transformed Egypt's Nile Valley and created Nasser's vast Lake. The High Dam project was created to stop significant floods in Egypt. And this caused a lot of unrest and loss of historical culture in Aswan, Egypt (Figure 3.8 A).

Nubian Villages (Siou and Koti) are sandwiched between the ruins of Abu, and the Mövenpick resort hotel is two colorful Nubian Villages, Siou, and Koti. Strolling through their shady alleys and gardens is a beautiful way to experience life on modern Elephantine. A north-south path across the middle of Elephantine Island links the two villages with a shady garden beside a traditional Nubian house (Figure 3.8 B).

Lake Nasser (Lake Nubia) s one of the world's largest artificial lakes, and Lake Nasser was formed when the Aswan High Dam successfully controlled the Nile, flooding around 2,027 square miles (5,250 square kilometers) of the desert. The majority of Lake Nasser is in Egypt; the rest extends across the border into Sudan, commonly known as Lake Nubia (Figure 3.8 C).

The Nubian Museum is found on the eastern bank of the Nile. Dating back to 1997, the museum is more recent than the Aswan Museum located on Elephantine Island. this museum contains the most attractive collection of artifacts dating back thousands of years. Once again, the museum focuses on Nubian history and culture, which is inseparable from the more famous ancient Egyptian history and culture (Figure 3.8D).

A **B**

C **D**

Figure 3. 8: The Attractive Culture Sites in The Study Area (Source: WEB[12])

D. Religion Historical Sites (WEB[13])

The **Fatimid cemetery** burial place is amazing as I can discover various kinds of adobe tombs dating back to the 9th century AD, which have been well protected over the years (Figure 3.9 A).

On the west bank of the Nile, facing Aswan, 7th-century **St. Simeon Monastery** looks more like a fortress than a place of worship. Also known as Anba Hatred, the brick-and-stone structure has been abandoned since the 13th century. The church to the monks' cells paints an atmospheric picture of monastic life in the ancient world (Figure 3.9 B).

A simple, austere structure with a dome topping crenelated walls, the **Aga Khan Mausoleum (Tomb of Muhammad Shah Aga Khan)** sits atop a hill on the outskirts of Aswan, overlooking the Nile. Built-in rose granite, with the tomb itself in white Carrara marble, the mausoleum is a fitting monument to the man who was once a supreme leader of the Shia Muslim Ismaili sect. Aswan has witnessed the going and coming of numerous rulers, religions, and pharaohs through the ages, and each of them tried to leave his mark in the city (Figure 3.9 C).

A B

C

Figure 3. 9: The Attractive Religion Historical Sites in The Study Area (Source: WEB[14])

3.3 Land Evaluation Process for RES Using MCE Model

3.3.1 Procedure

Figure 3. 10 illustrates the Multi-Criteria Evaluation (MCE) model of land evaluating current RES in Aswan City. GIS database development of this study was developed by using RES spatial evaluating criteria and displaying each spatial criterion in maps. However, AHP is a methodical method helping decision-makers and urban planners make better decisions to solve urban planning problems based on different priorities. Thus, in this study, AHP calculates land evaluation criteria' weight. To produce a land evaluation model of RES, four main steps have to be followed (Figure 3. 10). First, based on the literature review, gathering spatial land evaluation criteria to be used in the assessment process and transferring them based on their type to main criteria and sub-criteria which can be used as input layer in the MCE model. Second, determining land evaluation criteria priority by considering expert opinion and calculating criteria weights using the AHP method to be involved in the evaluation process. Third, criteria maps should be created using proper spatial analysis techniques in the ArcGIS environment such as Distance, Reclassify, and Raster calculation for applying NDVI analysis. And then produce a land suitability evaluation map by overlaying all criteria maps and weights using the weighted criteria overlay tool in the ArcGIS

environment. Finally, after producing a land evaluation map for RES, the current state of RES in Aswan city is evaluated based on the created land evaluation map.

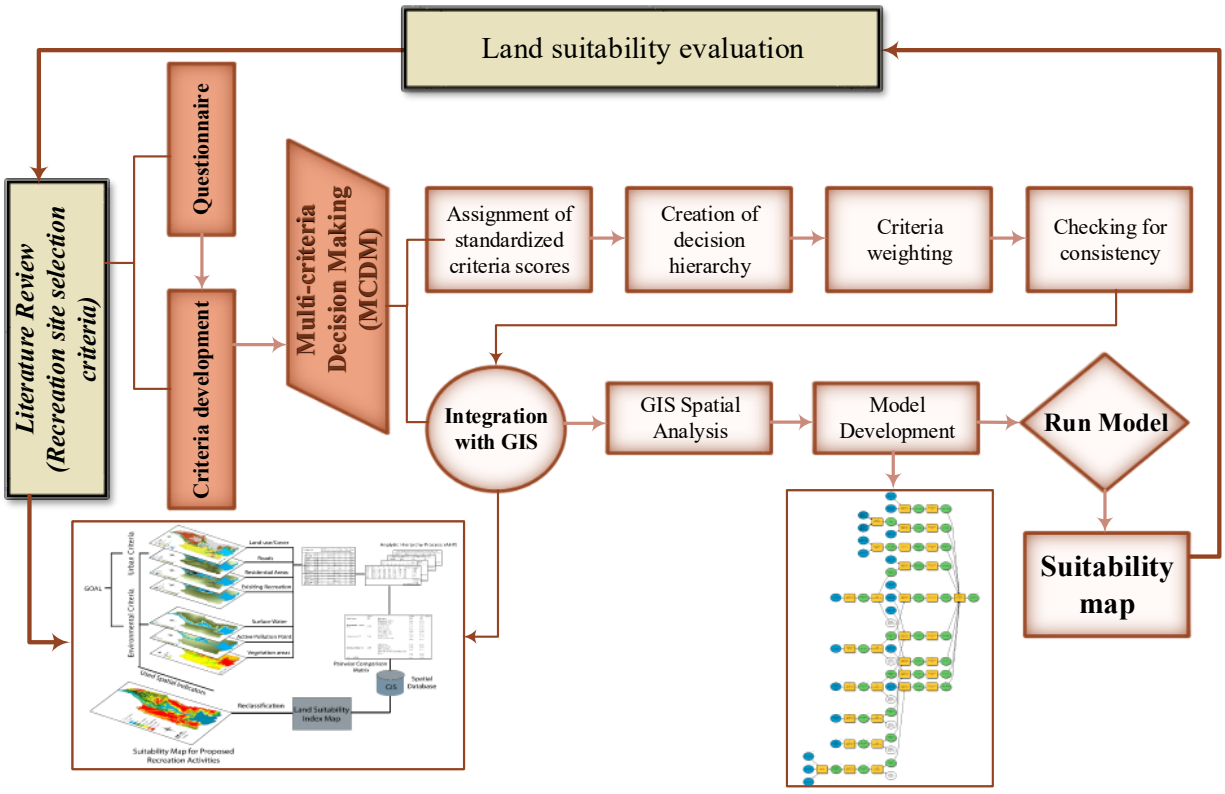


Figure 3. 10: Recreation and Ecotourism Services (RES) (Source: Author)

3.3.2 Utilized Land Evaluation Criteria

I classified the collected land suitability evaluation criteria into three main categories: environmental, social, and economic criteria. While all of biodiversity, availability, comfort, pollution, and topography are the appropriate sub-criteria in environmental criteria, accessibility, security and compatibility are the appropriate criteria in case of social criteria. However, there are four kinds of sub-criteria utilized in the case of economic criteria which are utility, efficiency, site price, and land use of the surrounding area. The definition of each sub-criteria are as the following:

- **Biodiversity**: Kind of fauna and flora on the selected site.
- **Availability**: Soil and vegetation of the selected site.
- **Comfort**: Wind direction, temperature, open water, and air quality of the selected site.
- **Pollution**: Accepted distance of the selected site from active pollution points.
- **Topography**: Acceptable topography limits or degree of slope of the selected site land.
- **Accessibility**: Acceptable distance of the selected site from the road network, existing recreation areas, and public transport stations.
- **Security**: Legislation of laws that protect these services in the selected site.

- **Compatibility**: Human culture inside and outside the selected site.
- **Utility**: Potential economic benefits from the selection of this site.
- **Efficiency**: Quality of the services in the selected site based on the carrying capacity of the landscape and the sensitivity of the landscape.
- **Site's price**: Price of the land in the selected site.
- **Land use of the surrounding area**: Land uses of the surrounding area to sure cover the large size of urban areas by the serving range of the selected site.

By integrating between the evaluation criteria of RES, which are (biodiversity, availability, comfort, pollution, topography, accessibility, security, compatibility, utility, efficiency, site's price and surrounding area) and evaluation sub-criteria which were addressed in Appendix 1, I could list each sub-criterion under the appropriate evaluation criteria based on the definition of the evaluation criteria. For instance, in the case of biodiversity criteria, which means the kind of fauna and flora on the selected site, vegetation is considering the appropriate sub-criteria for this kind of criteria (Table 3. 1). Regarding the sub-criteria related to the availability criteria, which indicate the type of soil of the selected site, soil erosion is considered the appropriate evaluation sub-criteria for this kind of criterion. One more example, in case of efficiency criterion, I consider 5 sub-criteria which could be utilized for evaluation the efficiency of RES services, and these sub-criteria such as landscape setting, carrying capacity, and population density. Table 3. 1 demonstrates the evaluation criteria and the related sub-criteria. And I can do the same for all types of collected criteria. The spatial criteria and sub-criteria could be utilized in the land suitability evaluation process (Table 3. 1).

3.3.3 Criteria Weights Calculation

There were 5 crucial steps to calculate the weights for land evaluation criteria using the AHP method which are: (1) Criteria order identification by using an expert-based questionnaire; (2) AHP hierarchy construction of this study; (3) Conduct a pairwise comparison between every two sub-criteria in the same group; (4) Calculate criteria weight; (5) Consistency check (Figure 3. 11).

3.3.3.1 Criteria Importance Rank (Order) Identification

An online questionnaire has been established to order the chosen RES evaluation sub-criteria based on their importance. Only Experts in urban planning, recreation, and tourism have been involved in this questionnaire. In this study, 200 questionnaires form had been sent to experts' emails, and all criteria gave a rating value from 1 "Least important" to 9 "Extremely important". The obtained sub-criteria were classified into three main criteria: Environmental, Social, and Economic criteria (Table 3. 1).

Table 3. 1: RES Evaluation Main Criteria and Sub Criteria Classification (Source: Author)

Evaluation criteria		Sub-criteria	Spatial Sub-criteria	Non-spatial Sub-criteria	Utilized sub-criteria
Environmental Criteria	Biodiversity	Vegetation	√	-	√
	Availability	Soil erosion	√	-	√
	Comfort	Water bodies	√	-	√
	Pollution	Active pollution points	√	-	√
	Topography	Elevation	√	-	√
Social Criteria	Accessibility	Distance from residential areas	√	-	√
		Distance from attractive sites	√	-	√
		Distance from road	√	-	√
	Security	Number of threats	-	√	
	Compatibility	Sense of satisfaction	-	√	
		Sense of happiness	-	√	
		Sense of care with the place	-	√	
Economic Criteria	Utility	Travel costs	√	-	
		Willingness to pay (WTP)	-	√	
	Efficiency	Landscape settings	√	-	
		Photographs	-	√	
		Accommodation	-	√	
		Carrying capacity	-	√	
		Population density	-	√	
	Site's price	Site location	√	-	
	Surrounding area	Land cover/use	√	-	
		Viewpoint	√	-	√
		Landscape Aesthetics	√	-	

Sampling Selection (Participants): A total of 53 respondents ranging from decision-makers, academicians, and landscape and urban planners with 5–15 years of landscape and urban planning experience, were involved in this survey. The stratified random sampling method was chosen, which comprises landscape experts, academicians, urban planning and design experts, architectures, and others. To ensure a better response, the survey forms were distributed by email. Moreover, part of the questionnaire was also sent by google accounts. Altogether, 41 questionnaires were completed among 11 landscape experts, 10 Architectures, 15 urban planning and design, and the remained number classified by others. The number of people to whom the online questionnaire was sent amounted to 200. The number of participants who started with the assessment and ranking of the evaluation criteria was just 53, whereas 41 evaluated the complete set of 12 criteria for at least one question. The participation/response rate was approximately 26%

(the number of people who assessed at least one question compared to those who sent the online surveys).

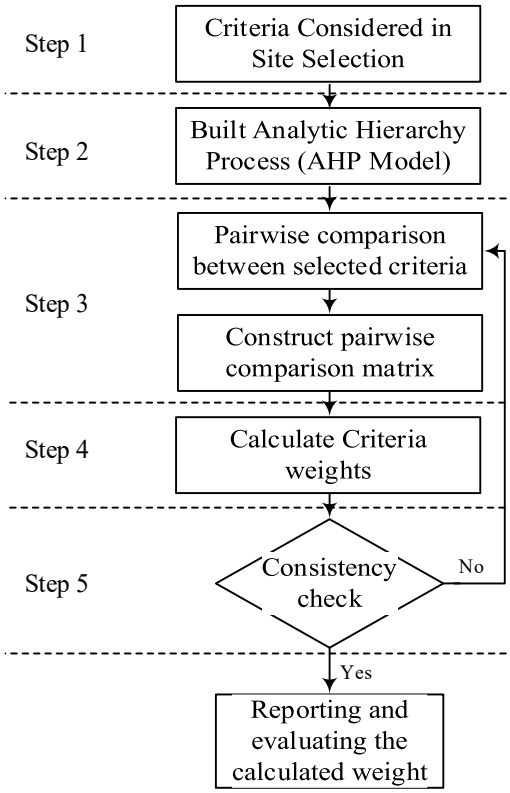


Figure 3. 11: AHP Hierarchy Process (Source: Author)

Survey Preparation: The survey is prepared considering all ethical rules and the privacy of the survey candidate. The question of who is prepared for this survey and where the results will be applied are given at the top of the questionnaire. Moreover, a detailed explanation of criteria and how to answer questions and an example evaluation are shown before answering the questions. Examples of the questionnaire questions are given in Appendix 2.

3.3.3.2 AHP Hierarchy Construction of the Study

After sub-criteria ordering, the AHP hierarchy model for this study has been established. The criteria of the AHP are determined depending on literature review and experts' opinion as I mentioned above and it was divided into three main criteria, which are environmental criteria (C1), social criteria (C2), and economic criteria (C3), and sub-criteria to form the hierarchical structure of the AHP. The problem's goal has to be in the first hierarchical structure level followed by main criteria and sub-criteria, respectively (Figure 3. 12). Firstly, five sub-criteria have been considered environmental criteria in the third level. Moreover, three sub-criteria also have been taken in social criterion. And finally, in the case of the economic criterion, I have focused on four sub-criteria. Moreover, Twelve sub-criteria have been utilized in the computation process, divided into three main groups. The first group includes environmental criteria, the second group is social criteria,

and the third group contains the economic criteria. The examined criteria were selected based on the relevant international literature.

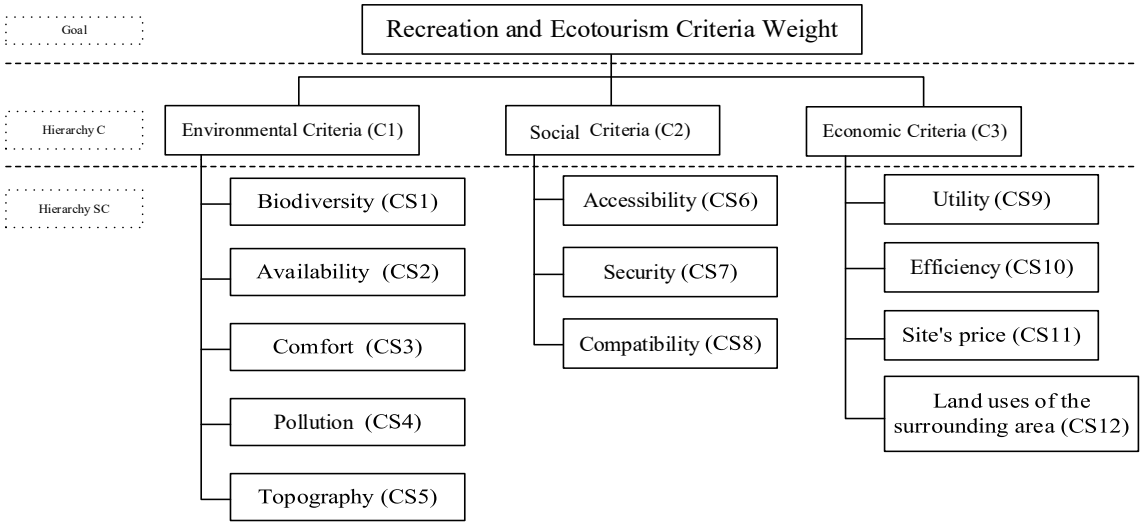


Figure 3. 12: Hierarchical Structure of The AHP Process of This Study (Source: Author)

3.3.3.3 Pairwise Comparison Between The Criteria Using Questionnaire Results

The Questionnaire result is adopted for assigning preferences during the pairwise comparison. Decision-makers can use the linguistic nine-point scale (1-9) (Table 2.2) to represent the preferences during pairwise comparison in the AHP approach (Figure 3. 13). To enable pairwise comparisons between the criteria, I utilized a scale of relative importance from 1 to 9 for making subjective pairwise comparisons to present experts' judgments on the relative importance between each sub-criteria in the same main group. To do that, all the questionnaire results have been converted to values based on the relative importance scale (Table 3. 2, Table 3. 3, and Table 3. 4). Pairwise comparisons of all related attribute values were used to establish the relative importance of hierarchy elements. Finally, all the values for the given criteria were pairwise compared using Excel and Equations 1 and 2. Their structural models calculated each criterion's weight (W) in each hierarchy. The pairwise comparison between each sub-criterion in the same criteria group has been addressed in Table 3. 5, Table 3. 6 and Table 3. 7.

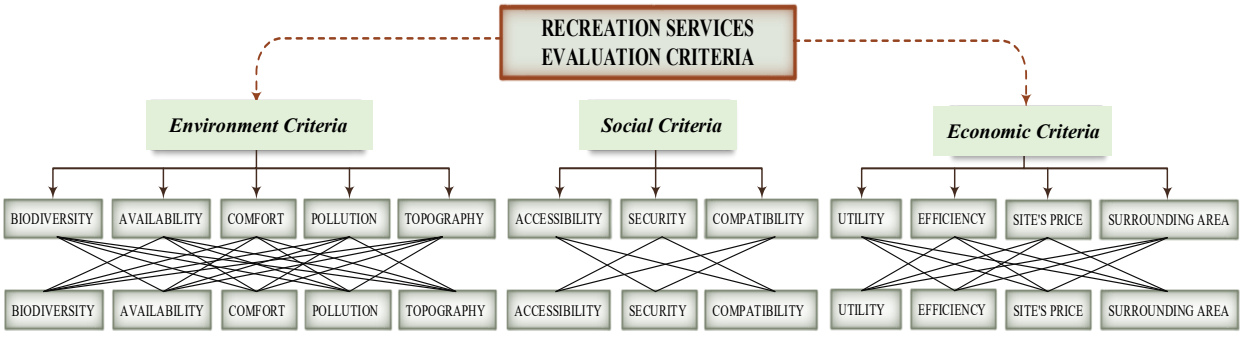


Figure 3. 13: Pairwise Comparison Between Each Sub-Criteria (Source: Author)

Table 3. 2: Importance or Preference Between Environmental Criteria (Source: Author)

Criteria	Criteria Weighting score									Criteria
	More importance than				Equal	Less importance than				
Biodiversity (CS1)	9	7	5	3	1	3	5	7	9	Availability (CS2)
Biodiversity (CS1)	9	7	5	3	1	3	5	7	9	Comfort (CS3)
Biodiversity (CS1)	9	7	5	3	1	3	5	7	9	Pollution (CS4)
Biodiversity (CS1)	9	7	5	3	1	3	5	7	9	Topography (CS5)
Availability (CS2)	9	7	5	3	1	3	5	7	9	Comfort (CS3)
Availability (CS2)	9	7	5	3	1	3	5	7	9	Pollution (CS4)
Availability (CS2)	9	7	5	3	1	3	5	7	9	Topography (CS5)
Comfort (CS3)	9	7	5	3	1	3	5	7	9	Pollution (CS4)
Comfort (CS3)	9	7	5	3	1	3	5	7	9	Topography (CS5)
Pollution (CS4)	9	7	5	3	1	3	5	7	9	Topography (CS5)

Table 3. 3: Importance or Preference Between Social Criteria (Source: Author)

Criteria	Criteria Weighting score									Criteria
	More importance than				Equal	Less importance than				
Accessibility (CS6)	9	7	5	3	1	3	5	7	9	Security (CS7)
Accessibility (CS6)	9	7	5	3	1	3	5	7	9	Compatibility (CS8)
Security (CS7)	9	7	5	3	1	3	5	7	9	Compatibility (CS8)

Table 3. 4: Importance or Preference Between Economic Criteria (Source: Author)

Criteria	Criteria Weighting score									Criteria
	More importance than				Equal	Less importance than				
Utility (CS9)	9	7	5	3	1	3	5	7	9	Efficiency (CS10)
Utility (CS9)	9	7	5	3	1	3	5	7	9	Site's price (CS11)
Utility (CS9)	9	7	5	3	1	3	5	7	9	Surrounding area (CS12)
Efficiency (CS10)	9	7	5	3	1	3	5	7	9	Site's price (CS11)
Efficiency (CS10)	9	7	5	3	1	3	5	7	9	Surrounding area (CS12)
Site's price (CS11)	9	7	5	3	1	3	5	7	9	Surrounding area (CS12)

3.3.3.4 Calculate Criteria Weight and Consistency Check

To ensure the credibility of the relative significance, AHP provides measures to determine the inconsistency of judgments mathematically. Based on the properties of reciprocal matrices, the Consistency Ratio index (CR) can be calculated by using Equation (1). Saaty suggests that if CR is smaller than 0.10, the degree of consistency is relatively acceptable. But if it's larger than 0.10, then there are inconsistencies in the evaluation process, and the AHP method may not yield meaningful results. After checking the consistency ratio, the criteria weights can be calculated using some Excel equations (WEB[15]).

$$CR = \frac{CI}{RI} \quad (1)$$

Table 3. 5: Comparison Matrix for Environmental Criteria Using AHP (Source: Author)

Criteria	CS1	CS2	CS3	CS4	CS5
CS1	1	1	1/9	1/9	3
CS2	1	1	1/7	1/9	3
CS3	9	7	1	3	9
CS4	9	9	1/3	1	9
CS5	1/3	1/3	1/9	1/9	1
Total	20,33	18,33	1,70	4,33	25,00

Table 3. 6: Comparison Matrix for Social Criteria Using AHP (Source: Author)

Criteria	CS6	CS7	CS8
CS6	1	1/5	3
CS7	5	1	7
CS8	1/3	1/7	1
Total	6,33	1,34	11,00

Table 3. 7: Comparison Matrix for Economic Criteria Using AHP (Source: Author)

Criteria	CS9	CS10	CS11	CS12
CS9	1	1	9	1/5
CS10	1	1	7	1/3
CS11	1/9	1/7	1	1/9
CS12	5	3	9	1
Total	7.111	5,143	26,000	1,644

3.3.4 Producing Land Suitability Evaluation Map for RES

To identify a land suitability class, the following steps were undertaken: (1) All selected evaluation criteria were transformed into raster layers; (2) Raster layers were classified according to the schemes given below; (3) Weighted and overlaid the evaluation criteria; (4) Each cell in the resulting raster layer was reclassified into a land suitability classes; and, (5) The final resulting raster could be assessed and displayed as a land suitability evaluation map (Figure 3. 10). All the previous steps have been conducted using the ArcGIS environment's evaluation model.

3.3.4.1 Criteria Transformation to Raster

Based on the sub-criteria mentioned earlier, I have seven criteria and nine related sub-criteria considered as input raster layers in the land evaluation model by involving spatial sub-criteria (More details about criteria and sub-criteria selection will be addressed in Chapter 4). To produce the land evaluation map, it is necessary to transfer the criteria mentioned above into raster layers on the ArcGIS environment to be converted to maps (Table 3. 1).

The utilized sub-criteria in the land evaluation of RES, namely (1) landcover/use; (2) water bodies; (3) attractive sites; (4) residential area; (5) road or transportation; (6) vegetation density; (7) elevation; (8) pollution points; and (9) soil erosion/loss. According to experts' opinions, the criteria and factors' importance were chosen and ordered. Collected factors for the land evaluation process should be comprehensive and measurable. In this process, data of all selected factors were displayed and analyzed individually. And then, all factors displayed with maps were overlaid together for producing the RES land evaluation map. Thus, the collected evaluation factors can be integrated into the MCE model to produce a land evaluation map. These factors must be transferred to layers on the ArcGIS environment to be converted to maps. Different sources are utilized to collect the data about the evaluation factors (Table 3. 8). For example, in creating both the landcover/use and vegetation density criteria map, layers displaying land use/cover and vegetation density have been corrected utilizing a Landsat satellite image (Landsat8 ETM+2011). In contrast, the road layer has been downloaded from ESRI. And other data such as attractive sites and current recreation and tourism sites have been collected using field survey data such as Global Positioning System (GPS) and General Authority for Urban Planning (GAUP) in Egypt.

Table 3. 8: List of Collected Data and Their Source (Source: Author)

Data	Type of data	Utilized for creating	Source
Aswan boundary file	Vector	Clip criteria maps	GAUP - Egypt
Landsat satellite image	Raster	Land cover/use	Landsat8 (bands 2,3,4,5,6,7) ETM+ 2011
DEM	Raster	Slope	USGS
Natural and cultural attractions	Vector	Dis-attractive sites	Field Survey with GPS
Road map	Vector	Dis-road and transportation	Road Layer, ESRI
Water bodies map	Vector	Dis-water bodies	GAUP - Egypt
Pollution map	Vector	Dis-active pollution points	GAUP - Egypt
Vegetation cover	Raster	Vegetation density	NDVI Index
World Soil map	Vector	Soil erosion/loss	FAO DSMW
Current recreation and tourism site	Vector	To evaluate current RES	Field Survey with GPS

Dis (Distance from); GAUP (General Authority for Urban Planning); USGS (U.S. Geological Survey); DEM (Digital Elevation Model); DSMW (Digital Soil Map of the World)

3.3.4.2 Evaluation Criteria Re-Classification

The specified land evaluation system was used to reclassify RES land evaluation factors according to the degree of effect on the land evaluation process. Each sub-criterion was categorized, and their land evaluation scores were presented in the standardized map format. Two main steps have to be

prepared to produce a land evaluation map. Firstly, I have to convert all raster criteria layers into a map. I can do that by applying the distance analysis tool for all criteria except elevation, vegetation density, soil erosion, and landcover map. All other layers have to be converted to layers by using the distance analysis tool (Appendix 3). All the created layers have been divided into levels based on their distance, and these levels range from Near to Far (Appendix 3).

On the other hand, five types of data processing were applied for creating, preparing, and classifying land evaluation criteria maps. All the utilized land evaluation criteria maps were divided into four classes by using reclassify tool spatial analysis tool (Arc Toolbox > Spatial Analyst Tools > Reclassify). And this processing is as the following:

- Digital Elevation Model (DEM) data processing (applied for slope criterion): The Digital Elevation Model data were downloaded from U.S. Geological Survey (USGS). The Slope and Elevation criteria were produced by using the surface analysis tool in ArcGIS (Arc Toolbox > Spatial Analyst Tools > Surface Analysis> Slope).
- Extract Landsate8 satellite image data processing (applied to create vegetation criterion and type of land cover criterion): the Landsate8 bands were also downloaded from USGS. After preprocessing landsate8 satellite images, by adding band 4 and band 5 in ArcGIS using Add data tools and using raster calculation tool for calculating NDVI by using this equation (NDVI = (NIR - VIS)/(NIR+ VIS), where NIR=band 5, and VIS=band 4.
- Furthermore, Landsate8 satellite images were utilized for creating a landcover/use criterion map by composite all of the bands 2,3,4,5,6,7 and using the resulting map for land use/cover classifications.
- World soil map data processing applied for creating soil erosion/loss criterion map by integrating between slope and land use/cover maps using raster calculation tool in ArcGIS environment, soil erosion/loss has been calculated (Arc Toolbox > Spatial Analyst Tools > Map Algebra > Raster Calculator. The soil erosion was determined by using this equation (A=R*K*LS*C*P) where A is the mean annual soil loss, R is the rainfall/runoff erosivity factor, K is the soil erodibility factor, LS is the slope length and steepness factor, C is the cover factor, and P is the support practice factor.
- GIS distance analysis data processing was applied for the fifth remaining criterion. The different distances were established for all pollution points, water bodies, residential areas, attractive points, and road and transportation criteria. GIS distance analysis was applied on raster layers of these criteria by using Euclidean distance in ArcGIS (Arc Toolbox > Spatial Analyst Tools > Distance > Euclidean Distance).

After applying the reclassify tool for the evaluation criteria, I divided the land evaluation index for

each land evaluation criterion map into four classes. These classes have been given the numerical values 4, 3, 2, or 1, which represent Most-suitable (MS), Suitable (S), Low-suitable (LS), and Not-suitable (NS), respectively (Table 3. 9). The evaluation classes are defined as follows; (1) Most-suitable class: it indicates a land parcel of high suitable that is located a considerable distance from natural and attractive culture sites which is close to residential areas and water sources and easy access to from the towns and that is suitable for developing RES in Aswan city; (2) Suitable class: it indicates a land parcel that fulfills many land evaluation criteria that may optimize the existing recreation and tourism resources to properly develop and promote a mass kind of RES and that could provide various opportunities for creating RES in these sites with some modification; (3) Low-suitable class: it is an intermediate level between the unsuitable and suitable classes; (4) Not-suitable class: it indicates a land parcel that relatively not fulfills many land evaluation criteria that is not suitable for developing RES in the study area which requires strict urban regulations.

Table 3. 9: Site Evaluation Criteria Reclassification and Land Evaluation Rate (LER) Index (Source: Author)

C1: Distance from WB (m)		C2: Distance from AS (m)		C3: Distance from CPP (m)	
Classes	LIR	Classes	LIR	Classes	LIR
0-300	MS (4)	0-250	MS (4)	0-700	NS (1)
301-700	S (3)	251-500	S (3)	>700	MS (4)
701-1000	LS (2)	501-700	LS (2)		
>1001	NS (1)	>701	NS (1)		
C4: Distance from R&T (m)		C5: Distance from RA (m)		C6: Land use type	
Classes	LIR	Classes	LIR	Classes	LIR
0-500	MS (4)	0-500	MS (4)	Grassland	MS (4)
501-1000	S (3)	501-1000	S (3)	Bare Land	S (3)
1001-2000	LS (2)	1001-2000	LS (2)	Sand Land	LS (2)
>2001	NS (1)	>2001	NS (1)	Buildup	NS (1)
C7: Slope (%)		C8: Vegetation density (%)		C9: Soil erosion	
Classes	LIR	Classes	LIR	Classes	LIR
0-6	MS (4)	0-10	NS (1)	High	NS (1)
7-20	S (3)	11-40	LS (2)	Moderate	LS (2)
21-30	LS (2)	41-70	S (3)	Low	S (3)
>30	NS (1)	>71	MS (4)	Very low	MS (4)

(LIR) Layer Index Reclassification; (WB) Water Bodies; (CPP) Active Pollution Points; (AS) Attractive Sits; (R$T) Road and Transportation; (RA) Residential Areas; (MS) Most-suitable; (S) Suitable; (LS) Low-suitable; (NS)Not-suitable.

The study area's land use/cover classes were categorized into these four evaluation classes. They are as follows: Most-suitable (Grassland), Suitable (Bare Land), Low-suitable (Sand Land), and not Suitable (Buildup) for RES (Table 3. 10, Figure 3. 14). Table 3. 10 illustrates that both Bare land and Buildup areas cover more than half of the total area of the case study (35.12% and 27.54%, respectively). Sandland covers around a fifth of Aswan city, accounting for 17.55% of the total

area. However, both Grassland and Water bodies cover almost the same area and account for 9.92% and 9.87%, respectively.

Table 3. 10: Type of Land Use/Cover Areas (Source: Author)

Type of Land use/cover	Area (Hectare)	Area (%)
Grassland	1161.99	9.92%
Bare land	4113.09	35.12%
Sand land	2054.79	17.55%
Buildup	3224.61	27.54%
River (Water)	1155.87	9.87%
Total	11710.35	100%

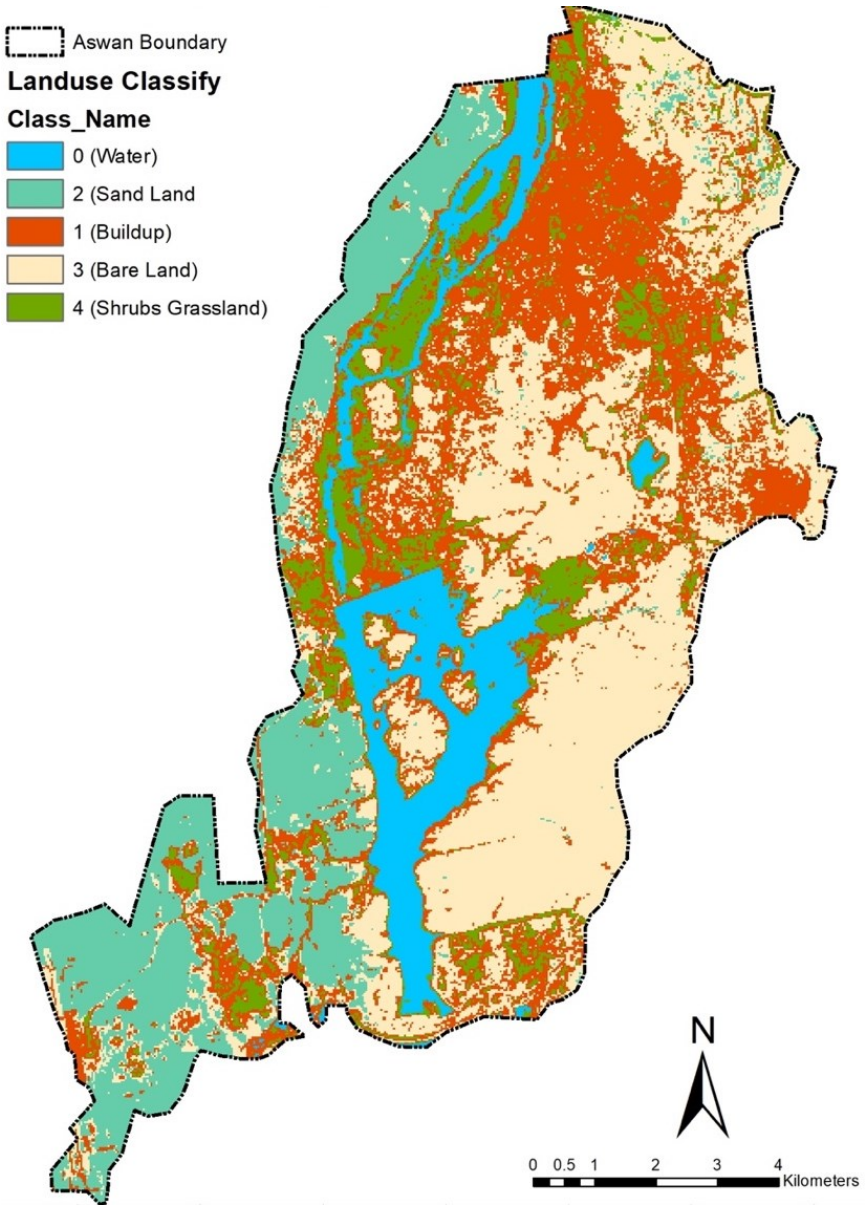


Figure 3. 14: Land Use Classification Map (Source: Author)

3.3.4.3 Land Evaluation Map Creation

The Recreation and Ecotourism Services (RES) land evaluation map is produced, based on the Weighted Linear Combination (WLC) of each selected sub-criterion's suitability score by using Equation 2. To calculate RES land evaluation criteria weights and identify the importance rate for all criteria, the AHP method has been applied. The land suitability score "S" for each site in the study area was calculated from the WLC of the land suitability score gained from each involved criterion. By using the WLC procedure and raster calculator tool in ArcGIS, the RES land suitability evaluation map has been established by using the following equation:

$$SE = \sum_{i-1}^{n} WiXi \qquad (2)$$

Eq 1: "SE" is the value of the RES suitability evaluation; "n" is the total criteria number; "Wi" is the weight result of each criterion "I", and "Xi" is the suitability map for each involved criterion in my analysis.

Like criteria map, land evaluation map of RES was divided into four classes, and these classes were given the numerical values 4, 3, 2, or 1, which represent Most-suitable (S1), Suitable (S2), Low-suitability (S3), and Not-suitable (N), respectively.

3.4 Demand Evaluation of RES

To evaluate future demands of RES in the study area, the methodology for this section of the dissertation consists of two parts. In the first part, the current state of RES is evaluated by utilizing a paper-based questionnaire. At the same time, the future demands evaluation of RES by using PPGIS is described in the second part.

To better understand the demands of residents in the study area, qualitative and quantitative data collection was performed in Aswan city. Data collection was accomplished by implementing a paper-based questionnaire (Appendix 4) and PPGIS as a map-based questionnaire (Appendix 5). Conduction of surveys was completed within two months between May and June 2021.

3.4.1 Questionnaire Design

Two questionnaires (Appendices 4,5) were designed to collect information on residents' different evaluation aspects. The goal of these questions was to recognize the differences between users and to provide a more reasonable basis for comparing populations. Moreover, the comparison between the previous aspects has been conducted across demographic characteristics. To achieve the aims of this part of my dissertation, the questionnaire is collected data about the following six major categories:

- **Visitors demographics** - a description of the RES participants' basic demographic profile is provided.
- **Visitor perceptions and preferences** - is concentrated on indicating attitudes and perceptions of respondents and identifying the aspects that greatly influence people.
- **Reasons to participate in RES**- discusses what possible reasons for participating in recreation are preferred by both genders and age groups.
- **Constraints of RES participating**- answers the question, "What constraints do people perceive when participating in recreation activities? And tests whether there are differences in the perceptions of constraints for different socio-demographic groups.
- **Willingness to pay for maintenance of RES**- discusses the kind of RES preferred to pay for and the influence of monthly income on the willingness to pay.
- **Preference area** - where the appropriate site for the most preferred RES in the study area.

The questionnaire was drafted in both Arabic and English. The questionnaire included 25 questions that aim to determine the RES utilization and tendencies of the urban residents. Section 1 contains basic demographics questions about the sample visitor and questions about the participants 'gender, age, kind group, and income. The second section includes questions on visitor preferences. This section aims to determine visitor preferences of RE activities and services that are mostly preferred for recreational purposes, and the preferred areas of the visit were questioned. Section 3 contains a question about the constraints and reasons that prevent locals from practicing in RES and WTP for RES maintenance. Finally, section 4 has questions about the preferred areas for a different kind of RES. In the first three sections of the questionnaire, I utilized a semi-structured questionnaire (Figure 3. 15) (Appendix 4). However, in the fourth section, the PPGIS method collects answers about the preferred areas for different kinds of RES (Figure 3. 16) (Appendix 5).

Figure 3. 15: Example of Semi-Structure Questionnaire Samples (Source: Author)

Figure 3. 16: Example of PPGIS samples (Source: Author)

3.4.2 Sampling Techniques

The study is based on a survey conducted among 146 residents in 10 districts of Aswan city. Respondents were chosen randomly, and the survey was conducted face to face in different parts of the districts like existing recreational areas, bus stations, streets, and restaurants. The surveys were conducted only among those who have known Aswan and its problems better were targeted for the survey. Both gender and different age groups were involved in my evaluation process.

3.4.3 Data Analysis

The aim of this study is to examine whether the hypothesis presented in Chapter 1 which related to differences between citizens across their perceptions, attitudes, willingness to pay to support RES maintenance and preferences, can be assumed or rejected in Aswan city as a case study.

According to the Semi-structure questionnaire result analysis, the summarized and numerically encoded survey data were set in an Excel spreadsheet, and data analysis was conducted using SPSS. Basic statistical analyses, such as relationship maps and frequencies, were used to characterize the people and create demographic profiles for each sampling. The effect of individual sampling groups and their characteristic variables on perceptions, attitudes, and WTP was analyzed utilizing a relationship map in an SPSS environment. The main purpose of this questionnaire is to determine if there are any differences between the users' attributes and if the differences between samples means are statistically significant.

Regarding to the PPGIS map analysis, the resulting data were collected using similar tools where citizens could map a particular place by leaving a point and answer questions regarding if the specific area got qualities or if it can be improved, along with a comment. Everyone interested (not only from Aswan city) left comments on the paper-based map. By using GIS, I create a database for all samples answers to be utilized in different GIS-based spatial analyses, such as applying Hotspot-analysis for the preferred areas for different kinds of RES and response rate analysis techniques. This analysis is based on regions preferred for different recreation and ecotourism services. The produced maps from the analysis give a clear and mathematically grounded answer to which area is statistically significant regarding a specific kind of RES in the study area. The utilization of GIS-spatial analysis to integrate the collected data from the study area and the results obtained from PPGIS results.

4. LAND EVALUATION OF RECREATION AND ECOTOURISM

In this Chapter, I intend to evaluate the existing RES in Aswan city by utilizing spatial evaluation criteria by using the Multi-Criteria Evaluation (MCE) model based on GIS and Analytical Hierarchy Process (AHP). To do that, I identify 9 spatial criteria as sub-criteria of the RES land evaluation process. According to the professional expert's opinions, those land evaluation sub-criteria were ranked based on their importance as I mentioned in Chapter 3.

4.1 Criteria Order

4.1.1 Environmental Criteria

First of all, dealing with the environmental criteria, experts have scored comfort as the fundamental criterion of environmental criteria with almost 54%, followed by pollution criterion with 51% in the "Extremely important" rank. In contrast, availability and biodiversity have been received lower importance than the previously mentioned criteria with 56% and 39% respectively in the "Very Strongly important" rank (Figure 4. 1). The previous results ensure that the order of environmental criteria from the extremely important to the least important as the following "comfort, pollution, availability, biodiversity and topography sequentially."

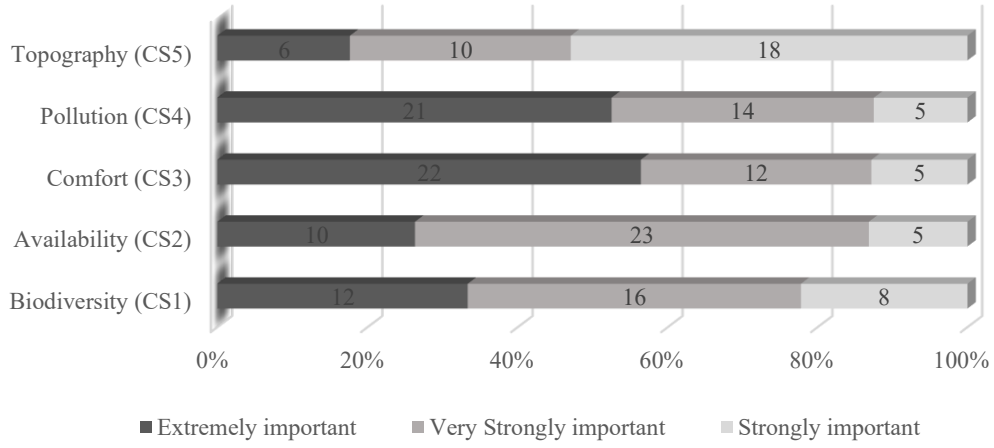


Figure 4. 1: Environmental Criteria Importance (Source: Author)

4.1.2 Social criteria

Another main factor in the evaluation criteria of RES is social criteria. The most important criterion is the security criterion followed by accessibility (41% in Extremely important rank, 41% in Very

Strongly important rank respectively). Moreover, the compatibility criterion has the lowest score among all social evaluation criteria (almost 32% in Strongly important rank) (Figure 4. 2).

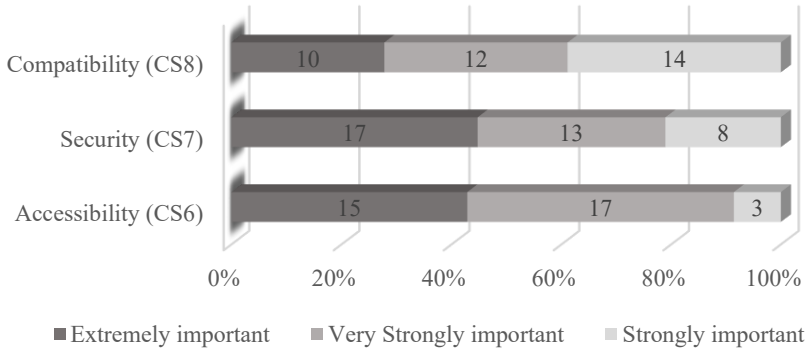


Figure 4. 2: Social Criteria Importance (Source: Author)

4.1.3 Economic Criteria

Although the economy is essential in the recreation sector, economic sub-criteria have been scored the lowest importance among all other criteria. No responses have been taken to the economic sub-criteria in the "Extremely important" rank based on the questionnaire results. For example, in the case of "Very Strongly important" rank, three sub-criteria have been found, which can be ordered as following "surrounding area, efficiency and utility" with percentages "46%, 39%, 39% respectively". However, the site's price scored nearly 39% in the "Strongly important" rank (Figure 4. 3).

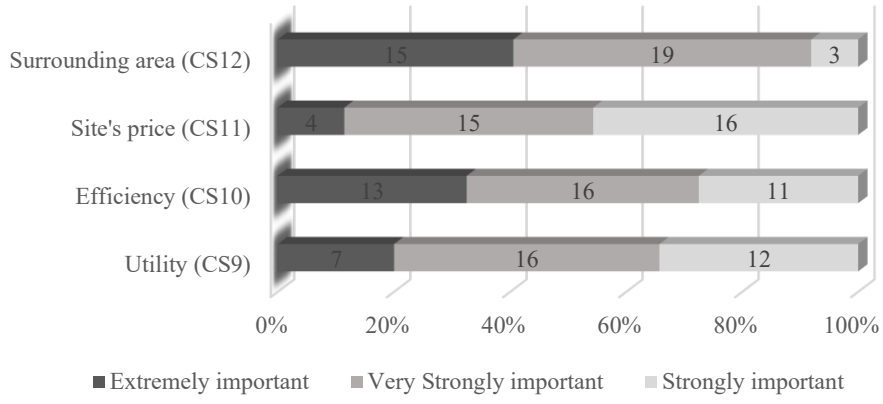


Figure 4. 3: Economic Criteria Importance (Source: Author)

Overall, as you can see in the above results, there are no evaluation criteria found in the “Moderately important” and “Least important” rank (Table 4. 1). This result indicates that all the selected criteria from the literature review are essential for RES evaluation. Moreover, these criteria are range from Extremely important “9” to Strongly important “5”.

Table 4. 1: Questionnaire Results Comparison (Source: Author)

Main Group	Criteria		Extremely Important	Very Strongly Important	Strongly Important	Moderately Important	least Important	Order	Total
			9	7	5	3	1		
Environmental Criteria (C1)	Biodiversity (CS1)	No. of Res.	12	16	8	3	2	7	41
		Percent	29.3%	39.0%	19.5%	7.3%	4.9%		100%
	Availability (CS2)	No. of Res.	10	23	5	2	1	4	41
		Percent	24.4%	56.1%	12.2%	4.9%	2.4%		100%
	Comfort (CS3)	No. of Res.	22	12	5	0	2	1	41
		Percent	53.7%	29.3%	12.2%	0%	4.9%		100%
	Pollution (CS4)	No. of Res.	21	14	5	1	0	2	41
		Percent	51.2%	34.1%	12.2%	2.4%	0%		100%
	Topography (CS5)	No. of Res.	6	10	18	6	1	8	41
		Percent	14.6%	24.4%	43.9%	14.6%	2.4%		100%
Social Criteria (C2)	Accessibility (CS6)	No. of Res.	15	17	3	5	1	6	41
		Percent	36.6%	41.5%	7.3%	12.2%	2.4%		100%
	Security (CS7)	No. of Res.	17	13	8	3	0	3	41
		Percent	41.5%	31.7%	19.5%	7.3%	0%		100%
	Compatibility (CS8)	No. of Res.	10	12	13	5	2	10	41
		Percent	22.0%	29.3%	31.7%	12.2%	4.9%		100%
Economic Criteria (C3)	Utility (CS9)	No. of Res.	7	16	12	4	2	7	41
		Percent	17.1%	39.0%	29.3%	9.8%	4.9%		100%
	Efficiency (CS10)	No. of Res.	13	16	11	0	1	7	41
		Percent	31.7%	39.0	26.8	0	2.4		100%
	Site's price (CS11)	No. of Res.	4	15	16	5	1	9	41
		Percent	9.8%	36.6%	39.0%	12.2%	2.4%		100%
	Surrounding area (CS12)	No. of Res.	15	19	3	2	2	5	41
		Percent	37%	46%	7.3%	4.9%	4.9%		100%

4.2 Statistical Quantitative Analysis of Questionnaire

As further support to the study, the quantitative survey was conducted among the three targeted groups, environmental, social, and economic groups; a total of 53 responses were collected, and 12 of them were excluded. The reliability of the criteria was investigated as well. The Cronbach's alpha (α) reflects the consistency of the set of items, which theoretically α ranges from 0 to 1. If α is near 0, then the quantified answers are not reliable at all, and if it is close to 1, the answers are very reliable. As a rule of thumb, if $\alpha \geq 0.8$, then answers are reliable. The quantitative statistical analysis applies rigorous statistical tests such as reliability data analysis, and ANOVA test will be discussed in the following subsections.

4.2.1 Reliability of the Questionnaire

The reliability of the questionnaire used for the data collection has used the property to understand the opinion of the research participants. The questionnaire that is being used must be reliable to provide practical information that is critical for the progress of society. The reliability of the questionnaire is assessed by focusing on if the questionnaire is providing credible information. If the same questionnaire is used well to collect data from other places, whether it provides credible information. The reliability statistic using statistical package for social sciences (SPSS) is used with the help of Cronbach Alpha; it was detected that 12 items of the questions were 88.1%, which means that the information is credible. A value higher than 50% is considered sufficient, and in this case, it is 88% (Table 4. 2). For all criteria except "confused" and "typical," satisfactory results for reliability have been achieved.

Table 4. 2: Reliability Statistics (Source: Author)

Cronbach Alpha	Number of Items
0.881	**12**

4.2.2 ANOVA Test

The parametric ANOVA test is the fundamental technique used for this type of research. The test involves the ranking of variables based on their overall mean values—the analysis of variance technique simultaneously facilities the testing of whether significant differences exist among the groups. The significance level assumed throughout the analysis is 5%, following the conventional risk level that ensures a confident interval of 95%. The F-tests -for ANOVA as shown in Table 4. 3 test the hypothesis that the evaluation criteria of RES by the three groups, "Environmental, Social, and Economical," do not differ from a set of specified constants. However, the results illustrated differing values of significant levels for different criteria (Table 4. 3). Only for the security

criterion, a value of P= 0.010 was obtained. These observed P values were much smaller than the adopted significance level alpha=0.05, allowing the conclusion that there was a significantly different view among this group being investigated. Similar tests were carried out into the other criteria, but the results were not significant (P> 0.05) (Table 4. 3).

Table 4. 3: ANOVA Results on Site Selection Criteria for RES (Source: Author)

Evaluation criteria	Mean Square	F	P-value
Biodiversity	1.842	2.032	0.087
Availability	0.988	1.288	0.288
Comfort	0.561	0.506	0.799
Pollution	0.967	1.733	0.142
Topography	0.844	0.862	0.532
Accessibility	0.921	0.759	0.607
Security	2.288	3.351	0.010
Compatibility	1.841	1.558	0.189
Utility	0.851	0.758	0.608
Efficiency	1.106	1.414	0.237
Site's price	0.847	1.021	0.428
Land uses of the surrounding area	0.135	0.104	0.995

4.3 Evaluation Criteria Importance Order and Weights

Based on the expert's questionnaire analysis explained in Chapter 3, distance from attractive points and distance from residential areas criteria have been scored as the most critical criteria for evaluating RES respectively, followed by distance from water bodies (Table 4. 1). In contrast, all the remaining criteria received the lowest importance compared to previous criteria. The previous results ensure that the rank of the land evaluation criteria of RES from the most important to the least important as the following respectively; distance from attractive points; distance from residential areas; distance from water bodies; soil erosion; distance from active pollution point; distance from road and transportation; vegetation density; slope; and type of land use/cover (Table 4. 1). According to Saaty and Kearns (1985), the global weights are synthesized from the second level down by multiplying the local weights by the corresponding criterion in the level above and adding them for each element according to the criteria effects. The consistency test and the local weights of sub-criteria were summarized in Appendix 6, Appendix 7, and Appendix 8. All CR values of all sub-criteria in each main group are lower than 0.1, and all the judgments are consistent.

According to the local weights, in the case of environmental criteria weights, the results showed in Table 4. 4 indicates that comfort (0,493) and pollution (0,344) are the two most important factors for evaluating the RES, followed by availability (0,067). Both biodiversity and topography (0,063, 0,033 respectively) appear to be the sub-criteria with the lowest importance. Security (0,724) is the most important factor in the RES evaluation regarding the social sub-criteria weights, followed by accessibility (0,193). However, compatibility is supposed to be the factor with the lowest importance (0,083). While land use of the surrounding area (0,481) appears to be the most important factor in the case of economic criteria (0,481), both utility and efficiency have the same importance in the RES evaluation (0,210). Overall, comfort (0,529), security (0,724), and land use of surrounding area (0,560) show the highest importance with respect to each main criteria group in the order of environmental, social, and economic criteria group, respectively. By looking at the global weights in Table 4. 4, comfort, security, and pollution are the top three rankings. In contrast, topography, site's price, and compatibility are the bottom three rankings.

Table 4. 4: Utilized Main Criteria and Sub-Criteria Weights in The Evaluation Process (Source: Author)

Main Criteria	Supposed weight	Sub-criteria	Local weigh (Wa)	Global weight (Wb)	Ranking
Environmental criteria	0,500	Biodiversity (CS1)	0,063	0,0315	8
		Availability (CS2)	0,067	0,0335	5
		Comfort (CS3)	0,493	0,2465	1
		Pollution (CS4)	0,344	0,172	3
		Topography (CS5)	0,033	0,0165	10
Social Criteria	0,300	Accessibility (CS6)	0,193	0,0579	6
		Security (CS7)	0,724	0,2172	2
		Compatibility (CS8)	0,083	0,0249	9
Economic Criteria	0,200	Utility (CS9)	0,201	0,0402	7
		Efficiency (CS10)	0,202	0,0404	7
		Site's price (CS11)	0,037	0,0074	11
		Land uses of the surrounding area (CS12)	0,560	0,112	4
Sum = 1 (100%)			Sum =	1,000	

W_a. Local weight is derived from judgment with respect to a single main criterion.

W_b. Global weight is derived from multiplication by the weight of the criteria.

4.4 Land Suitability Evaluation Map For RES

To identify a land suitability class, the following steps were undertaken: (1) All selected evaluation sub-criteria were transformed into raster layers; (2) Raster layers were classified according to the schemes explained in Chapter 3; (3) Weighted and overlaid all utilized evaluation criteria; (4) Each cell in the resulting raster layer was reclassified into a land suitability class; and, (5) The final resulting raster could be assessed and displayed as a land suitability evaluation map. All the previous steps have been conducted using the ArcGIS environment's evaluation model (see Chapter 3 for more details). Table 4. 5 demonstrates the type of utilized layers and the kind of spatial analyses tools applied in each layer to create the raster criteria layers. Like land evaluation factor classification, the values of the land evaluation map were divided into four classes, namely: not-suitable (N), low-suitable (S3), suitable (S2), and most-suitable (S1) (Table 4. 6).

Table 4. 5: Recreation and Ecotourism Services (RES) Land Evaluation Factors and Utilized Analysis Tool (Source: Author)

No.	Criteria	Layer type	Spatial analysis
C1	Vegetation density	Raster Layer	NDVI analysis (band 4,5)
C2	Elevation	Raster Layer	Slope tool
C3	Landcover/use	Raster Layer	Composite (band 2-7)-classification tool
C4	Water bodies	Shapefile-polygon-converted to raster	Distance tool (cell 30)
C5	Attractive sites	Shapefile-Points- converted to raster	Distance tool (cell 30)
C6	Residential areas	Shapefile-polygon- converted to raster	Distance tool (cell 30)
C7	Road or transportation	Shapefile-polyline- converted to raster	Distance tool (cell 30)
C8	Pollution Points	Shapefile-Points- converted to raster	Distance tool (cell 30)
C9	Soil Erosion/Loss	Vector Layer - Using Land use and Slope	Raster calculator

Overall, the results indicate that the spatial distribution of RES in Aswan city is high in the middle, especially along the Nile River, and low in the east and southwest (Figure 4. 4). Based on the land evaluation map, the most suitable (S1) area is located in the middle of the study area and about 2892.20 ha, accounting for 25%of the study area. Most of these areas are water bodies like lakes and rivers and areas with high green coverage. While the suitable area (S2) is 4523.53 ha, accounting for 39% of the case study. It contains buildup areas and social areas surrounded by green space. The less-suitable (S3) area is 3029.02 ha, accounting for 26%of the study area. And most of these areas are low-density urban construction land with serious ecological and environmental problems like areas close to active pollution sites. The not-suitable area is 1200.66 ha, accounting for 10 % of the case study. It is mainly the area with a low density of buildup and

urban construction and population such as desert and sand lands. Therefore, it is necessary to create new RES sites for all un-covered spaces with recreation sites as far as possible, to improve the distribution of these kinds of services in the sand and bare land areas and motivate the urban planning extension in those areas. Moreover, in my evaluation of study area land, it is evident that the most suitable lands for RES planning in the study area where the environment and ecological problems like pollution are not appropriate, and high vegetation density and green space are urgently needed. Regarding the analyzed results of the land evaluation process, the most suitable lands for RES are mainly distributed in the areas found on both banks of the Nile River. Table 4. 6 indicates and compares the land suitability classes of RES in Aswan city in terms of index value and area. Whenever the land suitability index value increases, the potential land suitability for developing RES rises.

Table 4. 6: Utilized Classification Index for Land Evaluation Map (Source: Author)

Definition	Classes	Index Value	Area (ha)	Area (%)
Not Suitable	N	<1.9	1200.66	10 %
Less Suitable	S3	1.91-2.5	3029.02	26%
Suitable	S2	2.51-3	4523.53	39%
Most Suitable	S1	>3	2892.20	25%
		Total	11645.41	100%

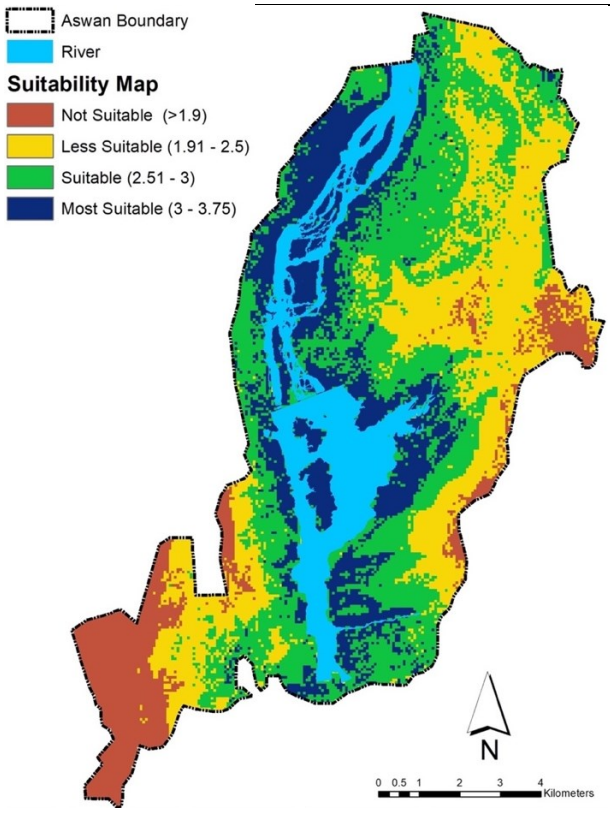


Figure 4. 4: Recreation and Ecotourism Services Land Evaluation Map (Source: Author)

4.5 Evaluate Current RES Sites in Aswan City

Aswan is a busy market and tourist center, and it is considered beside Luxor city as a vast tourism source in Egypt. Furthermore, Aswan city has many natural and cultural attractions and ancient pharaonic civilizations, including Pharaonic, Islamic, and Nubian (see Chapter 3 for more details). The natural and cultural attraction sites are the Upper Dam, the Tabiya Mosque, the Nile Museum, the Princess Ferial Park, the West Suhail area, the Nile Islands, and the twin temple of Abu Simbel. Moreover, Aswan has some site located on the Nile banks, which is considered tourist attraction sites, and it considers an appropriate site where visitors can practice the hobby of swimming and sailing boats. Appendix 9 shows the most common natural and attraction destinations in Aswan city.

Table 4. 7: Current RES Details and Evaluation Using Land Evaluation Map (Source: Author)

RES categories	No.	Name	Type of recreation activities	Location
Parks	1	Doret El Nile park	A path for walking and running, Sports, Seating places, Entertainment	Most Suitable land
	2	Phrial park	A path for walking and running, Sports, Seating places, Entertainment, Restaurants, Trips	Most Suitable land
	3	El Sheraton park	A path for walking and running, Seating places, Entertainment	Most Suitable land
	4	El Mashtal park	A path for walking and running, Seating places, Entertainment	Most Suitable land
	5	El Ward park	A path for walking and running, Seating places, Entertainment	Most Suitable land
	6	El nabatat park	A path for walking and running, Sports, Seating places, Entertainment, Restaurants, Trips	Most Suitable land
	7	El shagarah park	Seating places, Restaurants	Suitable land
Hotels	1	Hotel Sofitel Legend Old Cataract	Restaurants, Entertainment, Sports, social meeting, relaxing	Most Suitable land
	2	Mövenpick Resort Aswan	Restaurants, Entertainment, Sports, social meeting, relaxing	Most Suitable land
	3	Kato Dool Nubian House	Restaurants, Entertainment, Sports, social meeting, relaxing	Suitable land
	4	Basma Hotel	Restaurants, Entertainment, Sports, social meeting, relaxing	Suitable land
	5	Pyramisa Island Hotel Aswan	Restaurants, Entertainment, Sports, social meeting, relaxing	Most Suitable land
Kornish El-Nile path	1	along Nile river beach with length 10 Km	Running, Walking, Seating places, Restaurants, Entertainment	Most Suitable land

Regarding the land evaluation of current RES sits in Aswan city, it is apparent that there are many different kinds of RES in the study area like parks, hotels, walking and running paths, restaurants, chalets, and recreational clubs. According to hotels, almost half of the hotels in the study area are located in the most suitable lands based on the land evaluation map, as most of them were established on islands. Like hotels, walking and running paths are situated in the most suitable lands of RES, and it is created along Nile river beach with a length of 10 Km. However, around two-thirds of the parks founded in Aswan city are located in the most suitable lands, as most of them have been constructed along the Nile river beach. For more details about the current RES in Aswan city, see Figure 4. 5 and Table 4. 7

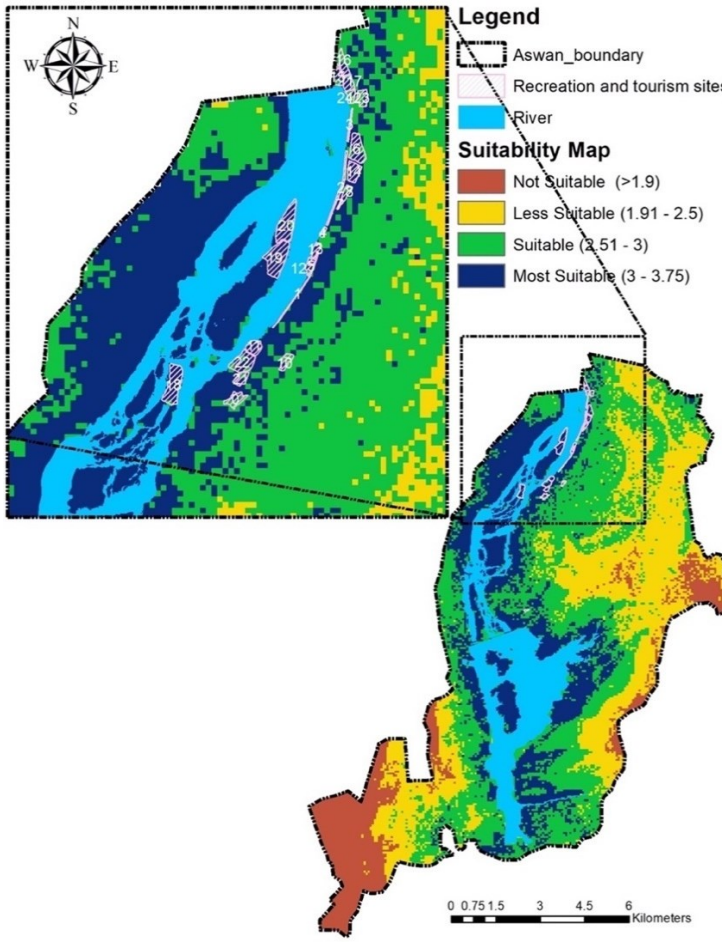


Figure 4. 5: Land Evaluation of Current RES In Aswan City (Source: Author)

By comparing natural and cultural attractive sites map (Appendix 9) and the evaluation map of current RES (Figure 4. 5), I can conclude that most of the existing RES sites in Aswan city are close to natural and cultural attractive sites. They are located in a 500 m buffer zone around these sites, which indicates why these RES are located in the most suitable lands based on the land evaluation map. The other reason is that distance from natural and cultural attractive sites is the most important sub-criterion among other land evaluation sub-criterion. All the lands close to the natural and cultural attractive sites are located in the most suitable zone in the study area.

5. DEMANDS EVALUATION OF RECREATION AND ECOTOURISM

Several ways have been used to evaluate the future demands of the Recreation and Ecotourism Services (RES). Assessing the demands of facilities and the outcomes for those who participate is necessary for the attainment of managerial goals and objectives, ascertaining the benefits of RES and programs, and for evaluation purposes relative to accountability. The primary purpose of this Chapter was to develop a tool for assessing the quality of RE facility amenities. To evaluate the future demands of RES, a tool was developed based on a literature review and then used on the recreation facilities in a medium-sized city located in the part of Egypt (Aswan city) to determine the required demands of the facilities.

5.1 Demographic Characteristics of the Sample

A total of 146 adaptive recreation participants were surveyed from May to June 2021. The sample group consisted of various participants with different beliefs and opinions of adaptive recreation opportunities. The respondents in this sample were asked several socio-demographic questions, such as gender, income, current position, etc. this dissertation focuses on the following demographic questions; gender, age group, income, and kind of group.

5.1.1 Gender

According to gender, respondents are relatively well distributed across male and female categories (Figure 5. 1). Of the total number of survey participants, a majority of the adaptive recreation participants were female (71.0%), while approximately (29.0%) were male. From the above results, I can highlight that more women than men participated in the survey with an overwhelming amount.

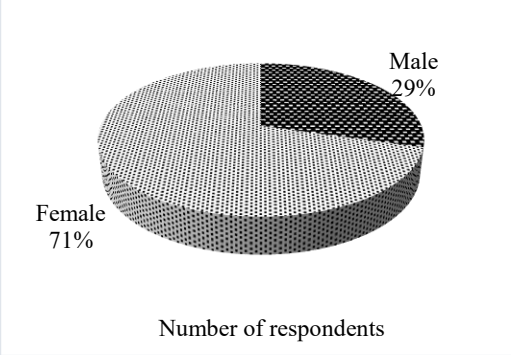


Figure 5. 1: The Percentage of Male and Female Respondents (Source: Author)

5.1.2 Age-Group

To provide a clearer understanding of the distribution of respondents across various age groups, four major age intervals were established before data analysis (Underage, Youth, Adult, Older). If "Underage" is age 0:14, "Youth" is age 15-24, "Adult" is 25-45, and "Older" is 45 and up, the distribution of age participation is more even (Figure 5. 2). Overall, most respondents belonged to the youth age group (71%). Approximately one-fifth of participants (19%) were adult age-group, while just 7% and 3% belonged to older and underage age-group respectively.

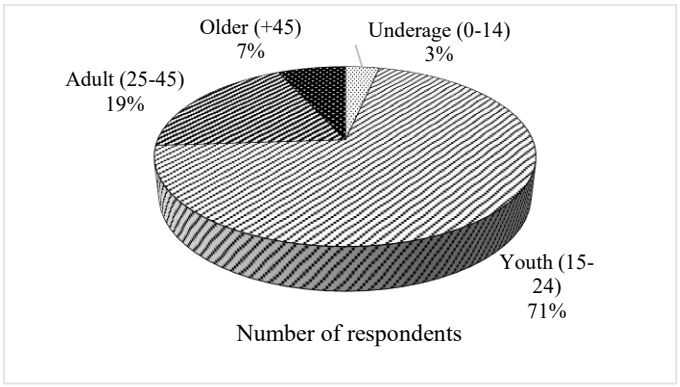


Figure 5. 2: The Percentage of Respondents Across Age-Group (Source: Author)

5.1.3 Income

When respondents were asked to report their total household income for 2021, the numbers ranged from under 2000 Egyptian Pound to over 2000 Egyptian Pound (Figure 5. 3) More specifically, the majority of the respondents (79%) reported their household income less than 2000 Egyptian Pound in the year 2021. Approximately one-fifth of the respondents (21%) reported their household income more than 2000 Egyptian Pound.

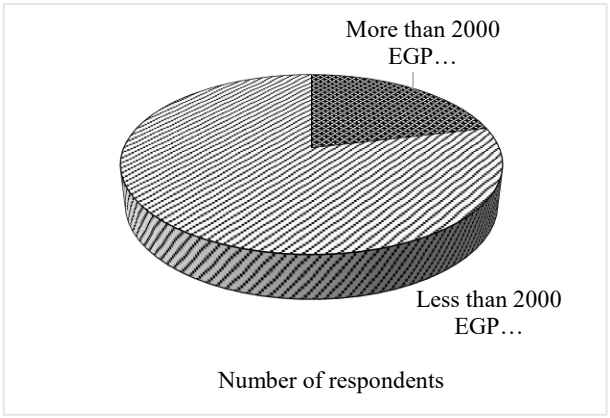


Figure 5. 3: The Percentage of Respondents Across Monthly Income (Source: Author)

5.2 Visitors Preferences and Perceptions

5.2.1 Preferred Kind of Recreation

The first survey question in this section asked respondents to indicate the kind of recreation activities they preferred to participate in. When I asked the responders to indicate which recreation activities they prefer to perform on the recreational sites, the answers are differed based on the genders, age group, and kind of group (Table 5. 1). The survey instrument allowed the respondent to choose one of the six recreation activities allowed to practice in the study area (Having a picnic, Playing soccer and basketball, Water sport (boating, swimming), Walking, or Camping).

According to the "kind of group", the results showed that the respondents who state themselves as a "family/social group" have an overwhelming level of interest in "Water sport activity" like boating and swimming, with a high mean value (2.60) and Std. Deviation (0.548) (Table 5. 1). While "Individual kind" group has an overwhelming level of interest in having a picnic in recreational parks with a mean value (2.57) and Std. Deviation (0.742), "Education group" has an overwhelming level of interest in walking with mean value (2.33) Std. Deviation (0.516) (Table 5. 1). The mean value of Family/social group respondents' number (2.33, N=43) with Std. Deviation (0.644) is more than the mean value of both Individual and Education group (2.30, 2.19 respectively) with Std. Deviation (0.697, 0.402 respectively).

In the case of gender, nearly half of males (20 out of 43) said that they were very interested in walking. However, one-third of females said they were very interested in having a picnic at the recreation site. The mean value of male's numbers (2.40) with Std. Deviation (0.877) is more than the mean value of female numbers (2.25) with Std. Deviation (0.519) (Table 5. 1). However, in the case of age group, the results showed that the underage has an interest in only three kinds of RES which are Having a picnic (mean=1.00, Std. Deviation=0.00), Playing soccer and basketball (mean=1.50, Std. Deviation=0.707), and Walking (mean=1.00, Std. Deviation=0.00). Moreover, like adults, older has an overwhelming level of interest in both Having a picnic with mean value (1.70, 1.50 respectively) and Std. Deviation (0.483, 0.548 respectively), and Walking activity with mean value (1.67, 1.00 respectively) and Std. Deviation (0.500, 0.000 respectively). The mean value of both adult's and youth's numbers (1.76, 1.75 respectively) with Std. Deviation (0.431, 0.441 respectively) is more than the mean value of both underage and older numbers (1.20, 1.30 respectively) with Std. Deviation (0.447, 0.483 respectively).

Table 5. 1: The Preferred Kind of RES Across the Demographic Data (Source: Author)

Which recreation activities you prefer to perform?			Having a picnic	Playing soccer and basketball	Water sport	Visiting historical sites	Walking	Camping	Other	Total		
										Mean	N	Std. Deviation
Kind of group	Family/ social group	Mean	2.29	2.14	2.60	2.00	2.33	-	3.00	2.33	43	0.644
		N	14	7	5	1	15	-	1			
		Std. Deviation	0.825	0.690	0.548	0.000	0.488	-	0.000			
	Individual	Mean	2.57	1.90	2.25	2.23	2.17	2.67	-	2.30	82	0.697
		N	28	10	4	13	24	3	-			
		Std. Deviation	0.742	0.316	0.500	0.599	0.702	1.155	-			
	Educational group	Mean	2.14	2.00	2.00	2.00	2.33	3.00	-	2.19	21	0.402
		N	7	1	3	3	6	1	-			
		Std. Deviation	0.378	0.000	0.000	0.000	0.516	0.000	-			
Gender	Male	Mean	2.62	1.50	2.00	2.50	2.25	4.00	-	2.40	43	0.877
		N	13	2	1	6	20	1	-			
		Std. Deviation	0.961	0.707	0.000	0.837	0.786	0.000	-			
	Female	Mean	2.36	2.06	2.36	2.00	2.24	2.33	3.00	2.25	103	0.519
		N	36	16	11	11	25	3	1			
		Std. Deviation	0.639	0.443	0.505	0.000	0.436	0.577	0.000			
Age	Underage	Mean	1.00	1.50	-	-	1.00	-	-	1.20	5	0.447
		N	1	2	-	-	2	-	-			
		Std. Deviation	0.000	0.707	-	-	0.000	-	-			
	Youth	Mean	1.81	1.93	1.88	1.73	1.59	2.00	-	1.76	103	0.431
		N	32	14	8	15	32	2	-			
		Std. Deviation	0.397	0.267	0.354	0.458	0.499	0.000	-			
	Adult	Mean	1.70	2.00	2.00	1.00	1.67	2.00	2.00	1.75	28	0.441
		N	10	2	4	1	9	1	1			
		Std. Deviation	0.483	0.000	0.000	0.000	0.500	0.000	0.000			
	Older	Mean	1.50	-	-	1.00	1.00	1.00	-	1.30	10	0.483
		N	6	-	-	1	2	1	-			
		Std. Deviation	0.548	-	-	0.000	0.000	0.000	-			
Total		Mean	1.73	1.89	1.92	1.65	1.56	1.75	2.00			
		N	49	18	12	17	45	4	1			
		Std. Deviation	0.446	0.323	0.289	0.493	0.503	0.500	0.000			

5.2.2 Preferred Kind of Recreational Sports

A relationship map between variables was utilized to investigate the relationship between the participants' age-group/ gender variables and the kind of recreational sports by using SPSS (Figure 5. 4, Figure 5. 5). Research participants were asked about recreational sports they prefer to practice in recreation sites. The survey instrument allowed the respondent to choose one of the five sports activities commonly practiced in the study area (Aquatic sports, biking, basketball, runway, or football).

In the case of gender, there is a high relationship between females and football and aquatic sports, which means most females were very interested in both types of sports (Figure 5. 4). Like females, males were very interested in both football and aquatic sports. Overall, based on that, I can say that the most preferred sports in recreating sites are football and aquatic sports. That means it is necessary for the planner and decision-makers to give high priority to this kind of recreation sports in future planning strategies.

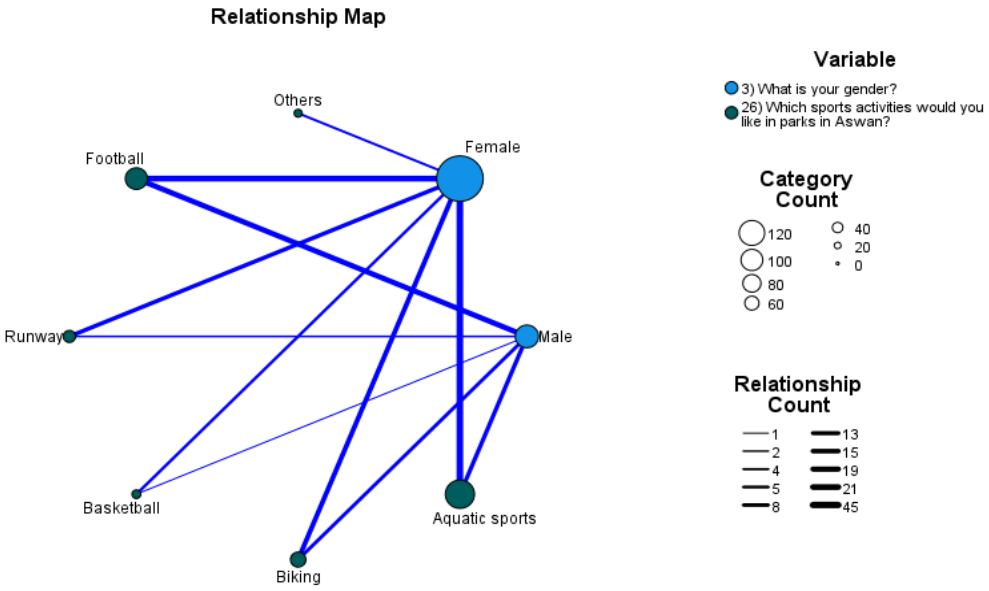


Figure 5. 4: The Relationship Between The Participants' Gender and Preferred Recreation Sport Activity (Source: Author)

However, in the case of the age group, the results showed that the underage has an interest in only three kinds of recreational sports: biking, football, and aquatic sports (Figure 5. 5). Moreover, like adults, the youth age group has an overwhelming interest level in practicing football and aquatic sports in the recreation sites. However, in the case of the older age group, most of the elderly are not prefer any kind of recreational sports, maybe that's because of the health problem. Overall, in all age-group except the elderly, the most preferred spots activities preferred in the recreation sites are aquatic sports, football, and biking, respectively.

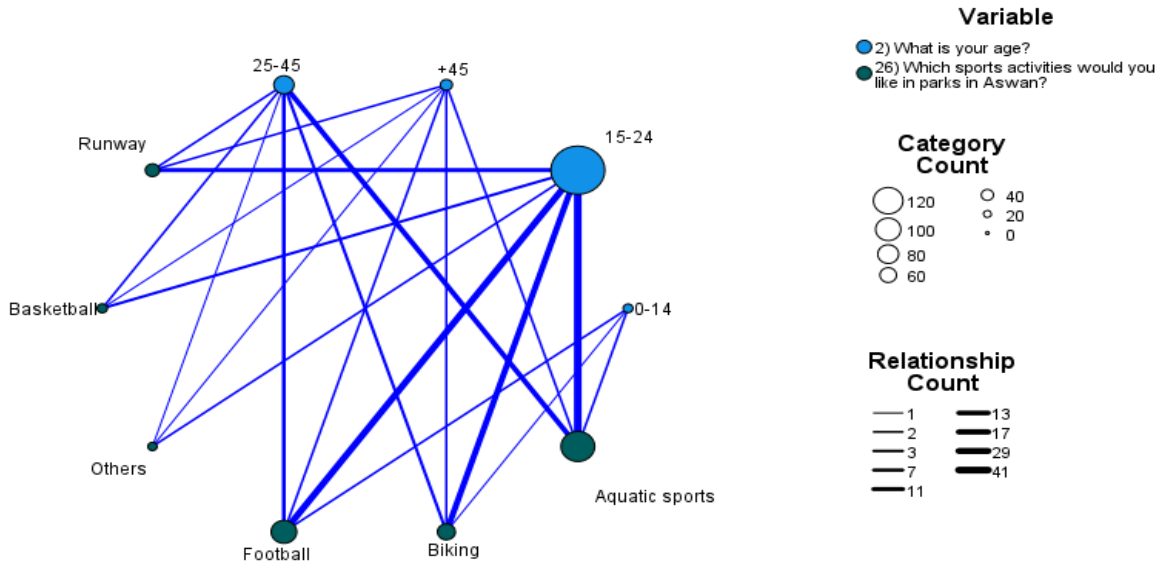


Figure 5. 5: The Relationship Between The Participants' Age-Group and Preferred Recreation Sport Activity (Source: Author)

5.2.3 Preferred Kind of Recreational Services

In order to find the most preferred recreation services across both gender and age groups, a relationship map between variables was utilized by using SPSS (Figure 5. 6, Figure 5. 7). Research participants were asked about the type of recreation services they prefer in recreation sites. The survey instrument allowed the respondent to choose one of the five sports activities appropriate to practice in the study area (walking paths, sports area, horseback riding, culture sites, biking, picnicking).

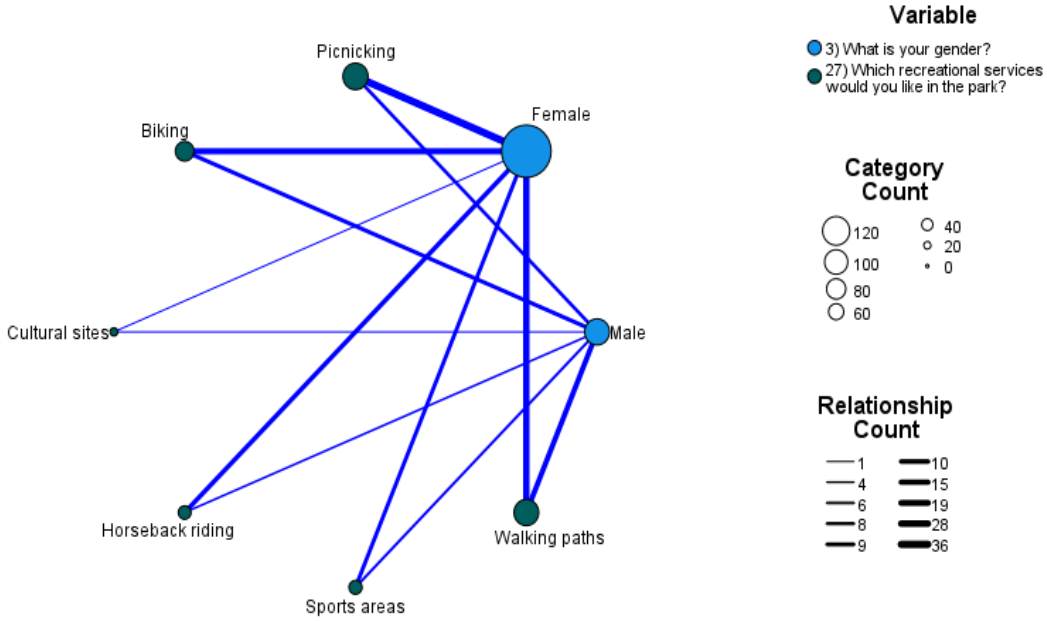


Figure 5. 6: The Relationship Between The Participants' Gender and Preferred Recreational Service (Source: Author)

In the case of gender, there is a high relationship between females and all picnicking areas, biking areas, and walking paths areas (Figure 5. 6). Like females, males were very interested in the picnicking area, biking area, and walking paths area. Overall, based on that, I can say the most preferred recreational services have to be in the recreation sites picnicking area, biking area, and walking paths area. That means it is necessary for the planner and decision-makers to give high priority to this kind of recreational service in future planning strategies.

However, in the case of the age group, the results showed that the underage has an interest in only two kinds of recreational services, which are biking and picnicking areas (Figure 5. 7). Moreover, the youth age group preferred all kinds of proposed recreational services except cultural sites. While the adult age group preferred walking paths and picnicking as a recreational service in recreation sites, the elderly are not mentioned to any desired kind of recreation services. Overall, in all age-group except the elderly, the most recreation services preferred to be in the recreation sites are picnicking, walking paths, biking, horseback riding, and sports areas, respectively.

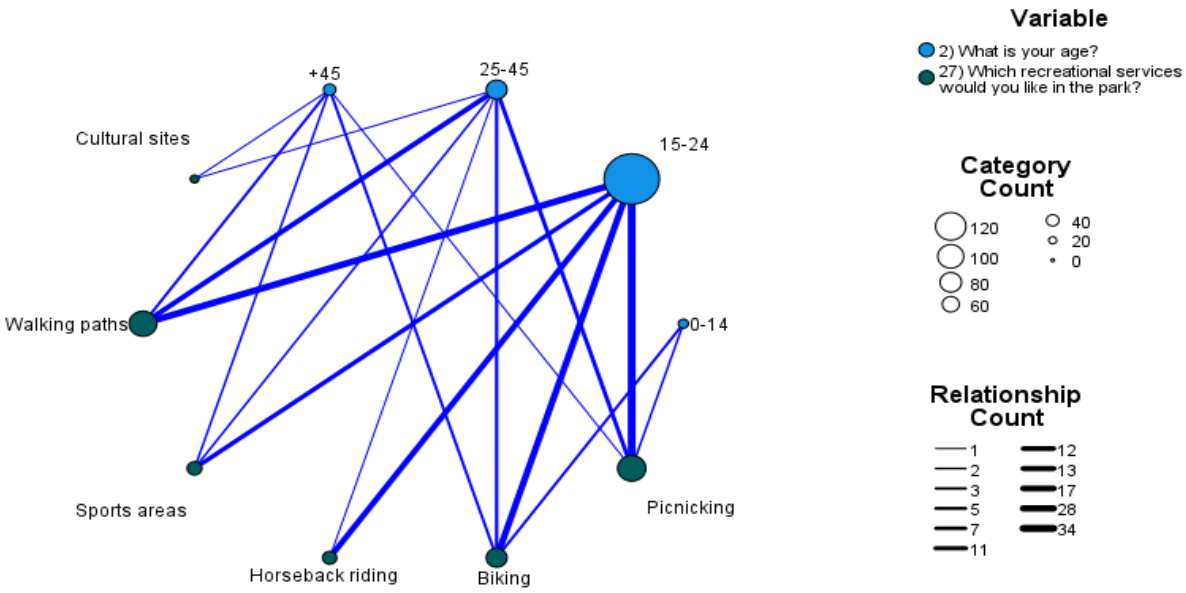


Figure 5. 7: The Relationship Between The Participants' Age-Group and Preferred Recreational Service (Source: Author)

5.2.4 Preferred Areas for Practicing Running and Biking Activities

In order to find the most preferred areas for practicing running and biking activities age group, a relationship map between variables was utilized by using SPSS (Figure 5. 8). Research participants were asked about the preferred place for practicing running and biking activities. The survey instrument allowed the respondent to choose one of the following five areas (close to a residential area, close to water bodies, close to roads/transportation, close to nature and open green areas, or close to the city Centre).

The results showed that the underage preferred only three kinds of areas where the running and biking baths could be established, which are areas "close to a residential area," "close to water bodies," and "close to roads/transportation." Moreover, the youth age group preferred all proposed areas for running and picking bath establishments. The adult age group preferred both areas, which are close to water bodies and close to nature and green places, to establish running and biking trails. The elderly mentioned all areas as a preferred site for running and biking trails with equal relationships (Figure 5. 8). Overall, in all age-group except the elderly, the most preferred areas to be utilized as the running and biking trail are areas that are "close to a residential area," "close to water bodies," "close to nature and open green areas," and "close to city Centre." That means it is necessary for the planner and decision-makers to give high priority to these areas when selecting the appropriate site for running and biking trails in future planning strategies.

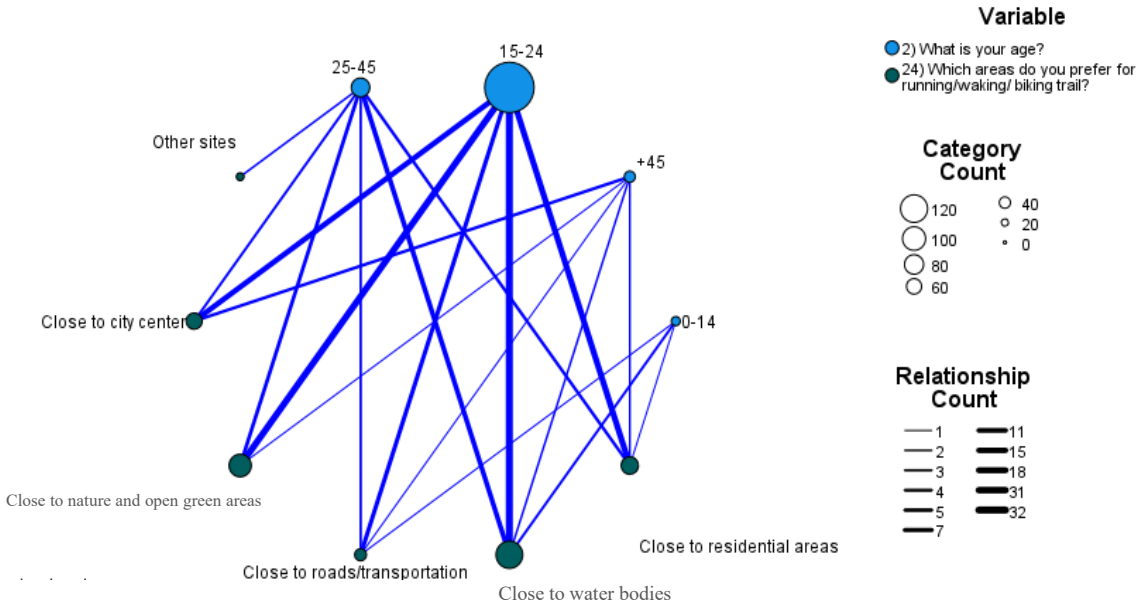


Figure 5. 8: The Relationship Between The Participants' Age-Group and The Preferred Areas for Walking/Running Trail (Source: Author)

5.3 Reasons to Participate/ Not Participate In RES

In this section, I intend to discuss possible reasons for participating in recreation for both genders and age-group. The survey question in this section is to ask the respondents to state if they use recreation sites what the primary purpose of that is. When I asked the responders to indicate the reason for visiting recreational sites, the answers are differed based on the genders and age group. The survey instrument allowed the respondent to choose one of the most common reasons for participating in RES (e.g., Enjoy the outdoors or nature, Walk or bike for exercise, Play sports, Participate in family activities, Picnic, and general leisure activities, Use a specific facility at a park, Meet friends, Attend special events/concerts/movies or Don't use parks).

In case of gender, while the majority of males (11 out of 43) said that they were visiting a recreational site for walking or bike for exercise, most of the females said they were visiting a recreational site to enjoy the outdoors or nature (19 out of 103) (Table 5. 2). However, in the case of the age group, the results showed that the underage was visiting recreation sites for only two reasons firstly; they were visiting the recreational site for practicing walk or bike for exercise, secondly; they were visiting the recreational site for playing sports. Moreover, like youth, adults were visiting recreational sites for four main reasons, which are enjoying the outdoors or nature with mean value, walking or biking for exercise with mean value, playing sports with mean value, and finally; participating in family activities (Table 5. 2). Regarding the order of the response of visiting recreational sites, I can rank it based on the Mean value from the lowest mean value to the highest mean value as the following; (1) Enjoy the outdoors or nature (Mean=1.00), (2) Walk or bike for exercise (Mean=2.00), (3) Play sports (Mean=3.00), (4) Participate in family activities (Mean=4.00), (5) Picnic and general leisure activities (Mean=5.00), (6) Use a specific facility (Mean=6.00), (7) Meet friends (Mean=7.00), and finally (8) Attend special events/concerts/movies (Mean=8.00). Based on the mentioned order of the reasons for visiting recreational sites, it is recommended to consider these orders of reasons in the future planning of recreation sites by fulfilling the physical and spatial related demands.

Table 5. 2: The Reasons for Visiting Recreation Sites Across the Demographic Data (Source: Author)

What are the primary reasons for visiting in RES?			R1	R2	R3	R4	R5	R6	R7	R8	R9
Gender	Male	Frequency	9	11	9	5	4	2	2	-	1
	Female	Frequency	32	19	18	16	10	5	2	1	-
Age	Underage	Frequency	-	4	1	-	-	-	-	-	-
	Youth	Frequency	32	21	20	13	9	5	1	1	1
	Adult	Frequency	7	4	4	7	2	1	3	-	-
	Older	Frequency	2	1	2	1	3	1	-	-	-
Total		Mean	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
		Frequency	41	30	27	21	14	7	4	1	1
Rank			1	2	3	4	5	6	7	8	9

(R1) Enjoy the outdoors or nature; (R2) Walk or bike for exercise; (R3) Play sports; (R4) Participate in family activities; (R5) Picnic and general leisure activities; (R6) Use a specific facility; (R7) Meet friends; (R8) Attend special events; (R9) Don't use parks.

Overall, the answer to this question in the case of both gender and age group indicates that there is a significant difference between males and females regarding the reasons for visiting recreational sites. Moreover, there is a significant difference between the four mentioned age- group.

5.4 Measures of Constraints

Respondents' perceived leisure constraints were measured using two mains patterned which are "Interpersonal Constraints" and "Structural Constraints". Respondents were asked to rate reasons they did not participate as much as desired. Table 5. 3 illustrates the simple frequency distributions and means run to determine the perception of constraints across the demographic characteristics of the samples. For ease in understanding and correctly interpreting the data, the constraints items were placed under their respective categories. Four of the items fell under the category of "Interpersonal Constraints," which are health problems, being too old, lack of companion, financial problems, and three items were in the "Structural Constraints" domain which are lack of time, insufficiency of recreation activities areas, and others like traffic, crowdedness, etc.

As shown in Table 5. 3, the items with the lowest mean score were insufficiency of recreation areas, lack of time, and financial problems (1.00, 2.00, and 3.00, respectively). This indicated that the respondents tend to believe they were constrained from practicing RES because they didn't have enough time and enough money besides the problem of Insufficiency of recreation areas. The following items with the lowest mean score (4.00, 5.00) were "being too old" and "health problems". This revealed that most respondents also felt this to be a significant reason they were constrained from practicing RES. The items that scored the highest mean score (7.00, 6.00) were other like traffic, crowdedness problem, and lack of companion. This indicated that respondents reported that both of mentioned items were not a major constraining factor on RES participation.

Table 5. 3: The Constraints That Prevent Local from Practicing Recreation Activities Across the Demographic Data (Source: Author)

Main constraints for perform recreation activities			Interpersonal Constraints				Structural Constraints		
			Health problems	Being too old	Lack of companion	Financial problems	Lack of time	Insufficiency of recreation areas	Others like traffic, crowdedness
Gender	Female	Frequency	2	4	2	11	24	-	1
	Male	Frequency	9	1	1	36	51	4	-
Age	Underage	Frequency	-	-	-	1	4	-	-
	Youth	Frequency	8	3	3	38	48	3	-
	Adult	Frequency	1	1	-	6	18	1	1
	Older	Frequency	2	1	-	2	5	-	-
Income	<2000 EGP	Frequency	10	3	3	39	55	4	1
	>2000 EGP	Frequency	1	2	-	8	20	-	-
Total		Mean	5.00	4.00	6.00	2.00	3.00	1.00	7.00
		Frequency	11	5	3	47	75	4	1

In order to find the constraints that prevent people from RES participation across both gender and age-group variables, a relationship map between variables was utilized to investigate by using SPSS (Figure 5. 9, Figure 5. 10). Research participants were asked about the constraints preventing them from RES practicing. The survey instrument allowed the respondent to choose one of the seven proposed constraints (health problems, being too old, lack of companion, financial problems, lack of time, insufficiency of recreation activities areas, and others like traffic, crowdedness, etc.).

In the case of gender, there is a high relationship between females and financial problem constraints and lack of time constraints (Figure 5. 9). Like females, males choose financial problems and lack of time as the main constraints preventing them from practicing RES. Overall, based on that, I can say that both genders have the same constraints that prevent both of them from practicing RES regularly.

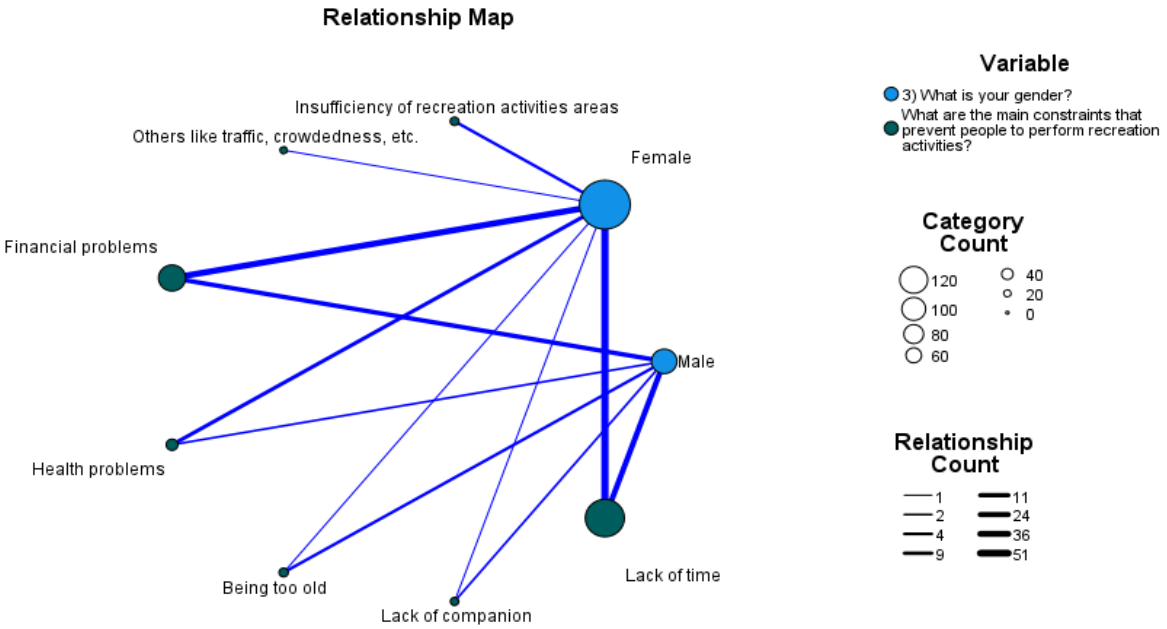


Figure 5. 9: The Relationship Between The Participants' Gender and The Common Constraints (Source: Author)

Regarding the age group, like the elderly, the underage group considered the Lake of time as the primary constraint preventing them from practicing RES (Figure 5. 10). That means they said they do not have enough time for practice RES, and they do not consider the RES the priority. While the youth addressed three constraints as the main reasons for not practicing recreation activities, which are financial problems; lack of time; and health problems, the adults considered only two items that prevent them from practicing RES, which are financial problems and lack of time (Figure 5. 10). Overall, based on that, I can say that all mentioned age-group addressed financial problems and lack of time as the main constraints preventing them from practicing RES regularly.

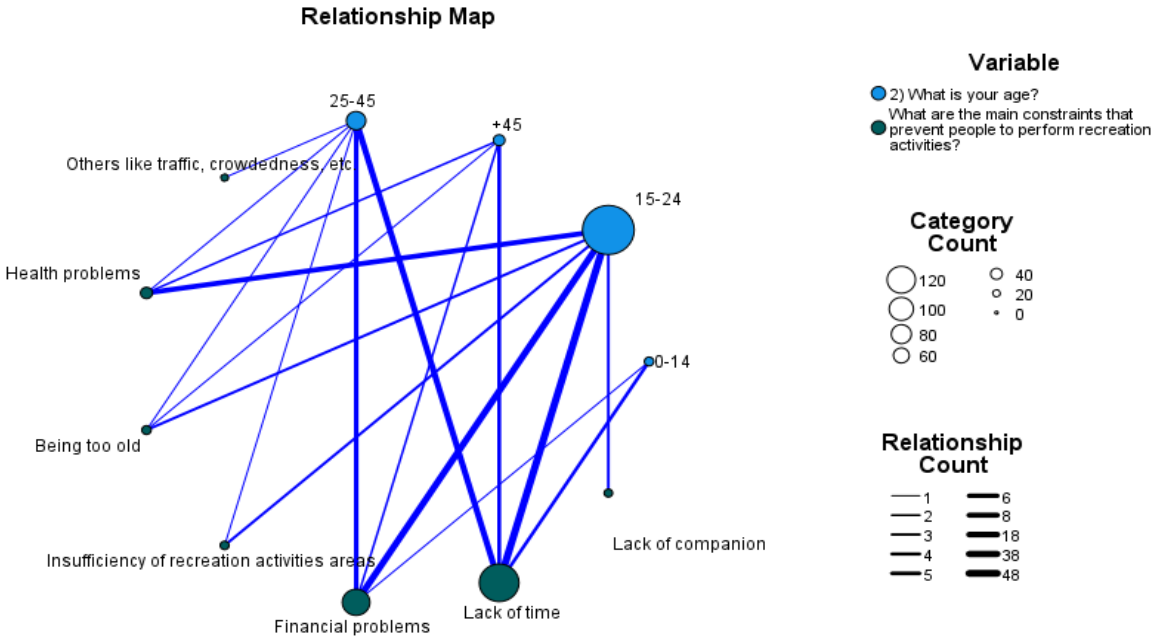


Figure 5. 10: The Relationship Between The Participants' Age and The Common Constraints (Source: Author)

5.5 Willingness to Pay

In order to find the main factors that affect the willingness to pay for recreation activities maintenance, the survey instrument allowed the respondent to choose one of the five proposed factors (offering special interest to me, located in a more convenient location, activity close to me, offering activities for kids and Others) (Figure 5. 11). By asking the participants about the factors that influence the amount they would pay for recreation activities, the majority of respondents stated: "offering special interest to me" factor as the essential recreation activities they would pay for (42 out of 146), followed by both of "located in more convenient location" and "activity close to me" (37, 34 out of 146 respectively).

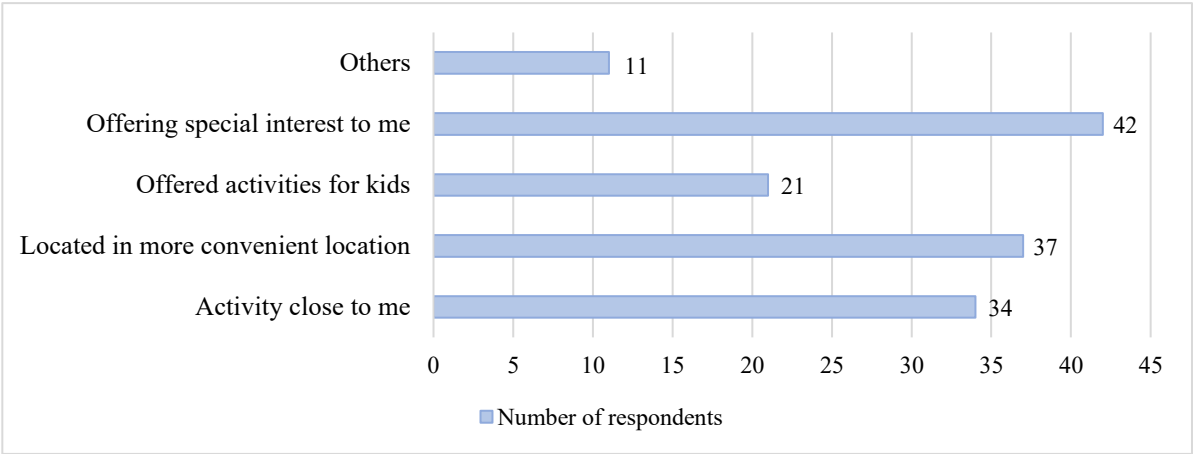


Figure 5. 11: The Factors Affecting on The Welling to Pay for RES Maintenance (Source: Author)

Overall, the answer to this question indicates that three main factors affect the willingness to pay for RES maintenance. These factors are the following; offering special interest to me, located in a more convenient location, and activity close to me, respectively. That means it is important to consider these factors in the future urban planning for new recreation sites in the study area.

A relationship map between variables was utilized to investigate the relationship between the participants' age-group/ gender variables and the kind of recreation activities willingness to pay for by using SPSS (Figure 5. 12, Figure 5. 13). Research participants were asked about the kind of RES they would pay higher entrance fees than the current fee to support the maintenance of RES. In the case of gender, both "water playgrounds" and "more river access for recreation, swimming and boating" recreation activity is the most preferred to pay for maintenance by females (Figure 5. 12). Like females, the majority of males agreed to pay more entrance fees for both "more river access for recreation, swimming and boating" and "water playgrounds" recreation activities. Based on that, I can say there is no difference between both genders.

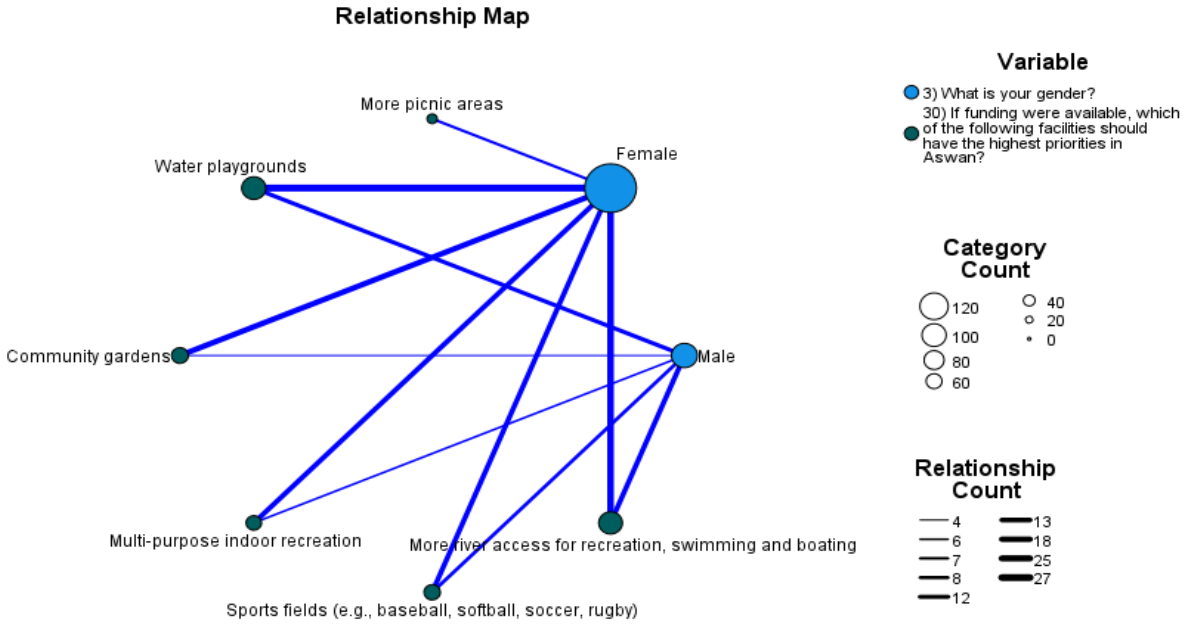


Figure 5. 12: The Relationship Between The Participants' Gender and The Preferred Recreation Facilities to Pay for Maintenance (Source: Author)

However, in the case of the age group, the results showed that the underage preferred only two kinds of RES to pay for maintaining issues which are "Water playgrounds" and "Sports field" (Figure 5. 13). Moreover, like adults, older have an overwhelming level of interest in paying for both "water playgrounds" and "multi-purpose indoor recreation ."However, in the case of the youth age group, they prefer to pay for all mentioned RES except "more picnic areas ."Based on that, I can say there is a significant difference between all age-group regarding the question about the preferred kind of RES they preferred to pay more entrance fee for maintenance.

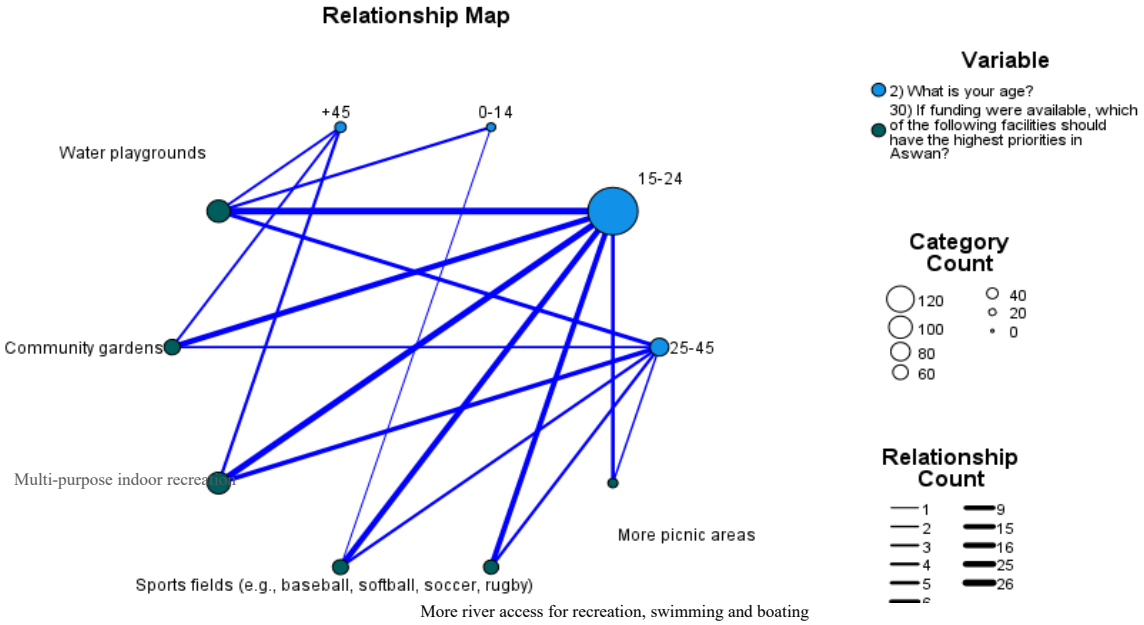


Figure 5. 13: The Relationship Between The Participants' Age and The Preferred Recreation Facilities to Pay for Maintenance (Source: Author)

In order to find the relation between willing to pay and monthly income, a multiple linear regression model was used (Table 5. 4), in which the variable monthly income level was considered the independent variable and the welling to pay as the dependent variable. The regression model results demonstrated that there was not a significant relationship between "willing to pay" and the monthly income. Through the value of (F), which is (1.654) with a significance (0.201) more than the level of significance (0.005), the results explain that the monthly income variable explains only 1.1 % (R2) of variations in welling to pay rate. The value of the beta, which shows the relationship between the welling to pay and the level of monthly income, came with a value (0.365) with statistical significance, as this can be deduced from the value of T (1.286) and the significance associated with it (0.201). This means that whenever the level of monthly income improves by one unit, the ability to pay will improve by (0.365) units. A multicollinearity test was carried out to verify the existence of the mentioned relationship. The result revealed that the Variance Inflation Factor (VIF) of the model was (1.000<3), which indicates that there is no problem of multilinearity among the model variables.

Table 5. 4: Liner Regression Between Monthly Income (Source: Author)

Variance	value
R Square	0.011
F Value	1.654
F (Significance)	0.201
T Value	1.286
T (Significance)	0.201
Beta Value	0.365
VIF factor	1.000

5.6 The Preferred Areas of Different Recreation and Ecotourism Services Using PPGIS Questionnaire-Based Map

After conducting the questionnaire for evaluating the quality of recreation service by asking the visitors about their perceptions, preferences, reasons for recreation activities participation, and the constrictions that prevent them from practicing recreation activities, I investigate the preferred area of the most preferred recreation activities the visitors mentioned in the previous Chapter by using PPGIS evaluation method. This sub-chapter presents the results from the PPGIS questionnaires based on GIS analyses performed on the collected data. These analyses are a response rate analysis and preference area analysis to find the appropriate site for the most preferred recreation activities in the study area. The GIS-data collection process is described in the methodology Chapter (Chapter 3) for all the analyses performed in this section.

5.6.1 Response Rate Analysis

The results of the response rate analysis show that respondents were generally different regarding the city. Further on, the response analysis resulted in denser response rates close to the city center and the north part of the city core. Several areas in the southern parts of Aswan city, along with villages outside the city center, are experiencing low response rates. These areas do not exceed 5 responses per 146 inhabitants. Figure 5. 14 shows the total number of responses per 146 inhabitants in each of the areas.

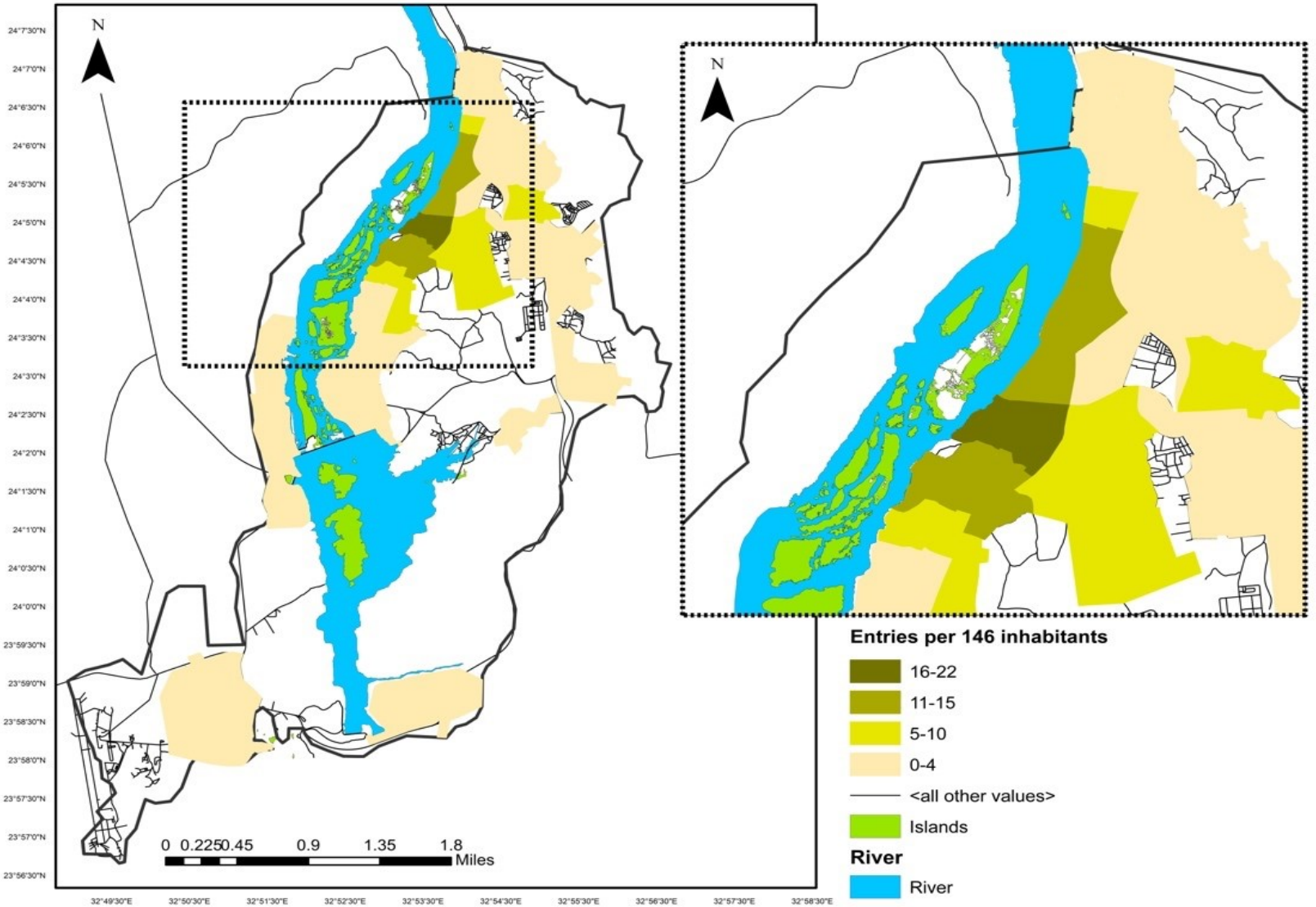


Figure 5. 14: Response Rate Analysis (Source: Author)

5.6.2 Preference Areas Analysis

In this section, I intend to discuss the preferred sites for different kinds of RES and social meeting. The survey question in this section asks the respondents to choose the preferred site for different items.

In the case of riding a horse carriage and camel riding, as you can see in Figure 5. 15 Sec.3, the most preferred sites for that kind of recreation activities were located around the river beach. When I asked the participants to indicate which areas, they prefer to meet friends, the answers differed. As you can see in Figure 5. 15, the majority of respondents prefer Seheil Island as the most preferred site for meeting friends, followed by Aswan Botanical Garden and Kornish el-Nile. However, the lowest number of respondents consider both Feryal Garden and Elephantine Island Pyramid the most preferred sites for meeting friends.

According to the preferred sites for gathering with family, the results showed that the majority of respondents stated that both Aswan Botanical Garden and Seheil Island were the most suitable areas to gather with family. In the case of the preferred sites for sailing by boat and the place where the respondents were feeling peaceful and relaxing, most of the respondents preferred the Islands as the preferred site. Overall, the results show that several areas are identified as preference spots for different kinds of recreation activities such as walking in nature and cycling, gathering with family, meeting friends, horse carriage, feeling peaceful and relaxing, and sailing by boat. Figure 5. 15 shows preferred sites which contain areas along the river beach, and others are located in the islands.

Like riding a horse carriage activity, walking in nature and cycling is preferred to practice in several areas, such as the east and west bank of the river coast (see Figure 5. 15 Sec.3,4), meaning a high number of respondent's entries are found there. However, the most prominent areas with numerous entries which preferred as a site for gathering with family is found in two islands and one garden, which are Aswan Botanical Garden (see Figure 5. 15 Sec.3) and Seheil Island (see Figure 5. 15, Sec.1), and Feryal Garden (see Figure 5. 15 Sec.3). Subsequently, only three main spots can be identified as preferred areas for family gatherings, shown in Figure 5. 15 Sec.2 and Sec. 3.

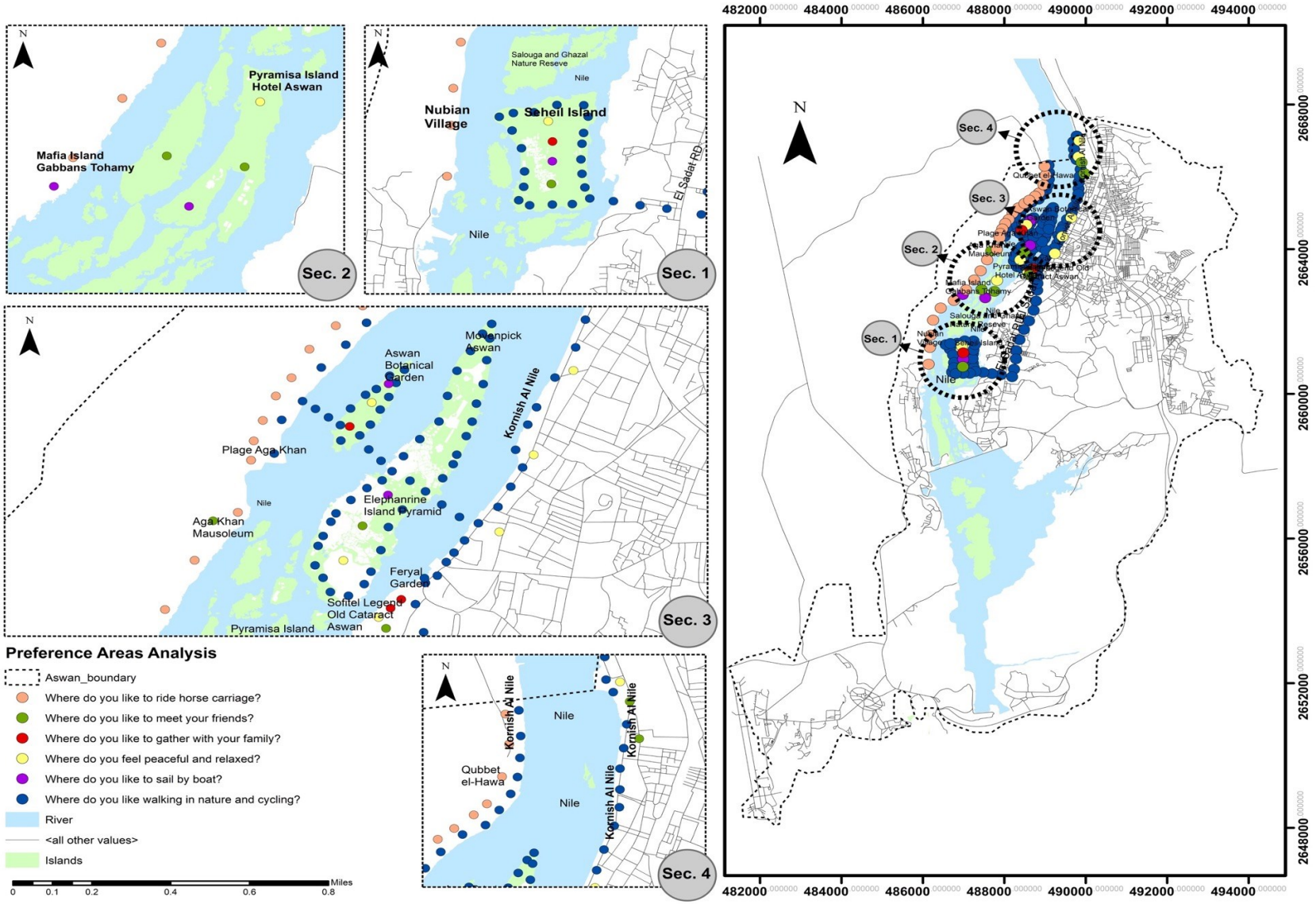


Figure 5. 15: Preference Areas Analysis based on PPGIS results (Source: Author)

Moreover, A preferred place appropriate for meeting a friend can be identified just in six places: Pyramids Island Hotel Aswan, Seheil Island, Aswan Botanical Garden, Movenpick Aswan, Feryal Garden, and Kornish Al-Nile. These areas are the most prominent spots in the city which are preferred for friend gatherings, meaning that it is the area where the most entries are statistically significant over a specific spatial extent.

The results also show several areas can be identified as places where the visitors feel peaceful and relaxing. These areas are primarily located along the river beach and islands (see Figure 5. 15). These areas have the large respondents' rates from participants, and they are all located very close to each other. Notable is that they are also located close to the city center and main road in the city. According to the appropriate place for sailing with a boat, the results showed that the majority of residents identified four main spots as a proper place for sailing to by boats, and these places such as Aswan Botanical Garden, Movenpick Aswan, Pyramids Island Hotel Aswan, Mafia Island Gabbans tohamy and Qubbet el-Hawa. Figure 5. 15 illustrates all the appropriate places as a spot for different recreation activities. Generally, the distribution of proper sites for practicing specific kinds of RES was identified along the coast rather than other islands and gardens.

5.7 Approach for Recreation Suitability Evaluation (RSE) to Recreation Planning

In this section, I intend to answer the research question about the appropriate approach for RES planning by integrating between proposed suitable areas for RES based on land suitability evaluation map and visitor demands based on demand evaluation analysis and PPGIS. Overall, recreation planning aims to achieve a balance between resources and community needs with management planning objectives to improve the quality of life for people. By the end of this section, I intend to; (1) Determine the most suitable recreational sites; (2) Measure the demands and tendencies of visitors; (3) Suggest recreational activities and facilities for the most suitable sites in the study area; (4) Develop an approach for the methodology of recreational suitability analysis for Aswan city or other areas. Specific objectives are to collect and identify the entire current natural, cultural, and visual data of Aswan city, create PPGIS and land suitability maps, and lead to a recreational plan and design of Aswan city in the future.

5.7.1 Overlaying Analysis

After analyzing the visitor demands and preference recreation activities, I can overlay both of land suitability map of RES, which was created in Chapter 4 based on the MCE model, and the visitor demands map, which was developed based on future visitor demands (see the previous section). Overlaying analysis can be conducted using spatial analysis tools in the ArcGIS environment. Figure 5. 16 demonstrates the produced map after overlaying analysis applied on all created PPGIS

maps. The results yielded by map overlaying provide strong evidence that all the proposed sites, which the visitor chose by using PPGIS (Figure 5. 16 map A, B,C,D,E,F) to fulfill future demands, are located in the most suitable areas based on land suitability map (Figure 5. 16). Moreover, as you can see in Figure 5. 16, I converted the PPGIS results, which showed in Figure 5. 15, to proposed sites for future recreation activities. It is noticed that most of the proposed sites for future RES are located along the river beach and islands (Appendix 10).

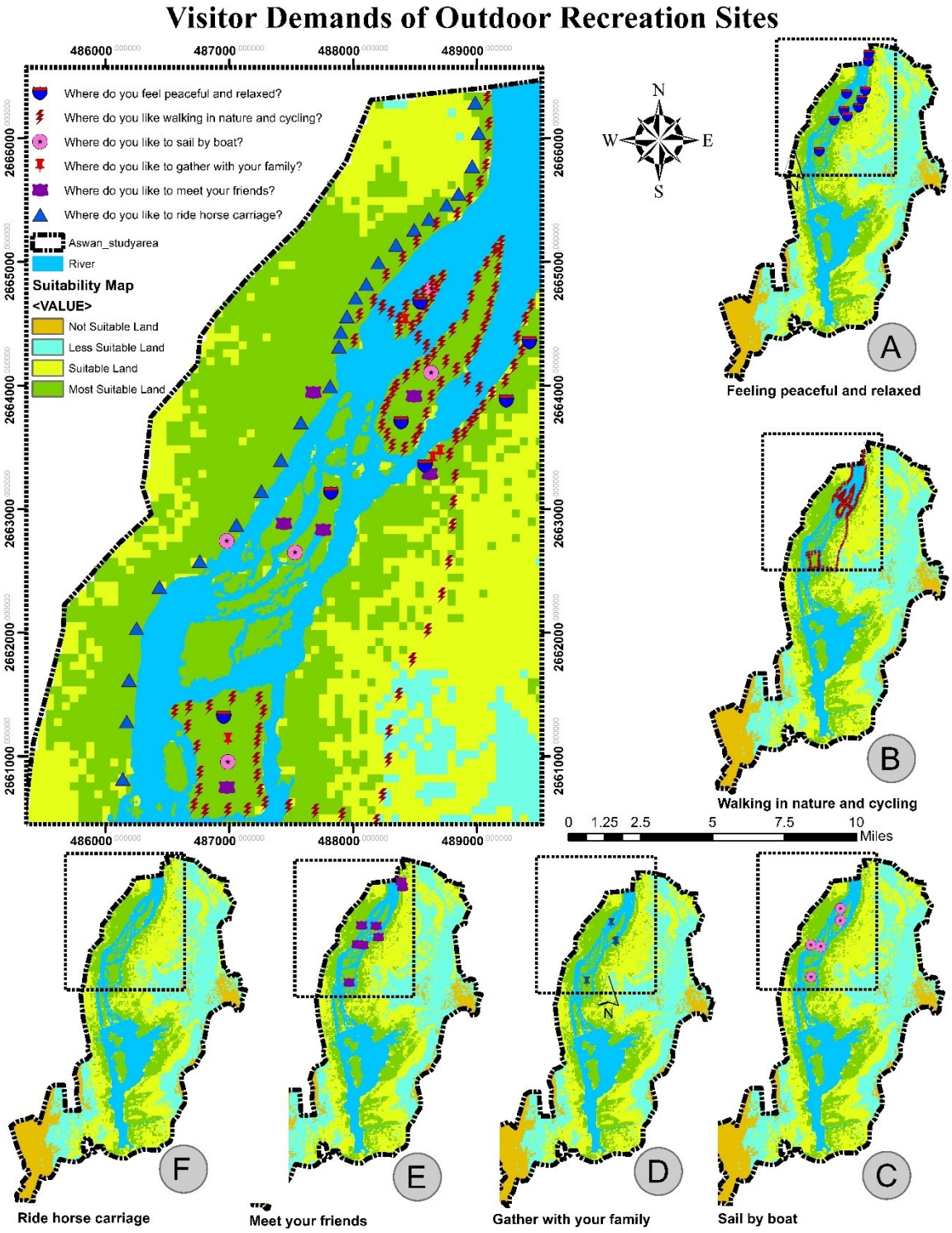


Figure 5. 16: Visitor Demand Analysis of Recreation Sites (Source: Author)

5.7.2 Output Evaluation of Visitor Demands of Recreation and Ecotourism Activities

After the recreational suitability map and visitor demands map were overlaid, eighteen potential recreational sites were selected in the most suitable units based on the land suitability map (Figure 5. 17). Various recreational facilities and activities were suggested at each site. All of the collected results about; (1) the preferred recreation activities and facilities; (2) the constricts of practicing recreation activities; (3) the suitability map results; and (4) the future visitor demands were considered all together when producing the proposed RES (Figure 5. 17). And the proposed sites are as the following:

- Kornish el-Nile and its surroundings, or sites number 1,2,3,4,5, were the most suitable recreational sites. Improvements were proposed, such as picnic sites, biking, cycling, sightseeing points, walking and running paths, aquatic sports in the lake, a cafeteria, food and local outlets, fountains, climbing, bird watching, sunsets observation, scenic points, a cafeteria, and sailing with boat view (Figure 5. 17).
- Elephantine Island Pyramid, or sites number 6,7,8, were determined to be the most suitable recreational sites, and improvements were proposed, such as a garden, camping, and picnic sites, a teleferic (cable railways), a rock garden, a cafeteria, scenic points, and playgrounds were suggested. Aswan Botanical Garden, or sites number 9, was determined to be the most suitable recreational site, and improvements were proposed, such as a garden, camping, and picnic sites, a cafeteria, scenic points, an arboretum garden, walking and running path, and scenic points were suggested (Figure 5. 17).
- The East bank of the river, or sites number 10,14, were determined to be the most suitable recreational sites, and improvements were proposed, such as horse and camel riding paths, running and cycling paths, scenic points, and mountaineering (Figure 5. 17).
- Pyramisa Island, or sites number 11,12,13, were determined to be the most suitable recreational sites, and improvements were proposed, such as a garden, camping, and picnic sites, a cafeteria, scenic points were suggested. Sheil Island, or sites number 15,16,17,18, were determined to be the most suitable recreational sites, and improvements were proposed, such as walking and running path, cycling, a cafeteria, camping areas, picnic sites, and playgrounds were suggested (Figure 5. 17).

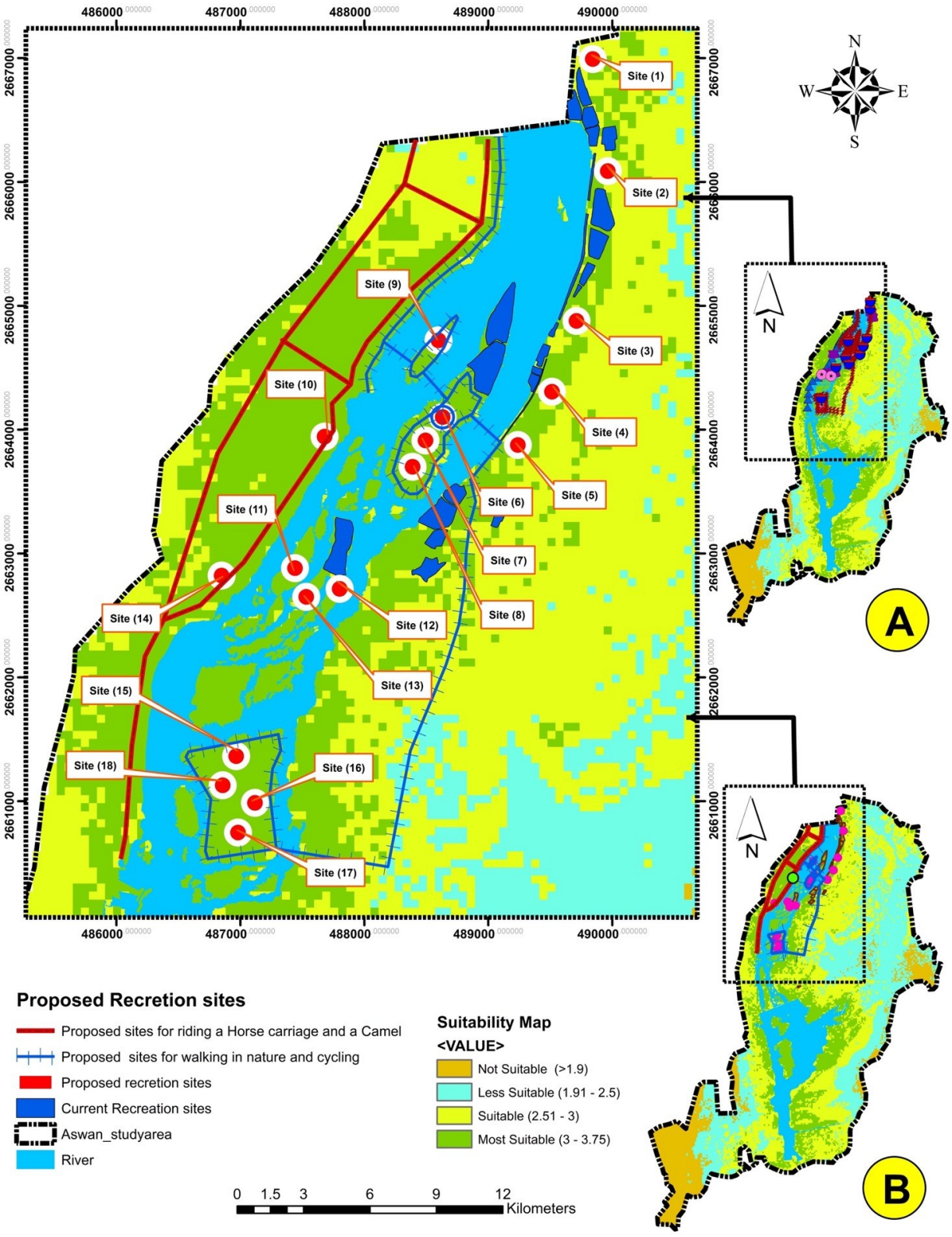


Figure 5. 17: Potential Recreational Sites for Future Map (Source: Author)

6. NEW SCIENTIFIC RESULTS

The most important new scientific results of the present dissertation can be summarized in ten following theses as follows (Appendix 11):

THESIS 1: Evaluation criteria for Recreation and Ecotourism Services (RES)

> ***"Based on deep analysis of the scientific literature review and expert-based questionnaire results, I identified that there are many different kinds of evaluation criteria could be used in the evaluation process of RES which are environmental, social and economic criteria. I indicate the importance order of these criteria which is as the following: environmental criteria are the most important criteria, followed by social and economic criteria"***

According to the literature review analysis, I divided each main group into criteria and sub-criteria. I identified five criteria that belong to the environmental group and 5 related sub-criteria (e.g., Vegetation, Soil erosion, and Elevation). While three criteria have been identified in case of social group and 7 related sub-criteria (e.g., Residential areas, Attractive sites, and Road). According to economic group, I identified 4 criteria and 11 related sub-criteria (e.g., Travel cost, Carrying capacity Viewpoint, and Landcover). An online questionnaire has been established to order the chosen RES evaluation criteria based on their importance. Only Experts in urban planning, recreation, and tourism have been involved in this questionnaire. In this study, 200 questionnaires form had been sent to experts' emails, and all criteria gave a rating value from 1 "least important" to 9 "Extremely important". The number of participants who started with the assessment and ranking of the evaluation criteria was just 53, whereas 41 evaluated the complete set of 12 criteria for at least one question. The participation/response rate was approximately 26%. Based on the scientific analysis of expert-based questionnaire results, I defined the order of the main criteria group based on their importance.

A. The importance order of the environmental evaluation criteria of RES is as the following (the order from the most important to the least important); comfort (53.7%), pollution (51.2%), availability (29.3%), biodiversity (24.4%), and topography (14.6%) sequentially.
B. Social criteria importance order, I defined that security (41.5%) is the most important social sub-criteria followed by accessibility (36.6%) and compatibility criterion (22.0%)

C. In the case of economic criteria, I summarized that land use of the surrounding area (37%) is the most important sub-criteria, followed by efficiency (31.7%) and utility (17.1%). However, the site's price (9.8%) has been scored as the lowest impotence sub-criteria.

THESIS 2: Evaluation criteria and sub-criteria utilized in the land evaluation process of RES.

> ***"According to the literature review analysis, I Justified that only the spatial sub-criteria could be used in the land evaluation process, which are biodiversity, availability, comfort, pollution, topology, and accessibility. And I considered nine sub-criteria as the raster layers utilized as input layers in the land evaluation model"***

A. I analyzed more than 200 publications to collect the possible evaluation criteria for different kinds of RES.
B. I divided the collected criteria into spatial and non-spatial criteria.
C. Nine main spatial sub-criteria were utilized in the land evaluation of RES. All environmental sub-criteria were included in the evaluation process which are vegetation (landscape scenery element), soil erosion, water bodies (landscape scenery element), active pollution point, and elevation. However, in the case of social, I considered 3 sub-criteria in the evaluation process which are distance from residential area, distance from attractive sites (landscape scenery element), and distance from road. In case of economic group, I involved only landcover criterion (landscape scenery element) in the evaluation.

THESIS 3: Multi-Criteria Evaluation (MCE) model of RES

> ***"I developed a Multi-Criteria Evaluation (MCE) model in the ArcGIS environment to be applied in the land evaluation process in this study by integrating between AHP method, which was being used for calculation RES sub-criteria weights, and ArcGIS, which was utilized to produce land suitability evaluation map"***

A. By utilizing the AHP method, I calculated the weights of the sub-criteria (W). The criteria with a high weight value were comfort (W=0,265), security (W=0,217), and pollution (W=0,126), respectively. However, the sub-criteria with the lowest weight values are as the following: topography (W=0,013), site's price (W=0,020), and compatibility (W=0,025), respectively.
B. For the creation of the evaluation model, five main steps were utilized, which are as the following: (1) Identify the spatial criteria to be converted to layers in ArcGIS environment; (2) Order all the selected criteria based on their importance; (3) Calculate the weight of each criterion by using AHP method based on the collecting criteria order; (4) Converted all the

collected spatial criteria to raster layers in ArcGIS environment; (5) Input both of raster layers of spatial criteria and criteria weights value in the created MCE model as Input data to create the land suitability evaluation map.

C. I demonstrated, based on the collected results from the analysis, that the integration between Multi-Criteria Evaluation (MCE) and GIS contributed to a more robust understanding of current recreation site distribution patterns and suitable areas for potential RES to fulfill future demands.

THESIS 4: Determination the characteristics of land suitability area of RES

> ***"After deep analysis of the suitability map results, I justified that three main characteristics have to be in the appropriate places for recreational services, which are (1) environmental problems such as pollution do not exist, (2) high vegetation density and green space is urgently needed, and (3) the areas are close to the water bodies".***

A. I divided the land suitability evaluation map into four classes: not-suitable, low-suitable, suitable classes, and most-suitable.

B. Not suitable class indicates a land parcel that relatively does not fulfill many land evaluation criteria that is not suitable for developing RES. Low-suitable class it is an intermediate level between the Not suitable and Suitable classes. Suitable class indicates a land parcel that fulfills many land evaluation criteria to optimize the existing recreation resources to properly develop and promote a mass kind of RES. That could provide various opportunities for creating RES in these sites with some modification. Most-suitable class indicates a land parcel of high suitable that is located a considerable distance from natural and culture attractive sites close to residential areas and water sources and easy access to from the towns and that is suitable for developing RES.

C. I demonstrated, based on the collected results from the analysis, that the integration between Multi-Criteria Evaluation (MCE) and GIS contributed to a more robust understanding of current recreation site distribution patterns and suitable areas for potential recreation and ecotourism services to fulfill future demands.

THESIS 5: Determination of the main categories which could be utilized in the future demand evaluation of RES

> ***"I justified that assessing the quality and demands of RES by involving users and local communities is necessary to attain managerial goals and objectives, ascertain the benefits of recreation facilities and programs, and for evaluation purposes relative to accountability".***

A. There are four main categories utilized in the RES demand evaluation process, which are: (1) Visitors' preferences and perceptions; (2) Reasons to participate in RES; (3) Constraints of RES participating; (4) Willingness to pay for maintenance of RES.
B. I developed a semi-structured questionnaire and PPGIS to collect data from residents, which could be utilized in the service demand evaluation of RES.
C. I involved 146 habitants in the evaluation process, and I asked them several questions.

THESIS 6: Identification of the preferred kind of RES across the demographic characteristics of the sample

> ***"Based on the demand evaluation, I justified that there is a significant difference in the preferred kind of outdoor recreation activities and sports across the demographic characteristics of the sample".***

When I asked the responders to indicate which recreation activities and sports they prefer to perform on the recreational sites, the answers are differed based on the genders (male, female), age group (underage, adults, youth, and older), and kind of group (family/ social group, individual, educational group).

A. According to the preferred kind of RES, the respondents who state themselves as a family/social group have an overwhelming level of interest in waking and having a picnic. like Family/social group, the individual kind group has an overwhelming level of interest in both waking and having a picnic. Education group has an overwhelming level of interest in both waking and having a picnic.
B. There are no significant differences between gender and the age group in the case of the preferred kind of RES. While both genders have an overwhelming level of interest in both waking and having a picnic, they do not prefer to practice camping and water sports (boating and swimming). However, there is a significant difference between the age group. p soccer and basketball, and walking. Like Youth, adults have an overwhelming level of interest in all kinds of RES, especially waking and having a picnic. However, the elderly people preferred four kinds of RES which are waking, having a picnic, camping, and visiting historical sites.

C. According to the preferred kind of recreational sports, there is no significant difference between both gender and the age group in the case of the preferred kind of outdoor recreation sports. There is a high relationship between females and football and aquatic sports, which means most females were very interested in both kinds of sports. Like females, males were very interested in both football and aquatic sports. In the case of the age group, the underage has an interest in only three kinds of recreational sports: biking, football, and aquatic sports, respectively. Moreover, like adults, the youth age group has an overwhelming level of interest in practicing football and aquatic sports. However, in the case of the older age group, most of the elderly are not prefer any kind of recreational sports, maybe that's because the health problem.

THESIS 7: Identification of the reasons and constraints of RES participation.

> ***"Based on the PPGIS results analysis, I justified that there are many reasons and constraints that prevent people from visiting and practicing recreation activities in Arab countries. And there is a significant difference between both genders and age-groups results"***

In Arab countries, there are many reasons for visiting RES sites. The order of most common reasons is; enjoy the outdoors or nature; walk or bike for exercise; play sports; participate in family activities; picnic and general leisure activities; use a specific facility; meet friends; or attend special events, respectively. Moreover, many constraints prevent locals from practicing RE activities which are lack of time, financial problems, health problems, being too old, insufficiency of recreation areas, lack of companion and others like traffic, crowdedness respectively. Note the first three reasons are the most common constraints.

A. I defined that there is a significant difference between the gender in case of the reasons of visiting recreation sites. For example, I justified that the majority of males said that they were visiting a recreational site for walking or biking for exercise. However, most females said they were visiting a recreational site to enjoy the outdoors or nature. However, the underage was visiting recreation sites for only two reasons: practicing walk or bike for exercise and playing sports. Moreover, like youth, adults were visiting recreational sites for four main reasons: enjoying the outdoors or nature, walking or bike for exercise, playing sports, and participating in family activities.
B. By comparing the mean value of constraints by using SPSS, I identified that the constraints with the lowest mean score were insufficient recreation areas, lack of time, and financial problems. This indicated that the respondents tend to believe they were constrained from practicing RES because they didn't have enough time and enough money besides the problem

of insufficiency of recreation areas. The following constraint with the lowest mean score (4.00, 5.00) was "being too old" and "health problems". This revealed that most respondents also felt this to be significant.

C. I justified that the constraint that scored the highest mean score (7.00, 6.00) were "other like traffic and crowdedness problem" and "lack of companion". This indicated that respondents reported that both mentioned reasons were not a major constraining factor on RES participation.

THESIS 8: Identification the main factors that effect on the willing to pay for RES maintenance in Arab countries.

> ***"Based on the result analysis, I demonstrate that three main factors affect the willingness to pay for RES maintenance in Arab countries, which are; activity offering special interest to me, activity located in a more convenient location, and activity close to me. That means it is important to consider these factors in future social planning for new RES sites"***

A. In order to find the main factors that affect the willingness to pay for recreation activities maintenance, the survey instrument allowed the respondent to choose one of the five proposed factors (offering special interest to me, located in a more convenient location, activity close to me, offering activities for kids and others).
B. By asking the participants about the factors that influence the amount they would pay for recreation activities, the majority of respondents stated: "offering special interest to me" factor as the most important recreation activities they would pay for (42 out of 146), followed by both of "located in more convenient location" and "activity close to me" (37, 34 out of 146 respectively).
C. I defined that three most important factors affect the willingness to pay issues, which are offering special interest to me, located in a more convenient location, activity close to respectively.
D. Based on a multiple linear regression model by using SPSS, I demonstrated that there was not a significant relationship between "willing to pay" for recreation maintenance and the monthly income.

THESIS 9: Investigate the importance of PPGIS as approach for recreation suitability evaluation of RES

> ***"Based on PPGIS results, I justified that there are many benefits of using PPGIS in the land evaluation process. Moreover, I determined the correlation between site characteristics and visitors' feelings. Furthermore, I indicate the connection between the preferred sites of different kinds of RES and the site properties"***

A. There are many benefits of using PPGIS in the land evaluation process. These benefits are as the following: (1) PPGIS gives the planners possibilities to early involve citizens in the planning process; (2) Provides the opportunity to see new patterns of planning using GIS-analyses; (3) PPGIS can also warn the planners early on serious matters (such as uncovering areas) or questions which may be missed otherwise; (4) Combination of several participation methods (e.g., public meetings and PPGIS) can give a better picture of what is needed in the city since all mainly interested groups in the society are allowed to participate.
B. The PPGIS results show several areas can be identified as places where the visitors feel peaceful and relaxing. These areas are primarily located along the river beach and islands, and these areas are all located very close to each other. Notable is that they are also located close to the city center and main road in the city.
C. For example, I asked respondents to indicate where they prefer to ride a horse carriage and camel riding. The analyzed results indicate that the most preferred sites for those kinds of recreation activities were located around the river beach. However, when I asked the participants to show which areas, they prefer to meet friends and family, the answers differed. The analyzed results indicate that the majority of respondents prefer islands like Seheil Island and Aswan Botanical Garden Island as the most preferred site for meeting friends.

THESIS 10: Determination of new approach development for optimizing the suitable sites for different kind of RES

> "***After the future demand analysis of RES, I developed an approach for optimizing the suitable sites for different kinds of RES. This approach integrates between the Land Suitability Evaluation (LSE) map of RES and the visitor demands evaluation map".***

This approach concentrates basically on map overlaying in the ArcGIS environment. More specifically, I overlaid both of land suitability evaluation map of RES and the visitor demands map. The results yielded by map overlaying provide strong evidence that all the proposed sites, which the visitor chose by using PPGIS to fulfill future demands, are located in the most suitable areas based on the land suitability map.

A. Overlaying analysis can be conducted by using spatial analysis tools in the ArcGIS environment.
B. I considered the following items when producing the proposed recreation activities map: (1) the preferred recreation activities and facilities (from service demand evaluation); (2) the constricts of practicing recreation activities (from service demand evaluation); (3) the suitability map results (from land evaluation), and (4) the future visitor demands (from future demands evaluation using PPGIS).

7. SUMMARY AND CONCLUSIONS

A summary of the findings related to this study's theoretical and practical implications is provided to highlight the key results of this study. Suggestions for future research are provided to assist in advancing the field related to image formation and destination selection. This study aimed to investigate the evaluation approaches of Recreation and Ecotourism Services (RES). The results indicate that there are not research has examined both land evaluation of RES and demand evaluation in the planning process of RES.

7.1 Summary

This section attempts to answer the research questions identified at the beginning of the dissertation. Each question is presented, along with the conclusion regarding that specific question right underneath.

The First Question Follows

Are the land evaluation criteria that were addressed in the previous literature sufficient to develop a sustainable diversified recreation and ecotourism service?

The answer is NO. The results show that it is necessary to integrate land evaluation of recreation and ecotourism services by utilizing special evaluation criteria and demand evaluation by using non-spatial criteria to achieve sustainable planning for future recreation and ecotourism sites. To justify this result.

- I Identify and implement criteria to evaluate RES based on previous literature review analysis.
- I classified the collected criteria based on their feature to spatial and non-spatial criteria.
- I involve experts in urban planning and recreation management in online questionnaire to order the collected criteria based on their importance.
- I calculate the criteria weights by utilizing AHP.

The Second Question Follows

Based on a land evaluation map, what are the potential reasons for locating some recreation and tourism services in suitable areas and others in non-suitable areas?

Based on my result analysis, there are many factors that result in locating some RE facilities in the most suitable areas, and these factors as the following: (1) close to water bodies, (2) close to

natural and attraction sites; and (3) close to reads. So, the areas, which fulfill the previous factors, are located in the most suitable land for RE facilities. However, the areas which do not fulfill the previous factors are found in non-suitable areas for RE facilities. To answer this question.

- I developed an MCE model for creating a land evaluation map of RES.
- I convert all spatial criteria to maps in the ArcGIS environment
- I input these criteria maps and their weights in the MCE model to create a suitability map.
- I overlaid both of current RES map and the produced suitability map to determine which current recreation and ecotourism sites are located in suitable land and which are not.

The Third Question Follows

Based on the demand evaluation of recreation and ecotourism services in Aswan city, what are the general evaluation aspects of the demands?

Based on the demand evaluation using a semi-structured questionnaire with local communities, it has been assumed that there are specific differences between locals in attitudes, perceptions, reasons for participating in RES, constraints that prevent locals from practicing RES, and willingness to pay to support the maintenance of RES. To approve this finding:

- I prepare a semi-structured questionnaire to ask the users about their perceptions, reasons for participating in RES, constraints that prevent locals from practicing RES, and willingness to pay to support the maintenance of RES
- I utilized the PPGIS method to collect data about the preferred site for different kinds of recreation and ecotourism services in Aswan City.
- I integrated the results obtained from the questionnaire method and PPGIS method to highlight the future demands of recreation and ecotourism services.

The Fourth Question Follows

According to the land evaluation and demand evaluation of RES, what are the most appropriate sites for future RES in the study area?

By overlying both of the land evaluation maps of RES- created by utilizing the MCE model- and demand evaluation map- created by using the PPGIS method, the results show that the most suitable areas for future recreation and ecotourism sites are located close to water bodies and natural and attraction sites. That means, in the case of both evaluation approaches – land evaluation and demand evaluation – distance from water bodies criterion and distance from natural and attraction sites criterion are the most important criteria for the assessment of recreational and ecotourism services.

7.2 Utilization of Results and Practical Implications

7.2.1 Utilization of Land Suitability Evaluation Results

The recreation land evaluation process used in this study demonstrated how MCE approaches could be incorporated into the GIS planning and decision process to evaluate the current state of RES based on spatial criteria. Additionally, combining MCE and GIS contributed to a more robust understanding of current recreation site distribution patterns and suitable areas for potential RES in the future. Moreover, this study provides a foundation for planners and decision-makers to continually develop and improve the urban planning approaches for future RES sites. Furthermore, this study identified, weighed, and ranked the spatial criteria of land evaluation for RES in Aswan city based on different kinds of site evaluation criteria. The present study produces a land evaluation map to be used in assessing the current state of RES in Aswan city, depending on several spatial criteria. The evaluation methodology utilized in this study, which is conducted for land evaluation of RES, can also be applied to other land evaluation processes. GIS-based AHP as an MCE approach is involved in this evaluation study. The main benefit of this evaluation approach is that it can be applied quickly using the data processing in the ArcGIS environment.

Based on my study regarding the land evaluation of RES results, the planner and decision-makers can follow the following recommendations:

- Utilize GIS-based land evaluation for suitability analysis modeling in land-use development and assessment plans of RES sites in the study area for future urban planning.
- Establish other RES to allow expansion of the urban area in Aswan city, ensuring all study areas are covered with recreation and tourism facilities, and motivating the urban planning development of these kinds of services.
- Make an ecological and environmental connection between all current recreation and tourism sites, potential sites, and cultural and natural attraction sites in the study area.
- Consider the mentioned evaluation criteria and their order when planning for new sites for RES in Aswan city.
- Integrate the natural and cultural attractive sites in Aswan city and the suggested or potential recreation and tourism sites and consider the land evaluation criteria which affect the suitability of the planned areas.

7.2.2 Utilization of Demand Evaluation Results

It was stated in previous chapters that many recreation and ecotourism services strive to create equal access for all and to enhance the quality of life of individuals who utilize their services. As such, this study has several implications for the practice of recreation and ecotourism. First, this study again suggests that individuals are unique but also similar; therefore, it is important to assess each individual's special needs, interests, and preferences within recreation and ecotourism services. In this study, it was evident that the participants had preferences regarding specific activity involvement and social interaction. Many participants enjoy recreation services that offer opportunities to improve aspects of their self-concept and human wellbeing. Secondly, this study purposes that individuals and locals in Arab countries may prefer activities involving social interaction opportunities. Therefore, when planning recreation areas, it is suggested that recreation professionals provide opportunities and particular sites for users to meet other people, such as friends and family. Recreation planners should accommodate inclusive recreation opportunities in the same planned area when considering adaptive planning options.

Also, this study helps define a clear picture of the factors that constrain individuals in Arab countries from practicing different kinds of recreation activities as often as they desire. As mentioned above, financial constraints and transportation issues were significant constraining factors. A discount lift pass or discount season access for individuals may be wise for recreational areas. This may increase the interest of those that already participate and those who may have an interest and feel that participating in recreational services may be too expensive. Addressing the transportation or accessibility issue may be a more difficult challenge for recreation and ecotourism service providers. Many Arab world’s offer a bus or van system that picks up at various locations. Ensuring these already existent transportation options are truly accessible to all people would be a great starting point.

Recommendations on planning and design of recreational areas based on the study data are as follows:

- Give the high different kinds of RES in future planning strategies in the study area.
- Activities that respect culture and nature and promote culture and nature should be organized predominantly for the visitors.
- Administrators should be learned about the environment and resource management to make accurate decisions and to present their knowledge to the locals and the visitors accurately
- Infrastructure service quality and facilities should be increased (Transportation, accommodation, waste treatment, food and beverage facilities, etc.).

- Determine a percentage of the proposed services in the future which have to be without entry fees.
- Make the priority to choose any new site for the RS that is close to roads and transportation to reduce the transportation cost as much as possible for the user.
- Make the utilization of the RS free for everyone under the age of 24 and Pension people.
- Distribution of the proposed RS over the study area to ensure a fair and sustainable distribution of RS for all residents and to reduce the cost of transportation.

7.3 Suggestions for Further Research

Although there are many potential applications of this research in developing more effective evaluation policies, there are some limitations. The majority of limitations to this research are given by insufficient financial resources and time to conduct more in-depth data collection. First, variations of residents' attitudes and perceptions between various areas would have better understood if a more significant number of the selected areas located to a different extent were included, such as urban and pre-urban areas. Often, subtle changes in the local cultural or economic characteristics of the selected areas can considerably impact human attitudes and perceptions. Thus, as my research study area is restricted to the urban areas, results might not be entirely suitable for making assumptions about rural or pre-urban areas. Second, although participation among residents was relatively high, constraints imposed by Covid 19 not only made traveling between urban areas difficult and reduced the data collection period to three weeks. As a result, the number of residents who participated in this research could be considered relatively low than the population density in the study area. To overcome the limitations of this study, future research should investigate people's attitudes and perceptions and WTP for improving the effectiveness of RES at larger spatial and temporal scales. The scope of this study can be expanded in various ways. Additional studies could enhance our understanding of the leisure and recreation experiences and quality of adaptive recreation services from the perspectives of individuals in others research areas.

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INTERNET SOURCES

WEB[1]:https://www.google.hu/search?q=recreation+activities+in+Aswan+city&sxsrf=AOaemvKmWaOrMFAr80t82bg_CBuO3A:1641550577993&source=lnms&tbm=isch&sa=X&ved=2ahUKEwi2ytO4tJ_1AhXSsaQKHZMXCqEQ_AUoAXoECAEQAw&biw=1280&bih=570&dpr=2

WEB[2]:https://www.google.hu/search?q=recreation+activities+in+Aswan&tbm=isch&ved=2ahUKEwiwrZSEtZ_1AhWUIMUKHfEEAy4Q2cCegQIABAA&oq=recreation+activities+in+Aswan&gs_lcp=CgNpbWcQAzIHCCMQ7wMQJzIHCCMQ7wMQJzoFCAAQgAQ6BAgAEBhQAFjuGWD0H2gAcAB4AIAB2gGIAacGkgEFOC4wLjGYAQCgAQGqAQtnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=kBPYYbClFJTBlAbxiYzwAg&bih=570&biw=1280

WEB[3]:https://www.google.hu/search?q=recreation+sites+in+aswan+city&sxsrf=AOaemvJiQLxwTf_aXcL_xtGmxh4VOZCMgg:1641548361798&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjN2fGXrJ_1AhVN-qQKHROsAQkQ_AUoAnoECAEQBA&biw=1280&bih=627&dpr=2

WEB[4]:https://en.climate-data.org/africa/egypt/aswan-governorate/aswan-6344/

WEB[5]:https://en.climate-data.org/africa/egypt/aswan-governorate/aswan-6344/

WEB[6]:https://www.divergenttravelers.com/things-to-do-in-aswan-egypt/

WEB[7]:https://www.google.hu/search?q=historical+places+in+aswan&hl=en&sxsrf=AOaemvLpjGcPyf4NorSsS6TCKtirdIFg9g:1641549954203&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjAwpqPsp_1AhWK6aQKHYYVCmgQ_AUoAnoECAIQBA&biw=1280&bih=570&dpr=2

WEB[8]: https://www.egypttoday.com/Article/6/67122/Top-10-tourist-attractions-in-Aswan

WEB[9]:https://www.google.hu/search?q=historical+places+in+aswan&hl=en&sxsrf=AOaemvJXeRrZYJlN_fcTOG_9URqWapM9Q:1641550068945&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiP3fXFsp_1AhWR66QKHUFWDjkQ_AUoAnoECAIQBA&biw=1280&bih=570&dpr=2

WEB[10]:https://www.divergenttravelers.com/things-to-do-in-aswan-egypt/

WEB[11]:https://www.luxorandaswan.com/en/Egypt/tour/Trip-to-the-Nubian-Villages-by-boat

WEB[12]:https://www.google.hu/search?q=historical+places+in+aswan&hl=en&sxsrf=AOaemvJXeRrZYJlN_fcTOG_9URqWapM9Q:1641550068945&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiP3fXFsp_1AhWR66QKHUFWDjkQ_AUoAnoECAIQBA&biw=1280&bih=570&dpr=2

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WEB[15]:https://www.cisa.gov/uscert/bsi/articles/best-practices/requirements-engineering/requirements-prioritization-case-study-using-ahp

WEB[16]:http://medurbantools.com/portfolio_page/ppgis-practical-guide/

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APPENDIX

Appendix 1: Example of Criteria Utilized for Evaluating Different Culture Ecosystem Services

CES	CES evaluation criteria	References example
Aesthetic enjoyment value	DEM	Sherrouse, Clement and Semmens, 2011
	Slope	Casalegno et al., 2013
	Site	Plieninger et al., 2013
	Distances	Casado-Arzuaga et al., 2014
	Green spaces	Schirpke et al., 2016
	Rare species	Tolli et al., 2016
	Land cover	Zoderer et al., 2016
	Distance to resources	Figueroa-Alfaro and Tang, 2017
	Distance to Scenic site	Yoshimura and Hiura, 2017
	Temperature	Bogdan et al., 2019
	Land use	Clemente et al., 2019
	Protected areas	F. Sun et al., 2019
		He et al., 2019
		Lee et al., 2019
		Gosal and Ziv, 2020
Inspiration value	Land cover	Sherrouse, Clement and Semmens, 2011
	landscape value	Plieninger et al., 2013
	Land use	Bogdan et al., 2019
		Clemente et al., 2019
		F. Sun et al., 2019
		Lee et al., 2019
		Zoderer et al., 2016; He et al., 2019
Spiritual value	Photographs	Hernández-Morcillo, Plieninger and Bieling, 2013
	Landscape settings	Sherrouse, Clement and Semmens, 2011
	Distance to resources	Plieninger et al., 2013
		Zoderer et al., 2016

Continued Appendix 1

CES	CES evaluation criteria	References example
Recreation and Ecoourism	Number of visitors	Bogdan et al., 2019
	Photographs	Mclaughlin, 1973
	Tourist attractions	Sherrouse, Clement and Semmens, 2011
	Landscape aesthetics	Van Riper et al., 2012
	Recreation potential	Plieninger et al., 2013
	Ecotourism potential	Casado-Arzuaga et al., 2014
	Rare varieties	Peña, Casado-Arzuaga and Onaindia, 2015
	Accommodation	Pietilä and Kangas, 2015
	Vegetation cover	Zoderer et al., 2016
	Fresh water	Khameneh et al., 2018
	Recreation fishing	Bogdan et al., 2019
	Accessibility	Clemente et al., 2019
	Land cover	Ebrahimi, Nejadsoleymani and Mansouri
	Distance	Daneshvar, 2019
	Urban green space	F. Sun et al., 2019
	Flower viewing	He et al., 2019
	Viewsheds	Lee et al., 2019
	Water fowls	(Mclaughlin, 1973
	Traffic census	Kliskey, 2000
	Resource availability	Gül, Örücü and Karaca, 2006
	Footpaths	Bunruamkaew and Murayama, 2011
	Cultural heritage	Chakrabarty, 2011
	Distance to resources	Chandio et al., 2011
	Population density	Zarkesh, Almasi and Taghizadeh, 2011
	Roads	Hernández-Morcillo, Plieninger and Bieling,
	Accommodation	2013 Nahuelhual et al., 2013
	Fish abundance	Pareta, 2013
	Visitors stay	Aklıbaşında and Bulut, 2014
	Visitors expenses	Beeco, Hallo and Brownlee, 2014
	Fish consumption	Jabir and S, 2014
	Soil	Richards and Friess, 2015
		Ala-Hulkko et al., 2016

Continued Appendix 1

CES	CES evaluation criteria	References example
	Climate	Bryce *et al.*, 2016
	Wildlife	Doğu. G and E, 2016
		Mahiny and Mirkarimi, 2016
		Dębski and Nasierowski, 2017
		Dağıstanlı, Turan and Dengiz, 2018
		Nadim *et al.*, 2018;
		Ruskule, Klepers and Veidemane, 2018
		Bogdan *et al.*, 2019
		Kaptan Ayhan *et al.*, 2020

Appendix 2: Online Questionnaire for Criteria Importance Order

Thank you for taking the time to complete this survey! A small sample of experts will be used, so your input is very important. Your responses will be completely anonymous and confidential. The findings of this study will never discuss individual responses. This survey will take about 10 minutes to complete. Your responses will help leisure and recreation service managers achieve the sustainable distribution of future recreation planning. You do not have to answer any questions that you do not want to. You are free to discontinue your participation at any time without consequence.

If you have any questions about this survey, you may contact Asmaa Abualhagag, Email: Asmaa.haggag2011@gmail.com

Thank you for participating in this study

(Biodiversity)

"This criterion indicates the kind of fauna and flora on the selected site"

Question1: "Give the relative importance of all the below criteria. Please put "X" on the number of your choice"

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Availability)

"This criterion indicates the soil and vegetation of the selected site"

Question 2: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Comfort)

"Wind direction, temperature, open water, and air quality of the selected site"

Question 3: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Pollution)

"Accepted distance of the selected site from active pollution points"

Question 4: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Topography)

"Acceptable limits of topography or degree of slope of the selected site land"

Question 5: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Accessibility)

"Acceptable distance of selected site from the road network, existing recreation areas, and public-transport stations"

Question 6: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Security)

"Legislation of laws that protect these services in selected site"

Question 7: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Compatibility)

"Human culture inside and outside the selected site"

Question 8: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Utility)

"Potential economic benefits from the selection of this site"

Question 9: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Efficiency)

"Quality of the services in the selected site"

Question 10: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Site's price)

"Price of the land in the selected site"

Question 11: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

Extremely Important	9□7□5□3□1□	**Least Important**

(Surrounding area)

"Land uses of the surrounding area to sure cover the large size of urban areas by the serving range of the selected site"

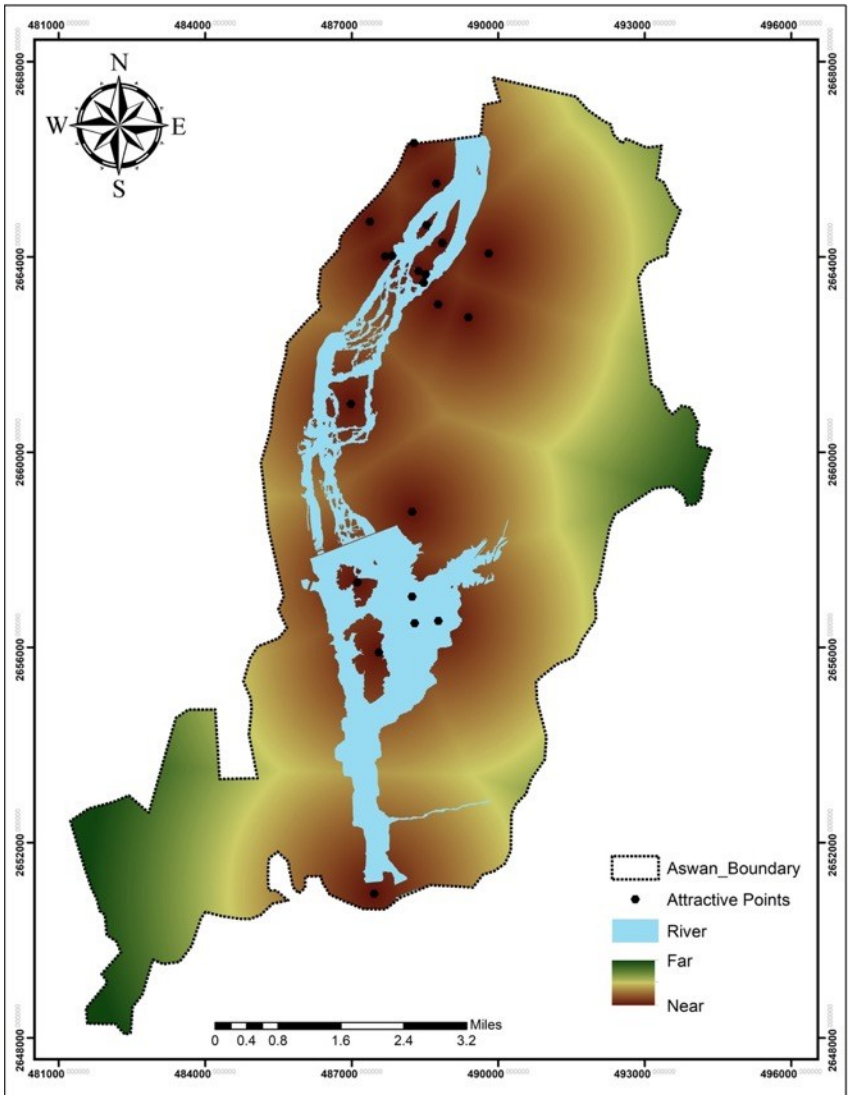
Question 12: Give the relative importance of all the below criteria. Please put "X" on the number of your choice.

9= Extremely **7**= Very Strongly **5**= Strongly **3**= Moderately **1**= least important.

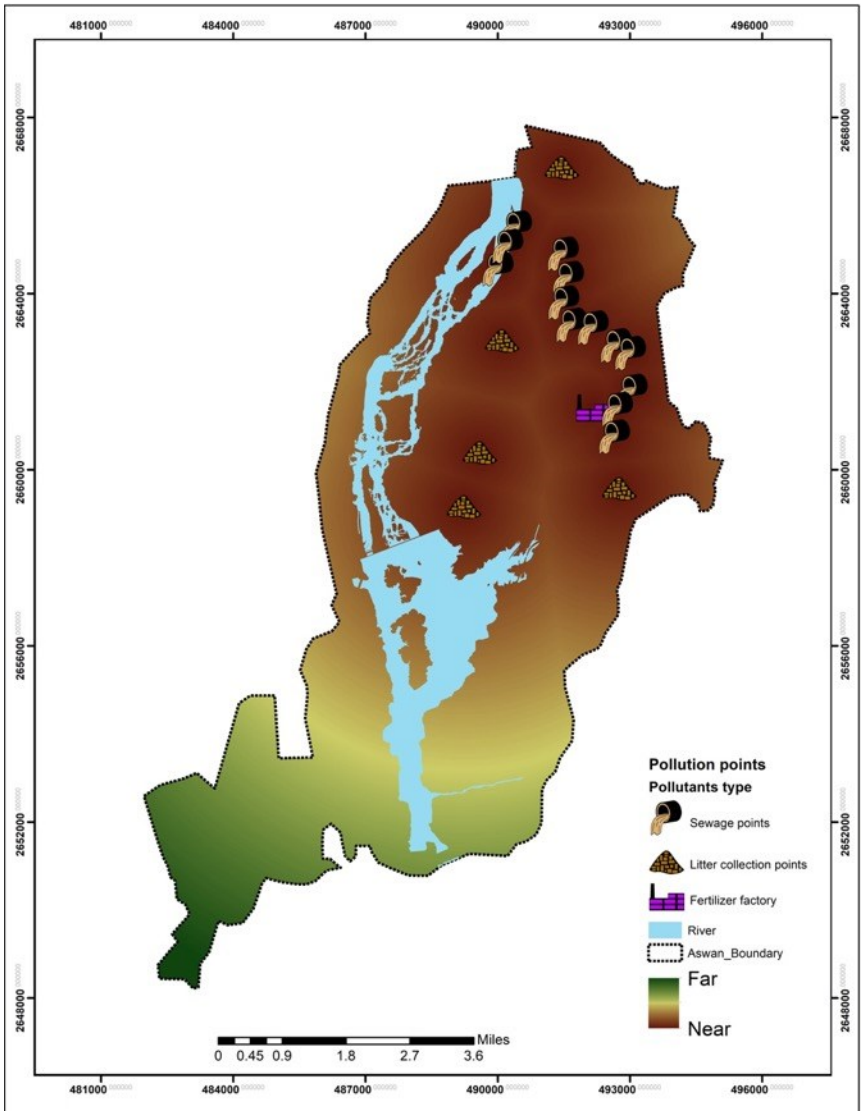
Extremely Important	9□7□5□3□1□	**Least Important**

Appendix 3: Land Evaluation Criteria Maps (Source Author)

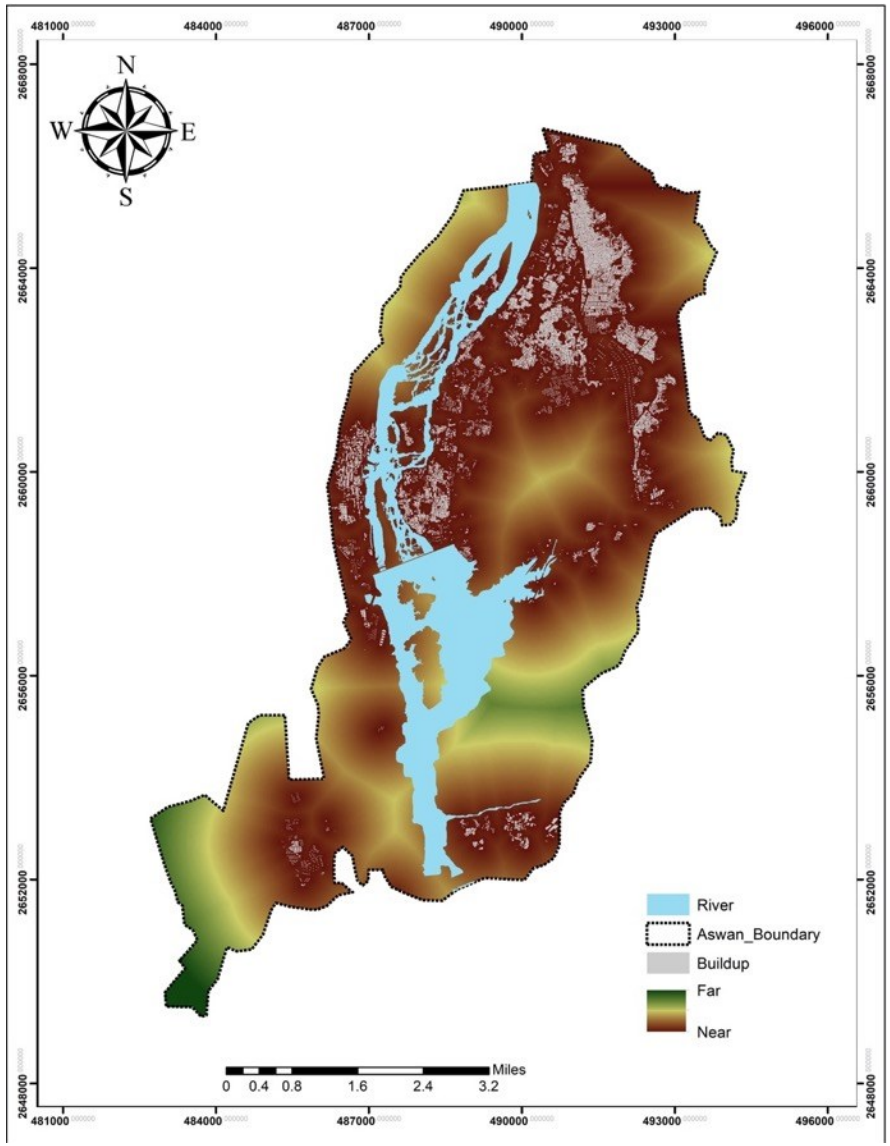
(A): Distance from Attractive nature and culture sites



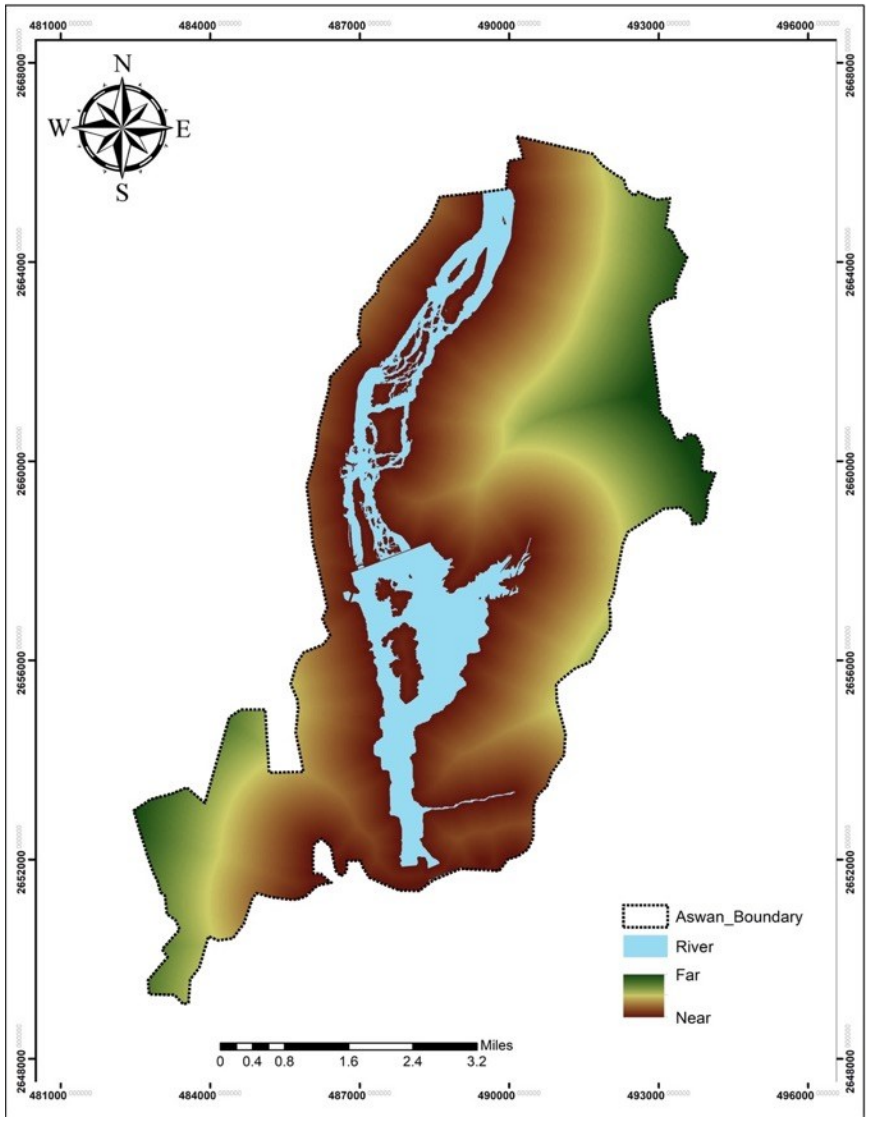
(B): Distance from Pollution points



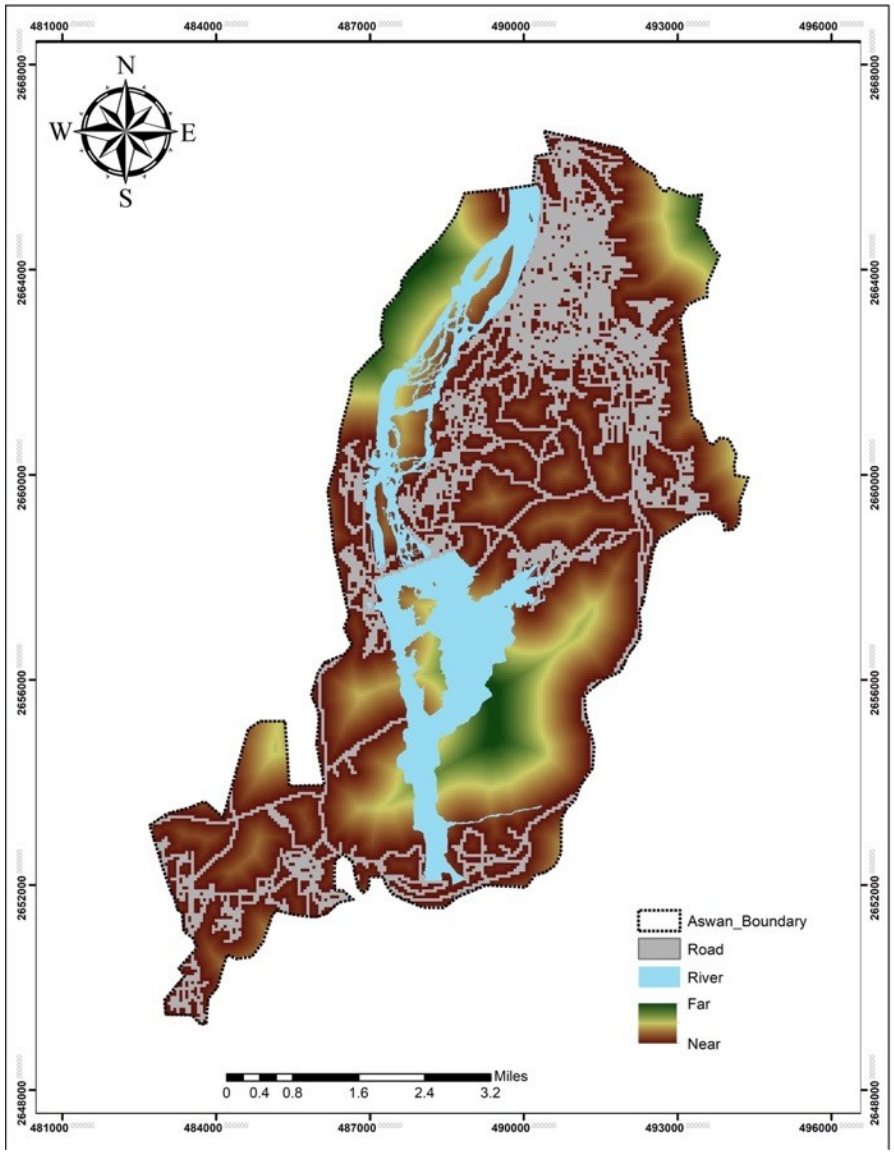
(C): Distance from Residential areas



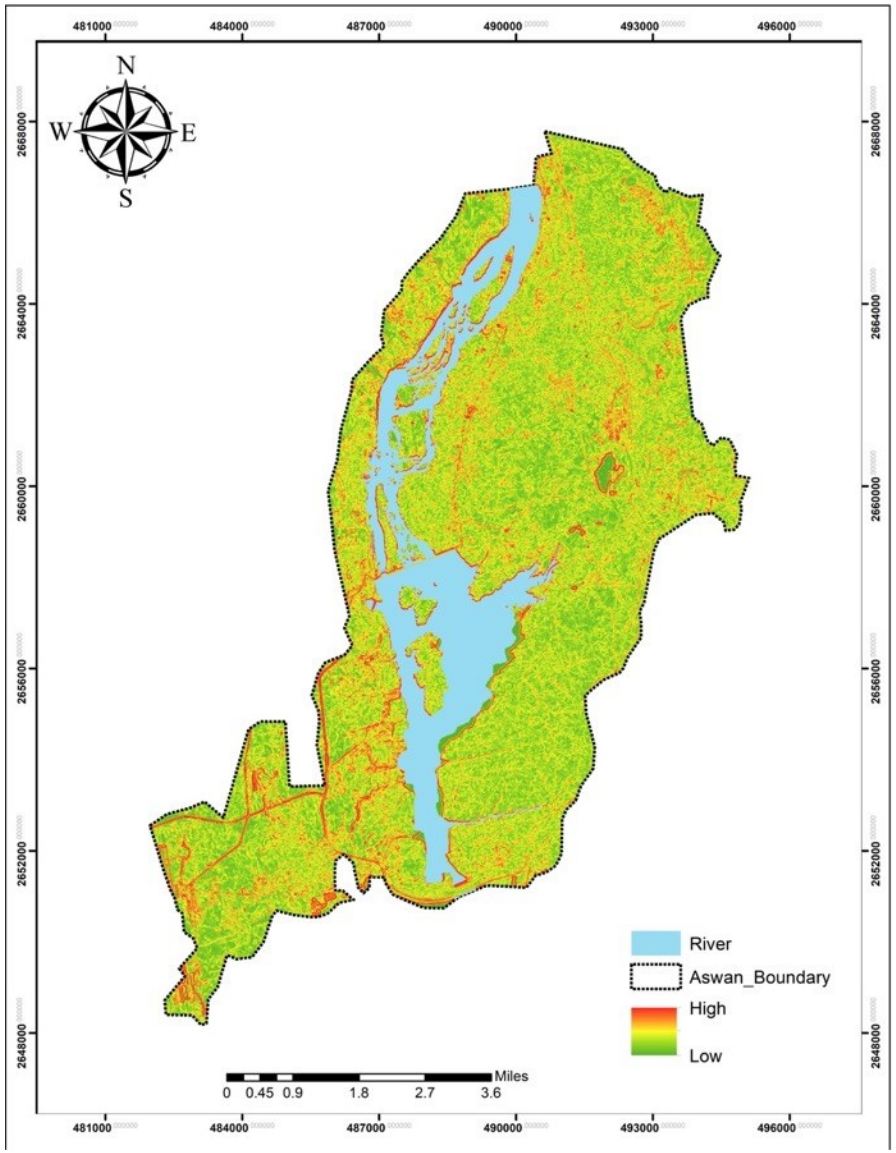
(D): Distance from Water Bodies



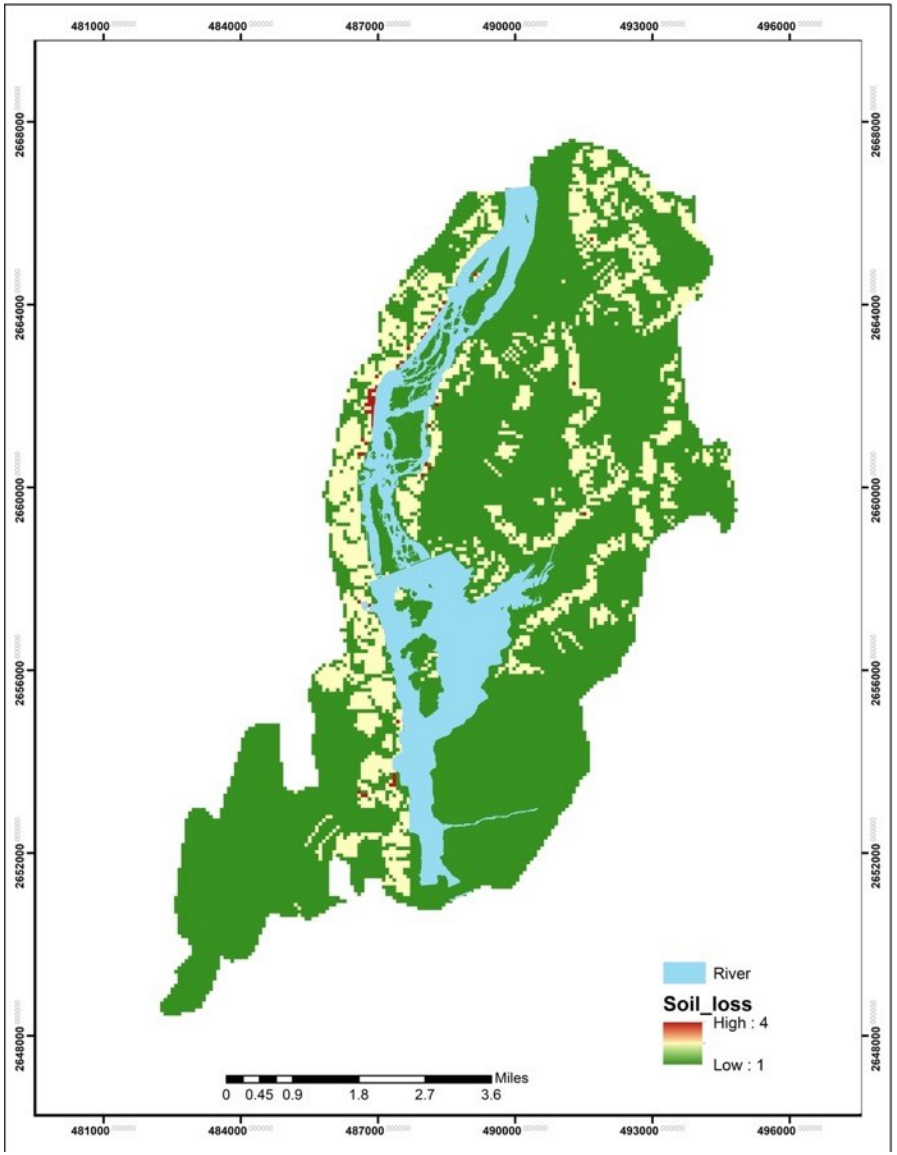
(E): Distance from Roads



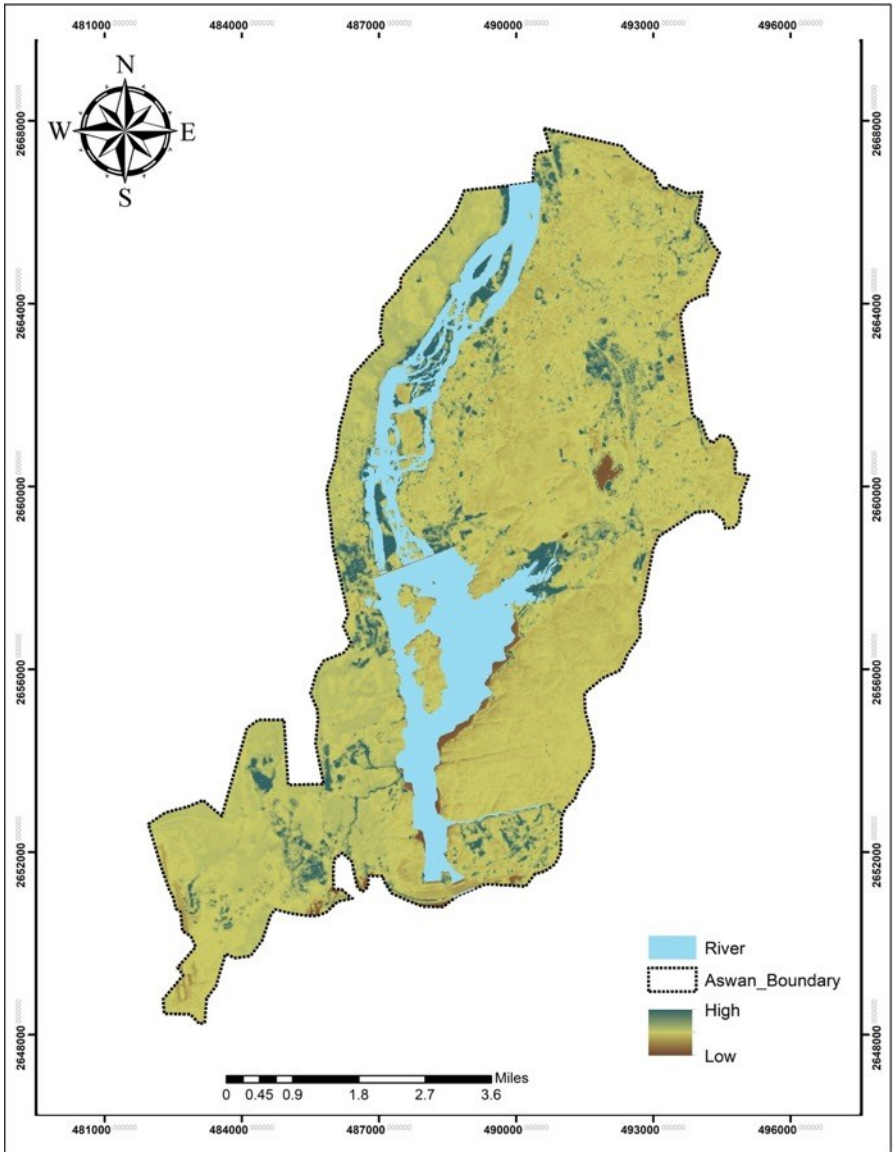
(F): Slop



(G): Soil Erosion



(H): Vegetation cover



Appendix 4: Demand Evaluation Questionnaire

Recreation Facility Evaluation

In this survey I intend to evaluate the current facilities in Aswan city by involving locals in my evaluation, and then ask users about their future demands and suggested improvement in the future urban planning for new recreation facilities. There are three types of recreation facilities in Aswan city which namely: Parks and Islands, Walking/Biking Trail, Sports Fields. Two evaluation methods which are PPGIS and questionnaire will be used it in this evaluation process.

Demographic data

1) Are you…….?

- Family/social group
- Individual
- Educational group

2) What is your age?

- 18-24
- 25-49
- 50+

3) What is your gender?

- Male
- Female

4) What is your monthly income?

- More than 2000 EGP
- Less than 2000 EGP

أداة التقييم الترفيهى فى مدينة أسوان

في هذا الاستطلاع أعتزم تقييم الخدمات الترفيهيه الحالية في مدينة أسوان من خلال إشراك السكان المحليين في تقييمنا ، ثم سؤال المستخدمين عن احتياجاتهم المستقبلية واقترح تحسين التخطيط الحضري المستقبلي لمرافق ترفيهية جديدة. هناك نوعين من المرافق الترفيهية في مدينة أسوان وهي: الحدائق والجزر، وسيتم استخدام طريقتين للتقييم هما PPGIS والاستبيان في عملية التقييم الحالية.

البيانات الديموغرافية للمشاركين

1) هل أنت\انتم .....؟

- الأسرة /مجموعة الاجتماعية\اصدقاء
- فردي
- مجموعة تعليمية

2) كم عمرك؟

- 18-24
- 25-49
- 50+

3) ما هو جنسك؟

- ذكر
- أنثى

4) ما هو دخلك الشهري؟

- أكثر من 2000 جنيه مصري
- أقل من 2000 جنيه مصري

5) Of the following categories, please check the current position that best describes you.	**5) من بين الفئات التالية ، يرجى التحقق من الموضـــع الحالي الذي يصفك على أفضل وجه.**
• Employed	• يعمل
• Retired	• متقاعد
• Unemployed	• عاطل عن العمل
• Student	• طالب
• Other	• آخري
Current State Assessment	**تقييم الوضع الحالي للخدمات الترفيهية**
6) Which recreation activities you prefer to perform?	**6) ما هي الأنشطة الترفيهية التي تفضل القيام بها؟**
• Having a picnic	• القيام بنزهة
• Playing soccer and basketball	• لعب كرة القدم وكرة السلة
• Water sport (boating, swimming)	• الرياضات المائية (القوارب والسباحة)
• Visiting historical sites	• زيارة المواقع التاريخية
• Walking	• المشي
• Camping	• تخييم
• Other	• آخري
7) What are the main constraints that prevent people to perform recreation activities?	**7) ما هي المعوقات الرئيسـية التي تمنع الناس من أداء الأنشطة الترفيهية؟**
• Insufficiency of recreation activities areas	• عدم كفاية مناطق الأنشطة الترفيهية
• Financial problems	• مشاكل مالية
• Lack of time	• قلة الوقت
• Being too old	• كبر السن
• Health problems	• مشاكل صحية
• Lack of companion	• عدم وجود رفيق
• Others like traffic, crowdedness, etc.	• عوامل اخري (مثل حركة المرور والازدحام وما إلى ذلك)

8) **How would the following factors influence the amount you would pay for recreation? For each factor, please give the rate that best describes how you would pay**	**8) كيف ستؤثر العوامل التالية على المبلغ الذي ستدفعه مقابل الترفيه؟ لكل عامل ، يرجى اختيار الرقم الذي يصف على أفضل وجه كيف ستدفع**
• Activity close to me	• نشاط قريب مني
• Located in more convenient location	• يقع في موقع أكثر ملاءمة
• Offered activities for kids	• الأنشطة المقدمة للأطفال
• Offering special interest to me	• نشاط يلائمني
• Others	• عوامل اخري
9) What are the major problems of recreation areas in Aswan city? You can choose more than one	**9) ما هي المشـــاكل الرئيســـية للمناطق الترفيهية في مدينة أسوان؟ يمكنك اختيار أكثر من واحد**
• Dirtiness and visual pollution	• النظافة والتلوث البصري
• Lack of security	• نقص الحماية
• Access to WC	• الوصول إلى دورة المياه
• Access to water	• الحصول على الماء
• Recycle bin	• سلة المهملات
• Overcrowding	• الازدحام
• Lack of facilities	• قله في التسهيلات
• Lack of care	• الافتقار إلى الصيانه
• High entrance fee	• رسوم دخول عالية
• Not suitable for family	• غير مناسب للعائلة
• There is no problem	• لا توجد
• Others	• عوامل اخري
10) What are the primary reasons that you use recreation parks in Aswan? You can choose more than one choice.	**10) ما هي الأســـباب الرئيســـية لاســـتخدامك الحدائق الترفيهية في أسوان؟ يمكنك اختيار أكثر من خيار.**
• Enjoy the outdoors or nature	• استمتع بالخارج أو بالطبيعة
• Walk or bike for exercise	• المشي أو استخدام الدراجة لممارسة الرياضة
• Play sports	• لعب الرياضة
• Participate in family activities	• المشاركة في الأنشطة الأسرية
• Picnic and general leisure activities	• التنزه والأنشطة الترفيهية العامة

- Use a specific facility at a park
- Meet friends
- Attend special events/concerts/movies
- Don’t use parks
- Others

11) If you do not use the recreation parks in Aswan, what are your reasons?

- Lack of facilities
- Don’t know what’s available
- Poorly maintained
- Too far away/not conveniently located
- Don’t know where they are
- Not interested
- None of the above

12) If your answer yes, what are your reasons? You can choose more than one answer

- Easy accessibility
- Low entry fees
- Low transportation fee
- Topographic problem
- Climate problem
- Close to water bodies
- Close to roads/transportation
- Close to city center
- Others

13) If your answer no, what are your reasons? You can choose more than one answer

- Not easy to Access
- High entry fees

- استخدم منشأة محددة في الحديقة
- تعرف على الاصدقاء
- -حضور المناسبات الخاصة / الحفلات / الأفلام
- لا استخدم الحدائق
- آحرون

11) في حالة عدم اســـتخدامك للمنتزهات الترفيهية في أسوان فما أسبابك؟

- قله في التسهيلات
- لا أعرف ما هو متاح
- صيانة ضعيفة
- بعيد جدًا / غير موجود في مكان مناسب
- لا أعرف أين هم
- غير مهتم
- لا شيء مما بالأعلى

12) إذا كانت إجابتك بنعم ، فما هي أسبابك؟ يمكنك اختيار أكثر من إجابة واحدة

- سهولة الوصول
- رسوم دخول منخفضة
- رسوم نقل منخفضة
- مشكلة الطبوغرافية
- مشكلة المناخ
- قريب من المسطحات المائية
- قريب من الطرق / المواصلات
- قريب من وسط المدينة
- آحرون

13) إذا كانت إجابتك لا ، فما هي أســـبابك؟ يمكنك اختيار أكثر من إجابة واحدة

- ليس من السهل الوصول إليها
- رسوم دخول عالية

- High transportation fee
- Topographic problem
- Climate problem
- Far from water bodies
- Far from roads/transportation
- Far from city center
- Others

14) **Which recreation facilities would you like in this park?**

- Fountains
- Food and local outlets
- Washing sinks for dirty dishes
- Camping site
- Information and exhibition center

15) **Which recreational sites would you like in the park?**

- Playground areas
- Sports areas
- Picnicking
- Cultural sites
- Horseback riding
- Walking paths
- Aquatic sports
- Biking

16) **From the list below, please select the four activities that are most important to manage at the recreation sites which suitable for Aswan city?**

- Walking for pleasure
- Bicycling for pleasure
- Swimming (river)
- Camping
- Nature walks
- Playground (visit/play)

- رسوم نقل عالية
- مشكلة الطبوغرافية
- مشكلة المناخ
- بعيدًا عن المسطحات المائية
- بعيد عن الطرق / المواصلات
- بعيد عن وسط المدينة
- آحرون

14) **ما هي المرافق التي تفضلها في الاماكن الترفيهيه؟**

- نوافير
- منافذ الطعام والمحلية
- غسل الأحواض للأطباق المتسخة
- مواقع التخييم
- مركز المعلومات والمعارض

15) **ما هي الخدمات الترفيهية التي تفضـــلها في الاماكن الترفيهيه؟**

- مناطق الملاعب
- مناطق رياضية
- التنزه
- المواقع الثقافية
- ركوب الخيل
- ممرات المشي
- الرياضات المائية
- ركوب الدراجة

16) **من القائمة أدناه ، يرجى تحديد الأنشـــطة الأربعة الأكثر أهمية لإدارتها في مواقع الترفيه التي تناســـب مدينة أسوان؟**

- المشي من أجل المتعة
- ركوب الدراجات من أجل المتعة
- السباحة (النهر)
- تخييم
- المشي في الطبيعة
- ملعب (زيارة / لعب)

- Exercising
- Jogging/Running
- Gardening
- Photography
- Picnicking
- Boating (non-motorized)
- Boating (power)

17) If funding were available, which of the following facilities should have the highest priorities in Aswan?

- Multi-purpose indoor recreation
- Water playgrounds
- More river access for recreation, swimming and boating
- Sports fields (e.g., baseball, softball, soccer, rugby)
- More outdoor courts for basketball or tennis
- Community gardens
- More picnic areas
- Others

18) Which sports activities would you like in parks in Aswan?

- Basketball
- Football
- Aquatic sports
- Biking
- Runway
- Others

- ممارسة
- الركض / الجري
- الحدائق
- التصوير
- التنزه
- القوارب (غير المزودة بمحركات)
- القوارب (المزودة بمحركات)

17) في حالة توفر التمويل ، أي من المنشآت التالية يجب أن يكون لها الأولوية القصوى في أسوان؟

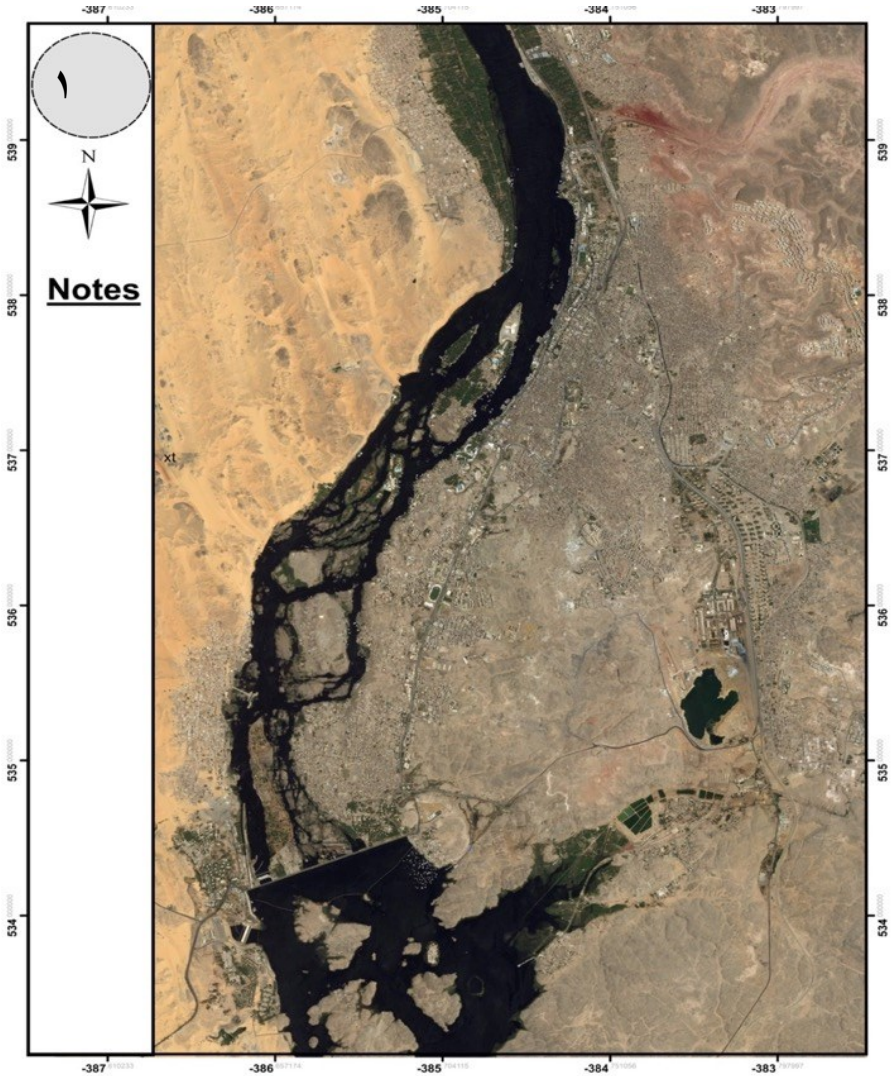
- ترفيه داخلي متعدد الأغراض
- انشطه ترفيهيه مائية
- المزيد من الوصول إلى النهر للاستجمام والسباحة وركوب القوارب
- ملاعب رياضية
- حدائق
- المزيد من مناطق التنزه
- اخري

18) ما هي الأنشطة الرياضية التي تفضلها في الحدائق بأسوان؟

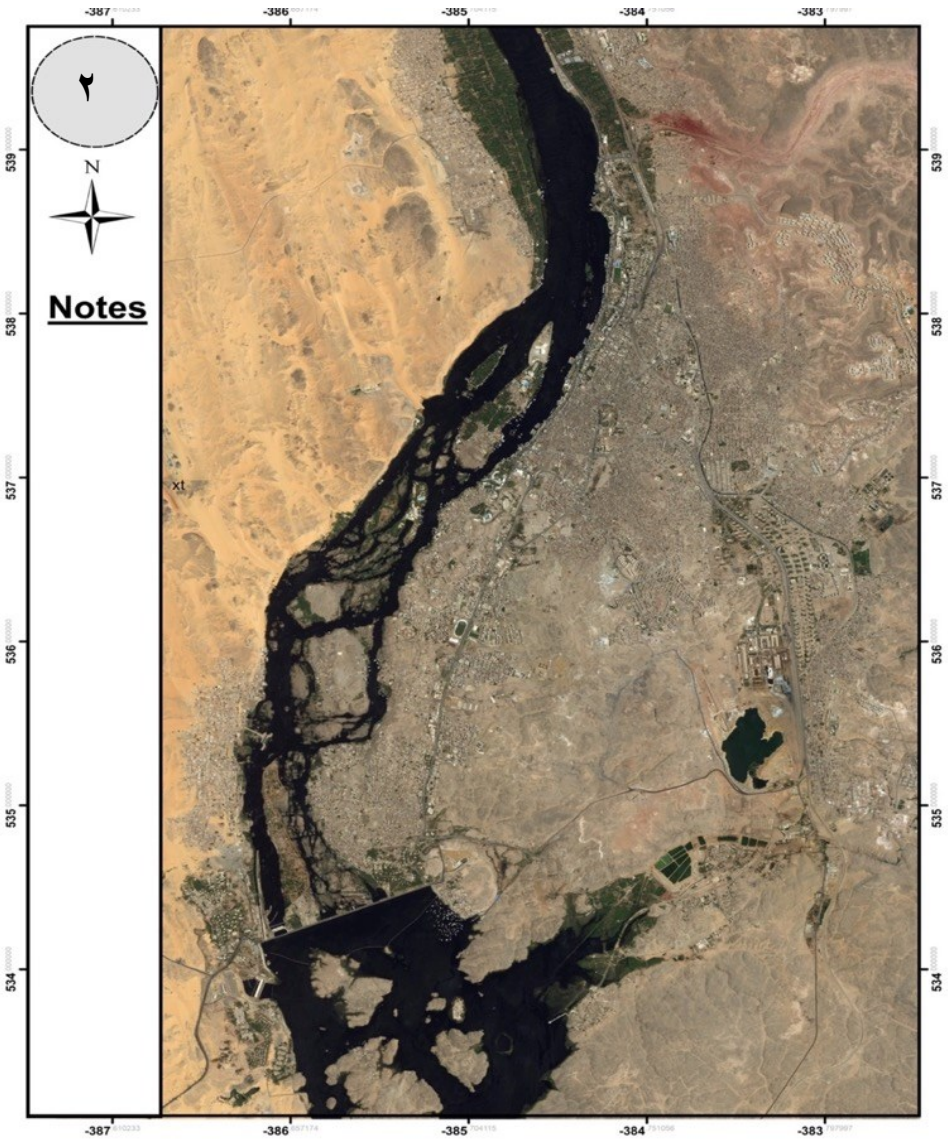
- كرة سلة
- كرة القدم
- الرياضات المائية
- ركوب الدراجات
- الجري
- آخرون

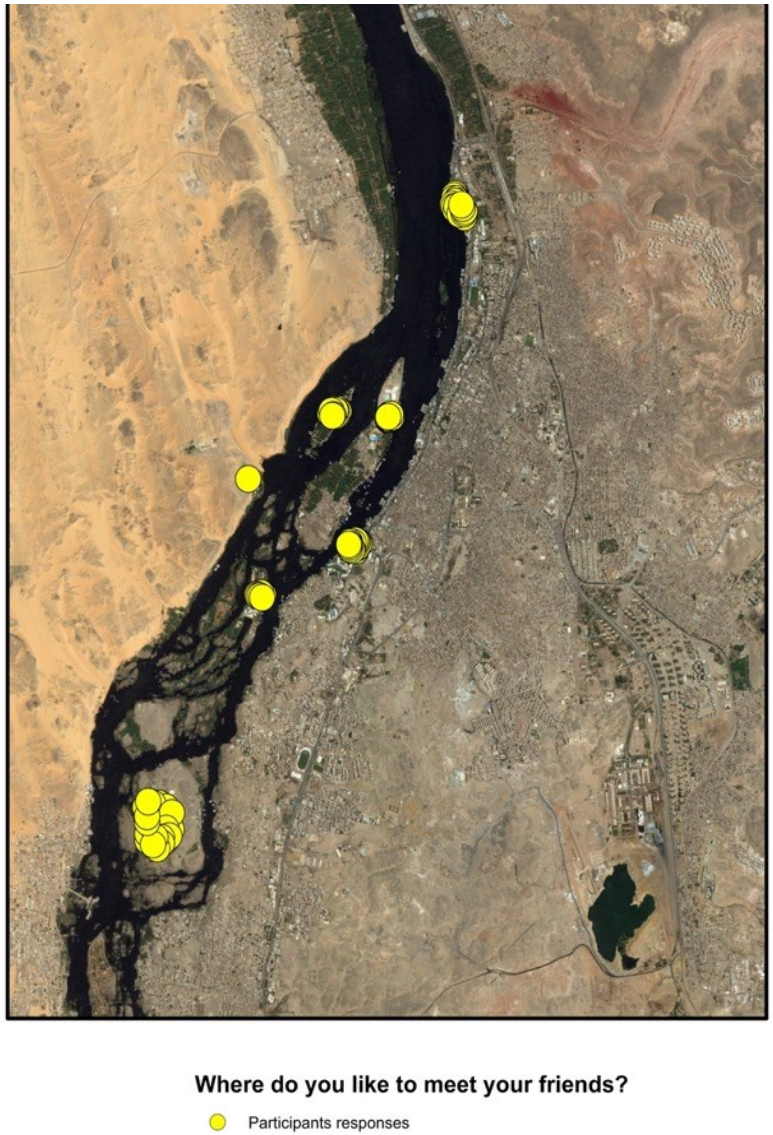
Appendix 5: PPGIS Survey (Source: Author)

1. Where do you like to ride a carriage? ١) في اي مكان تحب ركوب الحنطور؟	Participants Answer

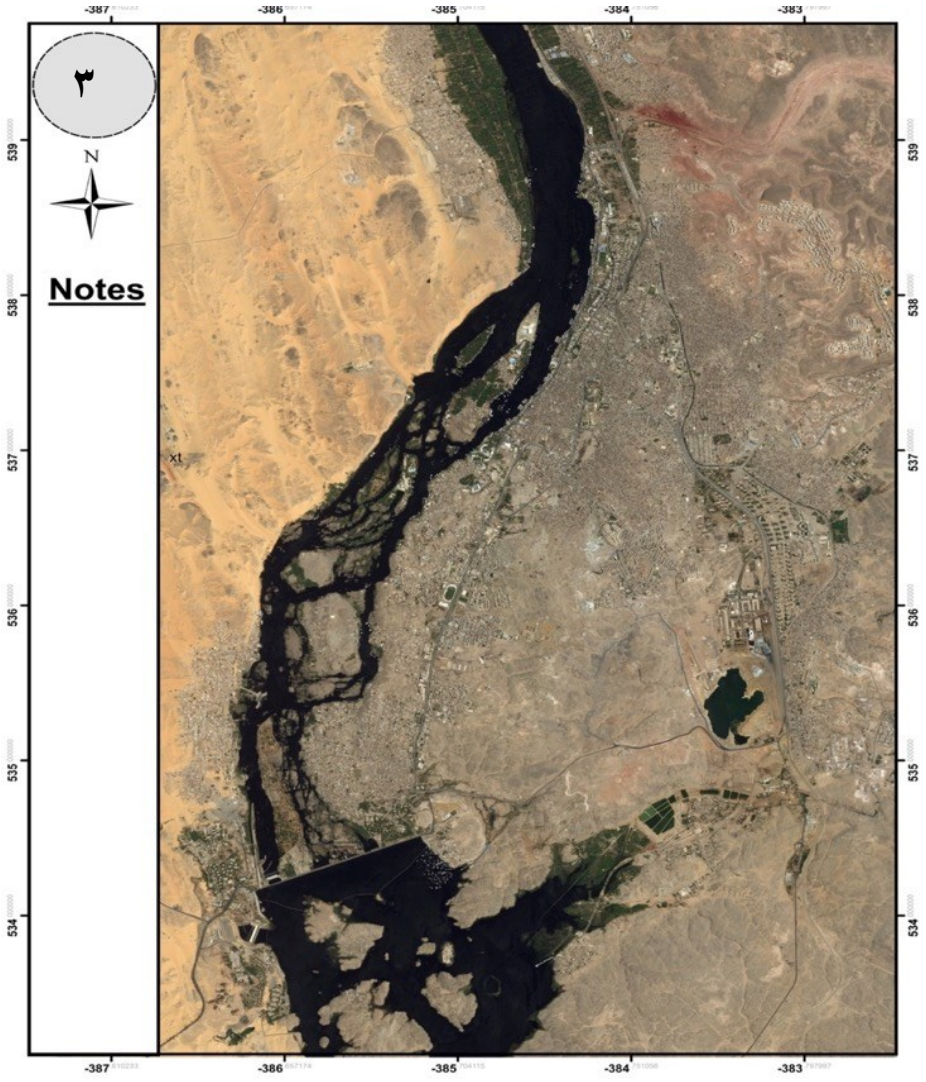


2. Where would you like to meet friends? ٢) في اي مكان تحب مقابله الاصدقاء؟	Participants Answer

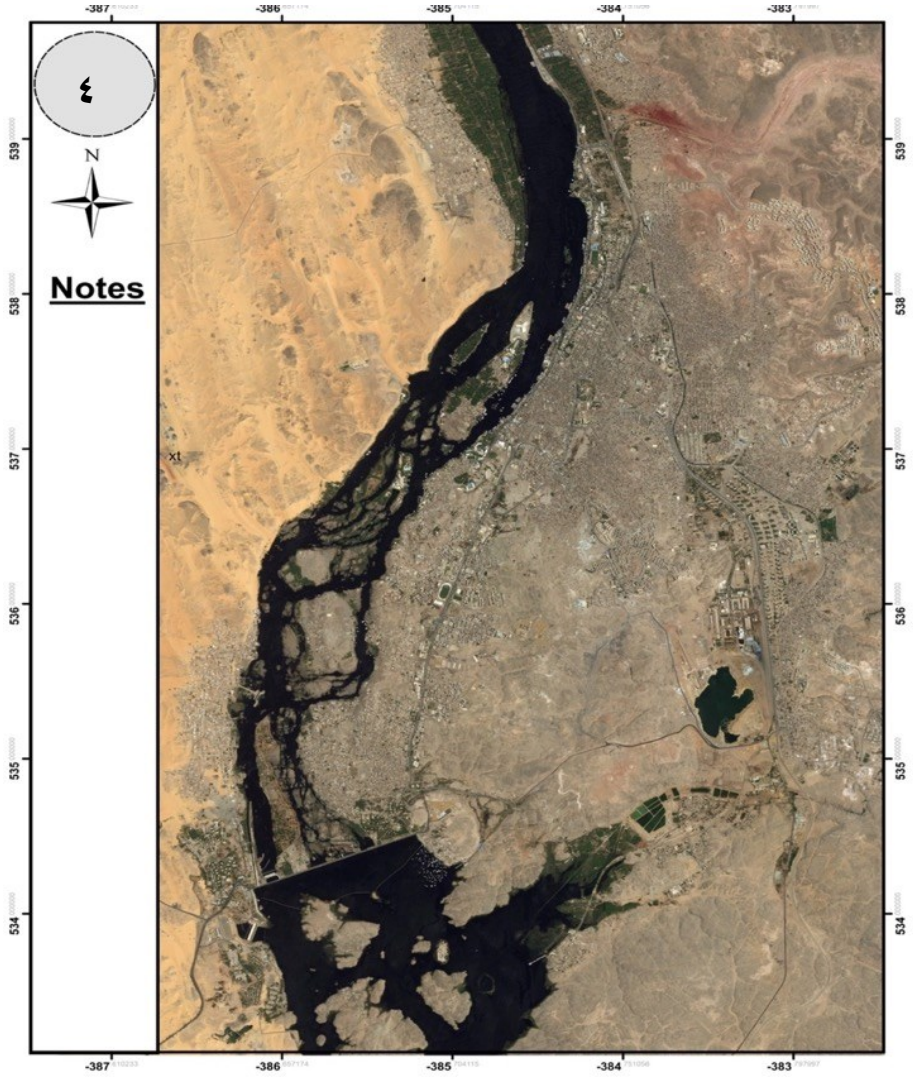


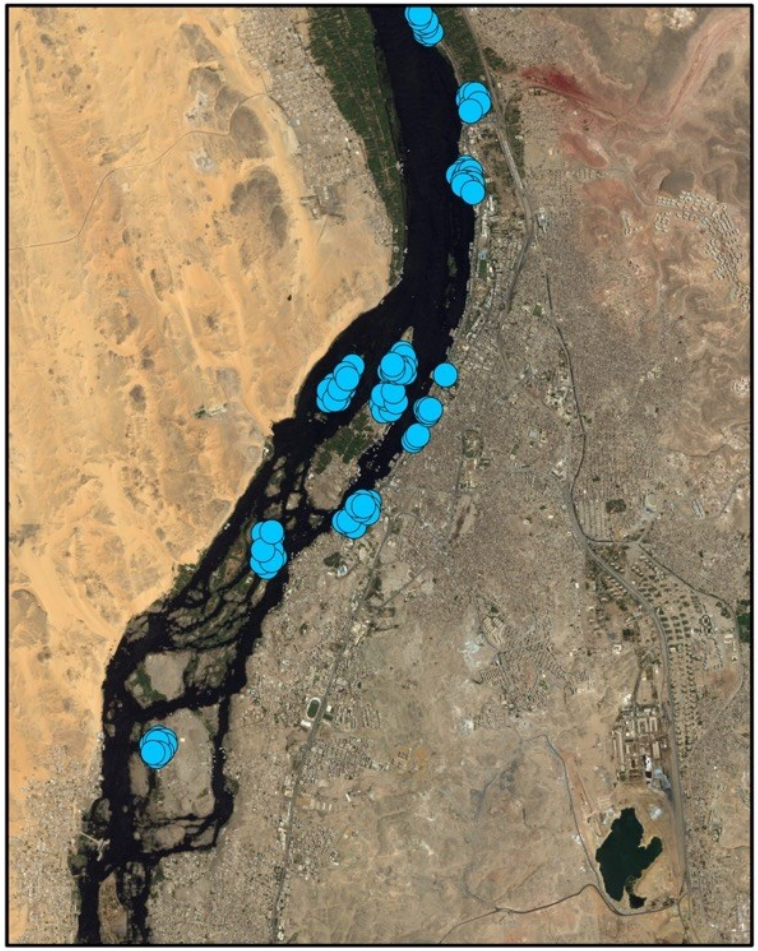


3. Where do you like to gather with the family?	٣) في اي مكان تحب التجمع مع العائلة؟	Participants Answer



4. Where do you feel reassured and relaxed?	٤) في اي مكان تشعر بالطمانيه والاسترخاء؟	Participants Answer

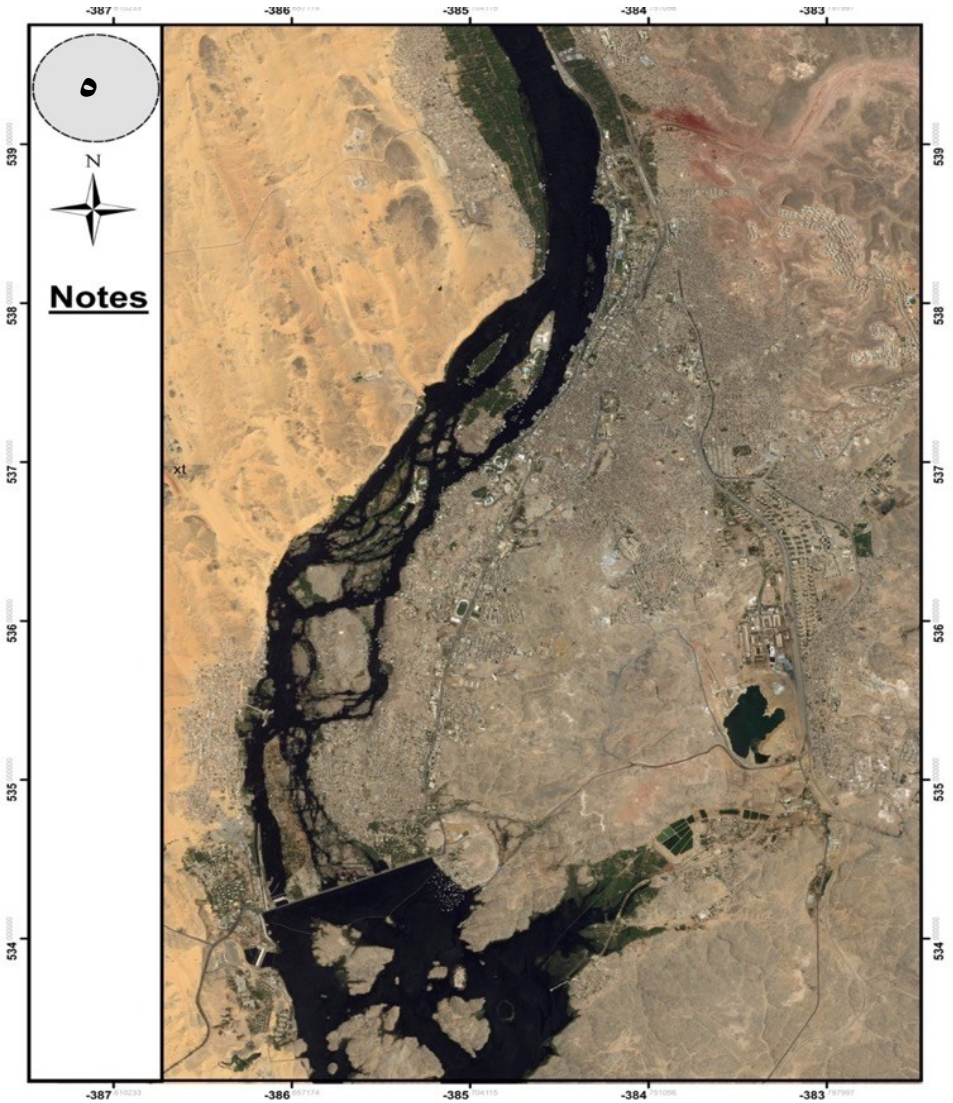


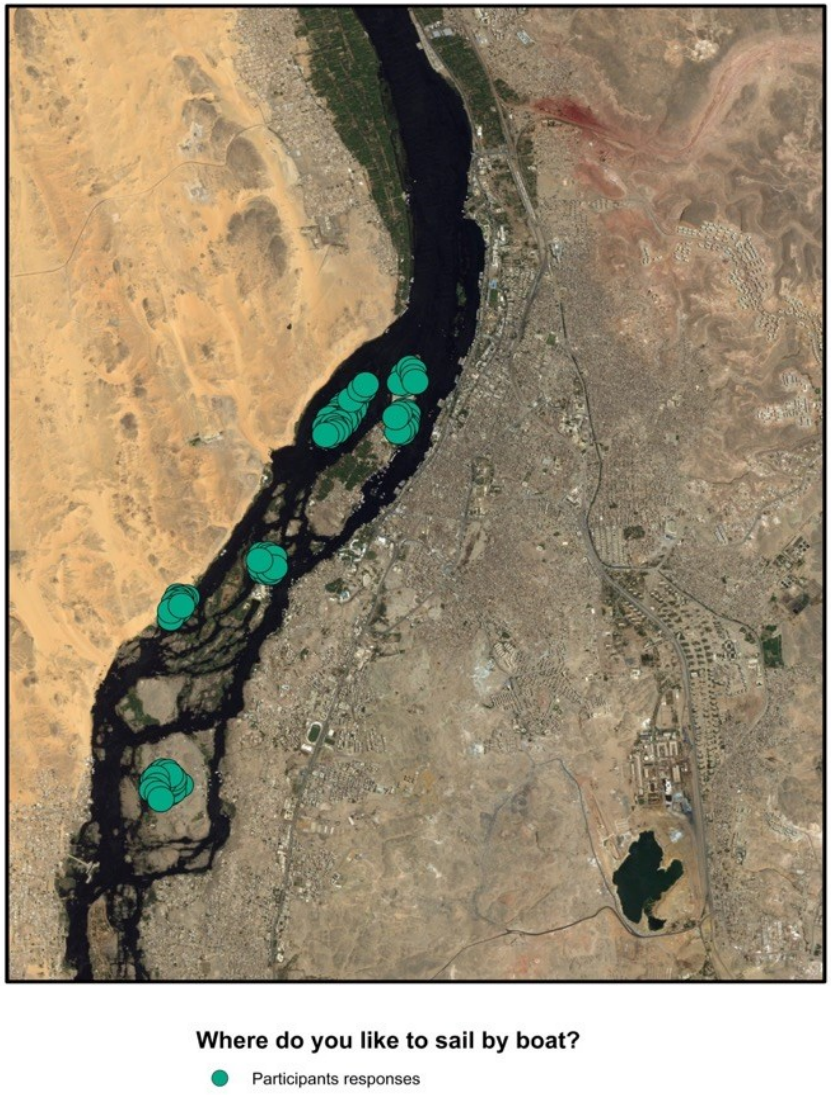


Where do you feel peaceful and relaxed?

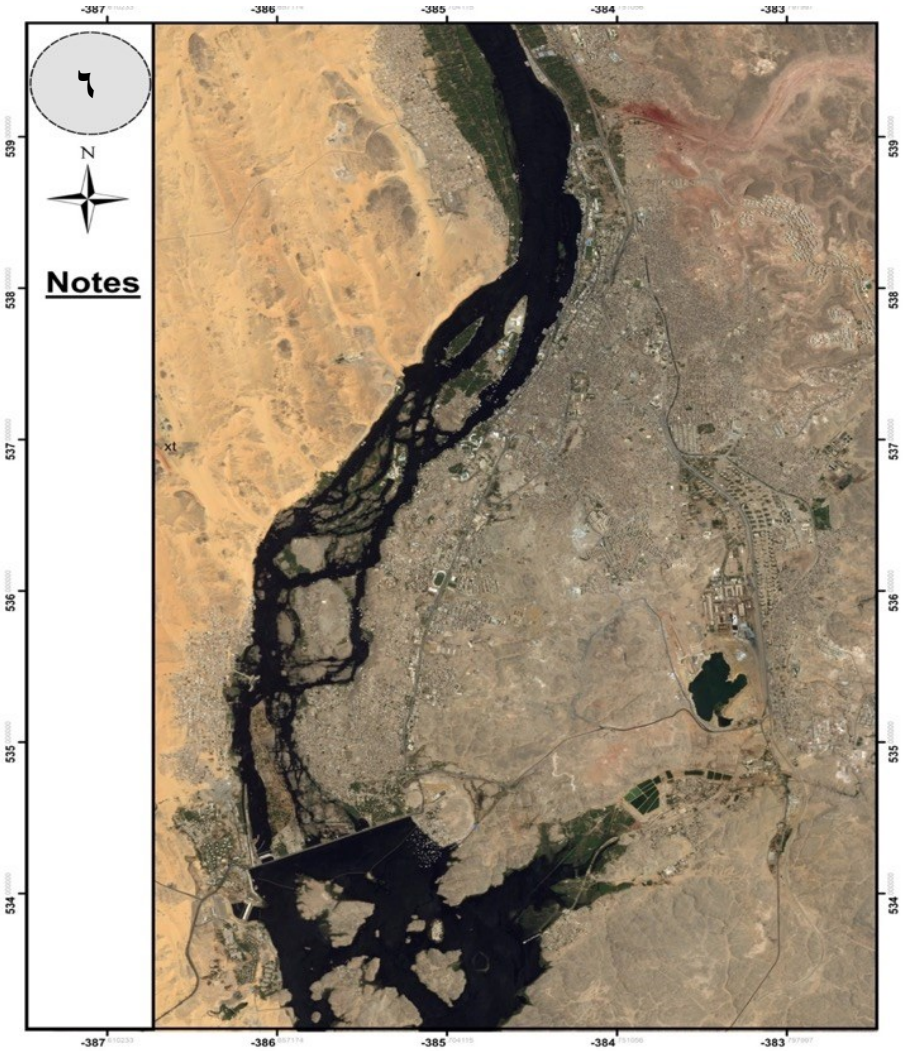
Participants responses

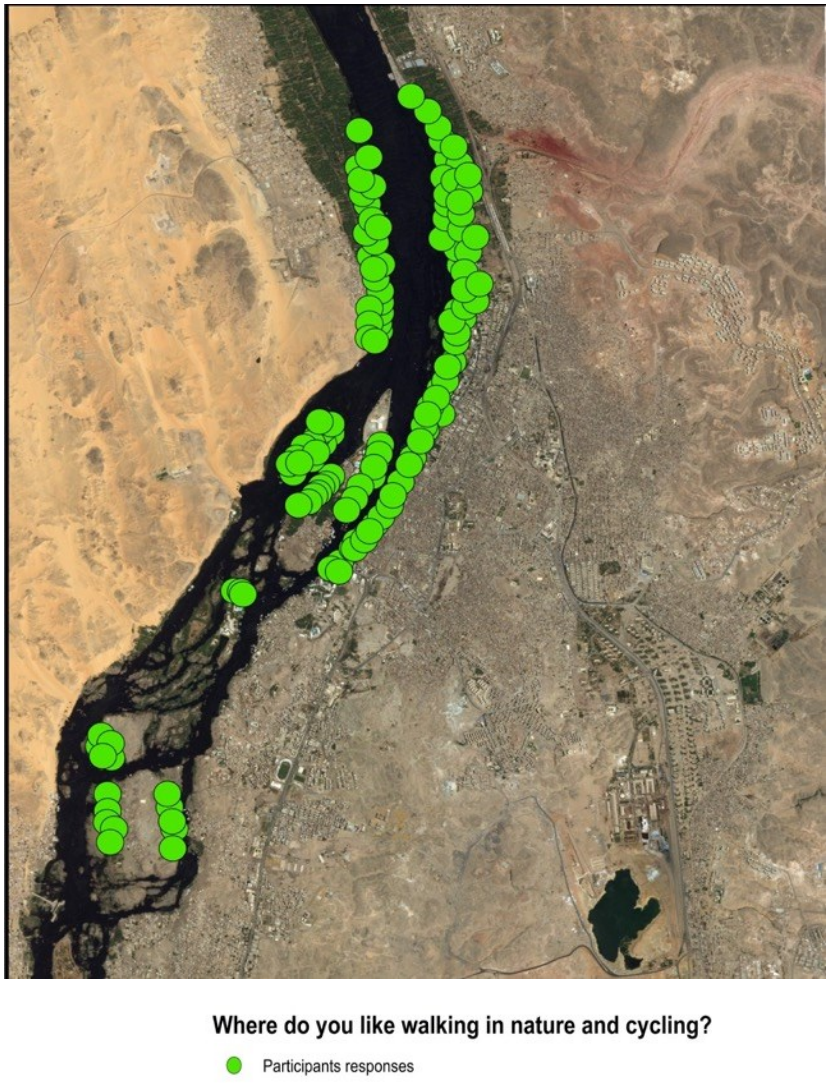
5. Where would you like to sail by boat?	٥) الي اي مكان تحب ان تبحر بالقارب؟	Participants Answer





6. Where do you like walking/cycling?	٦) في اي مكان تحب المشي في الطبيعة/ ركوب الدراجات؟	Participants Answer





Appendix 6: Environmental Criteria Weights Calculation (Source: Author)

Criteria	CS1	CS2	CS3	CS4	CS5	Sum	weight= sum/5	Consistency Measure
Biodiversity (CS1)	0,049	0,055	0,065	0,026	0,120	0,315	0,063	5,116
Availability (CS2)	0,049	0,055	0,084	0,026	0,120	0,333	0,067	5,063
Comfort (CS3)	0,443	0,382	0,589	0,692	0,360	2,466	0,493	5,794
Pollution (CS4)	0,443	0,491	0,196	0,231	0,360	1,721	0,344	5,735
Topography (CS5)	0,016	0,018	0,065	0,026	0,040	0,166	0,033	5,113
Total	1,000	1,000	1,000	1,000	1,000		1,000	
						CI=		0,091
						RI=		1,120
						CR=		0,081
						CR=8,1%<10% (Acceptable)		

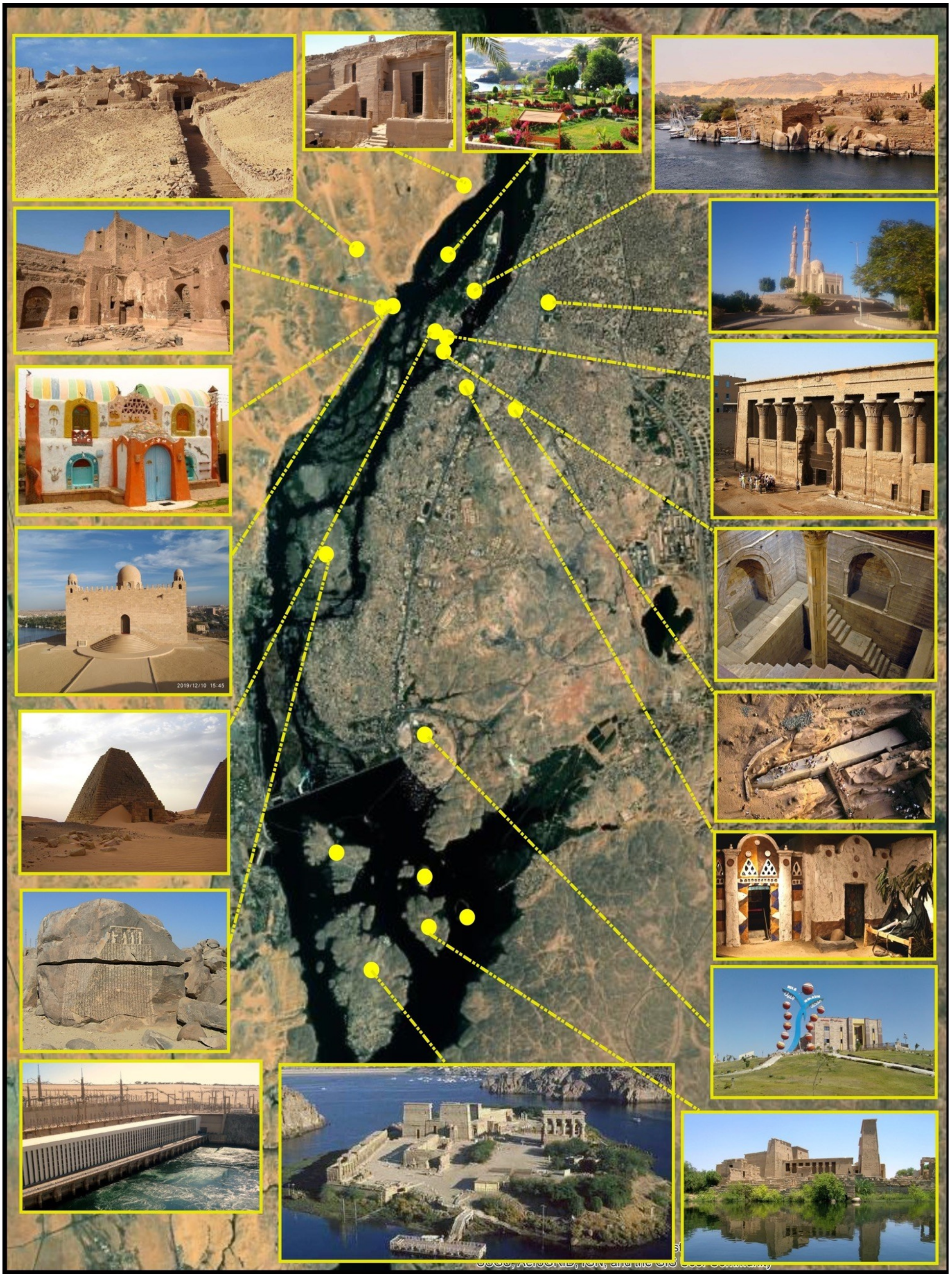
Appendix 7: Social Criteria Weights Calculation (Source: Author)

Criteria	CS6	CS7	CS8	Sum	weight=sum/3	Consistancy Measure
Accessibility (CS6)	0,158	0,149	0,273	0,580	0,193	3,043
Security (CS7)	0,789	0,745	0,636	2,171	0,724	3,141
Compatibility (CS8)	0,053	0,106	0,091	0,250	0,083	3,014
Total	1,000	1,000	1,000		1,000	3,066
					CI=	0,033
					RI=	0,580
					CR=	0,057
					CR=5,7% <10% (acceptable)	

Appendix 8: Economic Criteria Weights Calculation (Source: Author)

	CS9	CS10	CS11	CS12	Sum	weight=sum/4	Consistancy Measure
Utility (CS9)	0,141	0,194	0,346	0,122	0,803	0,201	4,239
Efficiency (CS10)	0,141	0,194	0,269	0,203	0,807	0,202	4,217
Site's price (CS11)	0,016	0,028	0,038	0,068	0,149	0,037	4,035
Surrounding area (CS12)	0,703	0,583	0,346	0,608	2,241	0,560	4,472
Total	1,000	1,000	1,000	1,000		1,000	
					CI=		0,080
					RI=		0,900
					CR=		0,089
					CR=8.9% <10% (Acceptable)		

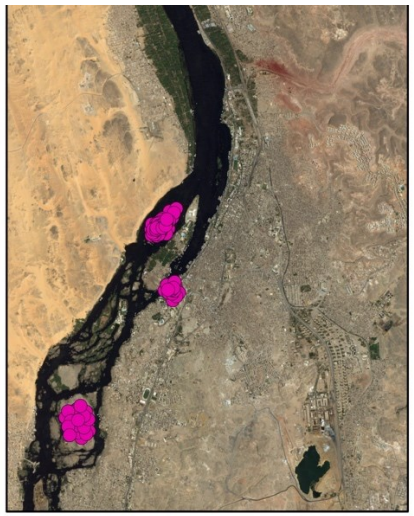
Appendix 9: Recreation and Tourism Attractive Sites (Source: WEB[17] Editing by Author).



Appendix 10: Preferred sites for future Recreation and Tourism (Source: Author).

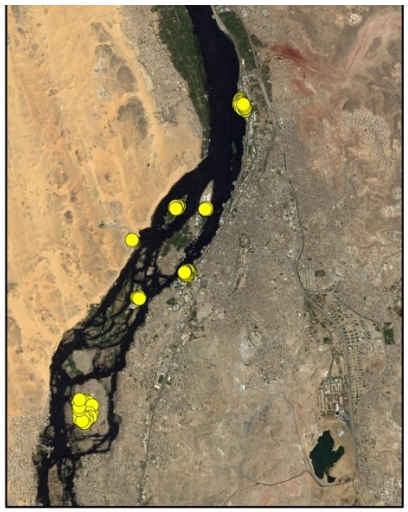
Where do you like walking in nature and cycling?

Participants responses



Where do you like to gather with your family?

Participants responses

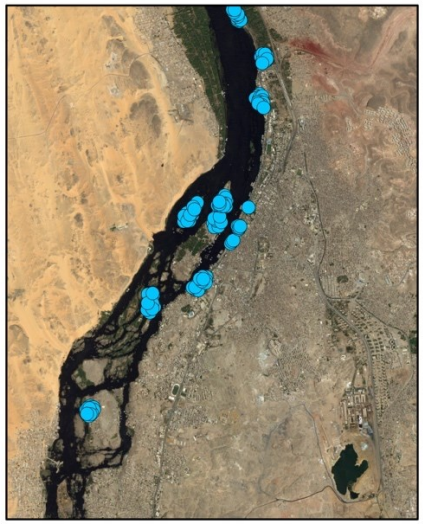


Where do you like to meet your friends?

Participants responses

Where do you like to ride horse carriage?

Participants responses



Where do you feel peaceful and relaxed?

Participants responses

Where do you like to sail by boat?

Participants responses

Appendix 11: New Scientific Results and Related Research Questions and Objectives (Source: Author)

Research Questions	**Objectives**	**Scientific results (THESIS)**
Questions 1: Are the evaluation criteria addressed in the previous literature sufficient to develop a sustainable, diversified recreation and ecotourism service?	- Identify and implement criteria to evaluate RE facilities. - Identify the most appropriate methods for RE evaluation - Calculate non-spatial criteria importance and weights by using AHP -	**THESIS 1:** "Based on deep analysis of the scientific literature review and expert-based questionnaire results, many different kinds of evaluation criteria could be used in the evaluation process of RES which are environmental, social and economic groups, based on their features. The importance order of these criteria is as the following: environmental criteria group is the most important criteria, followed by social and economic criteria group" **THESIS 2:** "According to the literature review analysis, I conclude that only the spatial sub-criteria could be used in the land evaluation process which are biodiversity, availability, comfort, pollution, topology, and accessibility. And I considered nine sub-criteria as the raster layers which utilized as the input layers in the land evaluation model"
Questions 2: What are the potential reasons of locating some recreation and tourism services in suitable areas and others in non-suitable areas based on land evaluation map?	- Prepare criteria maps of RE facilities within the area. - Create evaluation model by using ArcGIS - Produce land evaluation map by integrating between land evaluation model and criteria. - Identify the most suitable lands which could be used to fulfill future demands and needs of RE facilities in Aswan city. - Highlight the potential reasons of locating some recreation and tourism services in suitable areas and others in non-suitable areas based on land evaluation map. - Identify how the collected results help the planner and decision-makers in the local government for recreation and tourism planning	**THESIS 3:** "I developed a Multi-Criteria Land Evaluation Model (MCLEM) in ArcGIS environment to utilize it the land evaluation process in this study by integrate between AHP method, which was utilized for calculation RES sub-criteria criteria weights, and ArcGIS, which was utilized to produce land suitability evaluation map by using the developed model" **THESIS 4:** "After deep analysis of the suitability map results, I justified that there are three main characteristics that have to be in the appropriate places for recreational services which are; (1) environmental problems such as pollution do not exist, (2) high vegetation density and green space is urgently needed, and (3) the areas are close to the water bodies".
Questions 3 Are the existing RE facilities' efficiency sufficient to develop and improve a diversified RE services product?	- Indicate the influence of decreasing the recreational areas on local residents - Indicate the local residents' perceptions of RE facilities and the management of the recreation areas. - Highlight some of the major factors of RE facilities that influence awareness, attitudes, and perceptions of users. - Highlight the importance of PPGIS as more effective method for RES evaluation regarding collecting opinions from the citizens and tourists, compared to traditional public participation methods. - Indicate the most common reasons for visiting recreation sites across demographic categories - Illustrate the constraints that prevent people from practicing outdoor recreation activities - Indicate the relation between the income and willing to pay for recreation services maintenance	**THESIS 5:** "Assessing the quality and demands of recreation and ecotourism services by involving users and local communities is necessary for the attainment of managerial goals and objectives, ascertaining the benefits of recreation facilities and programs, and for evaluation purposes relative to accountability". **THESIS 6;** "Based on the questionnaire analysis, I justified that there is a significant difference in the preferred kind outdoor recreation activities and sports across the demographic characteristics of the sample" **THESIS 7:** "Based on the PPGIS results analysis, I justified that there are many reasons and constraints that prevent people from visiting and practicing recreation activities in Arab countries. And there are a significant different between both genders and age-groups results" **THESIS 8:** "Based on result analysis, I demonstrate that there are three main factor that effect on the willingness to pay for RES maintenance in Arab countries which are activity offering special interest to me, activity located in more convenient location and activity close to me. That mean it is important to consider these factors in the future urban planning for new RE sites" **THESIS 9:** "Based on PPGIS results, I indicate that There are many benefits of using PPGIS in land evaluation process. Moreover, I determined the correlation between site characteristics and the visitor's feel. Moreover, I indicate the connection between the preferred sites of different kinds of RES and the site properties"
Questions 4: Based on land and service demand evaluation of RE in Aswan city, what are the general evaluation aspects of RE services?	- Illustrate which RE facilities located in the suitable and not suitable sites based on land evaluation map. - Indicate if the current RE services need more development and improvement efforts to fulfill current and future local demands or not.	**THESIS 10:** "After analyzing the visitor demands and visitor preferences of RES, I developed an approach for optimizing the suitable sites for different kind of recreation and ecotourism activities. This approach integrate between the Land Suitability Evaluation (LSE) map of RES and visitor demands map."

DEDICATION

This dissertation is dedicated to

My family for their love, encouragement, and endless support

My Beloved Parents,

My Brother and Sisters,

My Sincere Husband,

And

My Son: Eyad,

ACKNOWLEDGMENT

In the Name of Allah, the Most Merciful, the Most Gracious

"***O, My Lord! Increase me in Knowledge***."

(Surah 'Taha', Ayah 114, The Holy Quran)

First, praise to **Allah** (God) for his kindness to let me possible to complete this dissertation. I would like to take this opportunity to extend my heartfelt appreciation to the following persons who have contributed directly or indirectly towards the completion of this study.

I owe my deepest gratitude to my supervisor Dr. Istvan Valanszki for the continuous support during my dissertation study and research, for his patience, motivation, and enthusiasm. His guidance helped me at all times during the study and writing of this dissertation.

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I would like to thank my family: my parents, my husband, my brother, my sisters, and my friends for support and prayers.